1.3.4 **Student's Field/Research Projects and internship**

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IMPACT OF CYCLONIC STORM AMPHAN ON AGRICULTURE IN WESTBENGAL

PALLI SIKSHA BHAVANA

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B.Sc Ag. Hons., Sem-(viii). Roll-01

RAWE-01

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I, **Abhijit Mandal** student of B.Sc. (Agriculture) Honours Semester-(VIII), offer my deep gratitude and regard to our Respected Teacher **Prof. Binoy Kumar Saren , Dr. Buddhadeb Duary** ,Dept. Of Agronomy, Palli Siksha Bhavana, Visva-Bharati for their constant guidance, support and motivation in completing the assignment on **IMPACT OF CYCLONIC STORM AMPHAN ON AGRICULTURE IN WESTBENGAL** which was meticulously planned and arranged.

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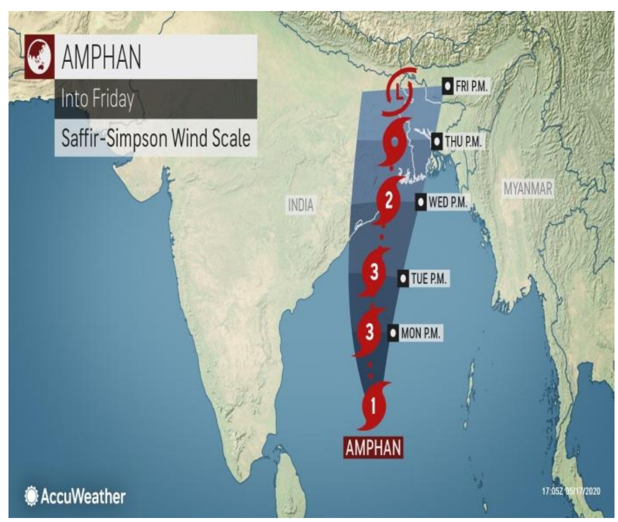
IMPACT OF CYCLONIC STORM AMPHAN ON AGRICULTURE IN WESTBENGAL

Super Cyclonic Storm Amphan was a powerful and deadly tropical cyclone that caused widespread damage in Eastern India in May 2020. Amphan made landfall near Bakhali in West Bengal at 2:30 p.m. IST on 20 May,buffeting the region with strong winds and heavy rains. West Bengal, the epicenter of the cyclone's landfall, saw the most widespread damage from Amphan. The storm was considered the strongest to hit the region in over a decade. The cyclone's effects were nonetheless widespread and deadly in the life of people and gave a powerful negative impact in agriculture. Apart from human and livestock casualties, the cyclone has caused severe losses to farmers by destroying their standing crops like paddy, mangoes, litchi etc. when it was a time for harvest.

METEOROLOGICAL HISTORY

The first tropical cyclone of the 2020 North Indian Ocean cyclone season, Amphan originated from a low-pressure area persisting a couple hundred miles (300 km) east of Colombo, Sri Lanka, on 13 May 2020. Tracking northeastward, the disturbance organized over exceptionally warm sea surface temperatures; the Joint Typhoon Warning Center (JTWC) upgraded the system to a tropical depression on 15 May while the Indian Meteorological Department (IMD) followed suit the following day. On 17 May, Amphan underwent rapid intensification and became an extremely severe cyclonic storm within 12 hours.



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On 18 May, at approximately 12:00 UTC, Amphan reached its peak intensity with 3-minute sustained wind speeds of 240 km/h (150 mph), 1-minute sustained wind speeds of 260 km/h (160 mph), and a minimum central barometric pressure of 925 mbar (27.32 inHg). The storm began an eyewall replacement cycle shortly after it reached its peak intensity, but the continued effects of dry air and wind shear disrupted this process and caused Amphan to gradually weaken as it paralleled the eastern coastline of India. On 20 May, between 10:00 and 11:00 UTC, the cyclone made landfall in West Bengal. At the time, the JTWC estimated Amphan's 1-minute sustained winds to be 155 km/h (100 mph). Amphan rapidly weakened once inland and dissipated shortly thereafter.Kolkata,Hoogly, Howrah, East Midnapur, North 24 Parganas, and South 24 Parganas in West Bengal—were affected by the cyclone.

Impact on agriculture

Cyclone Amphan has ravaged the farming sector in at least 14of the 23 districts in West Bengal and the loss incurred may create an all-time record.The state agriculture department has estimated the losses to be nearly Rs.5000 crore,across 14 districts in the state.The ,maximum damage was caused in North 24 Parganas followed by South 24 Parganas, Purba Burdwan,Nadia,Hoogly,Murshidabad,Birbhum,Jhargram and East Midnapur. **Minister Ashish Banerjee** said on Friday -According to initial estimates, Hooghly and Birbhum districts have incurred a loss of Rs 600 crore and Rs 462 crore respectively, Banerjee told PTI -In East Midnapore, a coastal district, crops in around 47,000 hectares of land were destroyed, while 70 per cent and 50 per cent of paddy in Burdwan East and Bankura districts were lost, officials said.

Amphan aftermath in Bengal: losses of around Rs.5,000 crore in agriculture

02 Jun 2020 Our Bureau

Large area of farmland and standing crops were destroyed in Bengal due to cyclone Amphan, that made landfall on May 20 in the state.

The state agriculture department has estimated the losses to be nearly Rs.5,000 crore, across 16 districts in the state. The maximum damage was caused in North 24 Parganas followed by South 24 Parganas, Purba Burdwan, Nadia, Hooghly, Murshidabad, Birbhum, Jhargram and East Midnapore.

The agriculture department officials have stated in their report that due to proper weather forecast, only 15 percent of *boro* rice was lost and the rest could be saved. Yet, the loss was enormous, and need major interventions, they said. Crops over large areas could be saved as they were removed from the fields before the cyclone hit, following the forecast. Maximum damage has been caused to *boro* rice in Purba Burdwan.

According to the agriculture department authorities, the cyclone has also destroyed huge farmlands of jute, cereals, nuts

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According to the agriculture department authorities, the cyclone has also destroyed huge farmlands of jute, cereals, nuts and corn.

Farmers dry paddy a day after the storm

“There are at least 14 districts where agriculture has been devastated. We have not received reports from all the districts as connectivity is yet to be fully restored. But from the initial reports, we can understand that the losses could be an all-time record,” Banerjee said.

“Farmers had hoped that after the lockdown is lifted, they will be able to sell their produce and compensate for their losses. The cyclone has thrashed all their hopes,” the official told PTI.

Farmers severely hit by cyclone

Impact on rice:

Harvesting of boro paddy (the rabi crop), which was already bearing the brunt of labour shortage as most of them had gone back to their villages due to the pandemic scare, has been further impacted due to the cyclone Amphan. The agriculture department officials have stated in their report that due to proper weather forecast,only 15% of boro rice was lostand the rest could be saved.Yet,the loss was enormous, and need major interventions, They said.

Crops over large areas could be saved aas they were removed from the fields before the cyclone hit, following the forecast. Maximm damage has been caused to Boro rice in Purba-Burdwan, which is the largest paddy growing district of the state has suffered an estimated of around Rs. 3 billion.

"We had managed to harvest only 30 per cent of the paddy cultivation. The rest is now under water. The entire paddy is lost," an official said.

In Bardhaman district alone, where the impact of the storm was not as severe as in certain

other districts, 30,000 hectares of paddy has been damaged, 10,000 hectares in Hooghly and 10,000 in West Midnapore is destroyed. The State produces close to 70 lakh tonnes (lt) of paddy in the rabi season each year but the production is estimated to be close to 60 lt this year.

The paddy which fell off due to the impact of the cyclone is likely to get contaminated with fungus, the standing crop is likely to be of inferior quality with the grains getting damaged and discoloured.

Impact on banana and mango

Cyclone Amphan has dealt a crushing blow to Bengal's fruit and flower cultivators, especially mango and banana growers, as they are confronted huge losses from the widespread damage it caused to orchards and fruits ripe for its seasonal harvest.

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Banana

According to reports from the Horticulture department, banana is an important cash crop in West Bengal. Around 70 per cent production comes from Nadia and the cyclone has ravaged banana orchards grown in 6.5 thousand hectare in Nadia only.

Around 90,000 families have been affected so far, said a district horticulture officer. Tissue culture banana is being cultivated over an approximate area of 700 hectares in Murshidabad and Nadia districts as part of the new project since last year, but most orchards have been ruined due to the impact of Amphan, an official said.

The horticulture officials said banana (Musa sp.) is the second most important fruit crop in India next to mango.Its year round availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favourite fruit among all classes of people. It also has good export potential.

Mango

For mango growers in Nadia, Murshidabad and Malda districts of Bengal are no different as the unfavourable climatic conditions coupled with lockdown had already led to severe losses. Among these major mango producing districts, Malda alone produces over 2 million ton heavily contributing to India's national yield of 22 mt. Over 3 lakh people working in 50,000 orchards grow near 250 varieties of mango there.

"Hundreds of trees got uprooted while thousands suffered heavy damage due to the storm. Half ripe fruit worth crores got lost. Stock piles of already harvested fruits under temporary

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sheds are almost completely lost. All these fruits will now decompose and rot," said Ujjal Saha, President Malda Mango Merchant's Association .

According to state Govt Horticulture department officials, the actual immediate loss is likely to be in the scale of crores.

“The mango production sustained severe damage due to unseasonal rains and hailstorms during February,March, this year when the flowers were sprouting. As a result, 70 per cent of the crop got destroyed. The cyclone has finished whatever little was left. The financial crisis would have a long-term impact as it might deter farmers from mango cultivation next year. We fear that around 38,000 tonnes of mangoes have been destroyed in the cyclone,” said Basudev Biswas, a mango wholesaler at Majdiya.

Fruit merchants fear production of mango and litchi in Malda district in the current year will come down to just one-fourth of the average annual yield because of triple factors of labour crunch caused by the coronavirus-induced lockdown, Cyclone Amphan and a series of storms.

“Malda has its own economy known as ‘mango economy.’ Production of mangoes and litchis determines the trend in the market. If central and state governments do not offer compensation to the fruit producers, the situation would further worsen,” Chowdhury said.

Flowers

This apart, flower cultivation in the state has also been severely affected by the storm. In East Midnapore, flower beds in around 6.95 thousand hectare have been completely

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destroyed while in Nadia, flower cultivation on 3.75 thousand hectare has been grossly affected. In two districts, more than 1.5 lakh families have been affected, a horticulture officer said. The flower growers of Howrah and Hooghly districts are also severely affected.

Vegetables

Initial estimates suggested that over 3,360 hectares of crops had been destroyed in the storm in Bhangar 2 block in South 24-Parganas.Farmers in the southern districts of Bengal, who are staring at difficult days ahead as the super cyclone has dealt a heavy blow to their livelihood.

“It is true that the prices were low. But we were able to make ends meet with whatever we earned. What will we sell now that all the crop has been destroyed?” asks Muhammad Saheb Ali Mullah, a middle-aged farmer.

This correspondent visited Bhangar on Friday to find hectares of vegetables chilies,lemon,pumpkin,bottle gourd have already decayed.

The losses engendered by Amphan, several farmers said, would have a long-term impact as the practice in the area was to use the money from the sale of one crop as the capital for the next season.

“The next season is of spinach, which is also a capital-intensive crop. Farmers need to construct poly tunnels to ensure better quality of crops,” said Sahid, explaining that poly tunnels are smaller versions of a poly house. Now it is not possible for them to cultivate crops for next season.

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In East Midnapore, and vegetables in around 5,000 hectares of land have been lost due to the cyclone, a senior official of the agriculture department said.

Price of vegetables are increasing at a faster rate:

Some common vegetables, like ridged gourd, green chilli, cucumber, brinjal, bottle gourd, pumpkin and pointed gourd, were damaged across south Bengal. Vendors said that in the coming few days, there will be distress sale of these vegetables. That will be followed by highly fluctuating prices in a volatile vegetable market, predicted Kamal Dey, president of West Bengal Vegetable Vendors' Association.


উম্পুনের জের, সব্জির ছেঁকায় জেরবার গেরস্ত

Shramana Ray | EiSamay.Com
Updated: 24 May 2020, 08:28:00 AM

উত্তর ২৪ পরগনা জেলার কৃষি বিশারদ দেবাশিস মণ্ডল জানান, কলকাতা শহরে সব্জি মূলত আসে বনগাঁ, বসিরহাট, নদিয়া এবং দক্ষিণ ২৪ পরগনা জেলা থেকে। উম্পুনে...

"The vegetables are irretrievable. Unless the water recedes fast from the fields, we cannot accurately estimate the loss. But after Covid-19 had delivered a blow to the state's agriculture, cyclone Amphan has virtually broken its backbone," said Adhir Sarkar, secretary of Vegetable Growers' Association in south Bengal.

Others

Apart fron the above mentioned crops Amphan cause several losses,like it has been destroyed (1 lakh ha.) 50% of sesame crops. Papaya,litchi,jackfruit and other horticultural crops has been damaged badly.Groundnut, another oilseed produced in Bengal, has also been affected. Amphan ravaged around 8,500 hectares of betel-leaf farmlands in two districts—East Midnapore and South 24-Parganas, with losses mounting to ₹4,000


Cyclone Amphan leaves bitter taste for litchi farmers

Causes over Tk 150cr in damages in Pabna litchi orchards

Ahmed Humayun Kabir Topu

The super cyclone Amphan did not only take lives, destroy homes and uproot trees.

It also crushed the last strands of hope for many amid the Covid-19 pandemic.

"I planted litchi trees in

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crore. Most of the farmlands in Sunderban have also been damaged due to the saline water. Saline water of the Matla, Vidyadhari, Hogol, Kalagachi, Piyali, Saptamukhi, Muriganga, Hugli, Hatania Doania, Thakuran, Gosaba and Rasulpur rivers entered inside the villages and agricultural fields due to breach of embankments in several locations. Many farmers had taken loans at high rates from private moneylenders for survival. The cyclone has added to their misery.

Conclusion

The Coronavirus outbreak has caused a severe disruption to the economy. Now the extensive damage wreaked by the severe cyclone has added to the woes of the farmers who were looking to harvest and sell their crops. In this grim situation, farmers need fresh lines of credit to resume their economic activities as most of them have exhausted their savings in the absence of any economic activity during the lockdown.

While a moratorium is being offered to the farmers to reduce the immediate impact of the debt burden, this may not be the only solution as the interest keeps accruing on the loans, and if the economic cycle is not resumed then it could lead to further stress. This also exposes the people to the risk of being trapped by moneylenders.

While the government is trying to put more money in the hands of farmers, it is high time to devise multi-pronged strategies bringing together a proper mix of easy financing, best quality seed support, use of advanced technology, skill-driven knowledge, etc. to support the agri sector.

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ASSIGNMENT ON DIVERSIFICATION OF CROPS AND ITS BENEFITS :

RAWE - 01

SUBMITTED BY : ANKITA DAS

ROLL NO : BAG(SEM – VIII) – 04

PALLI SIKSHA BHAVANA, VISVA BHARATI

SRINIKETAN

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Teacher's signature.

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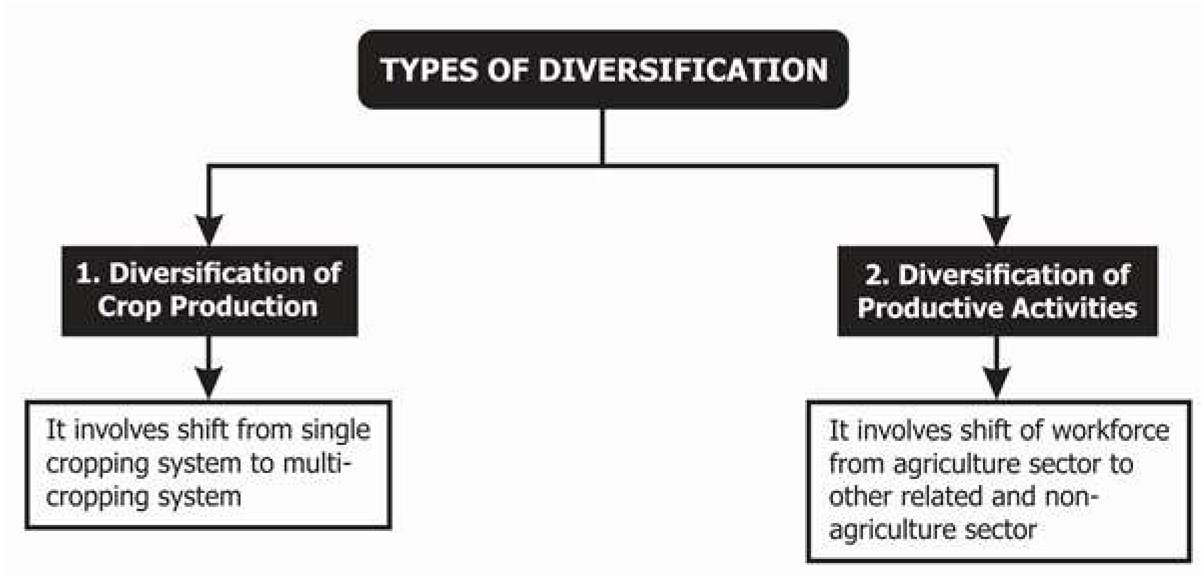
INTRODUCTION :

Farming continues to be the major source of food, nutrition, income and employment for the most of the rural population in India. The country's farming is characterized by presence of a large number of small and marginal scale farmers with small farm holdings. However the country is blessed with diverse agro-climatic conditions which enable the farmers to produce a large number of agricultural commodities. The challenge of producing enough food for the growing population with the reducing holdings is a herculean task. With the development of commercial agriculture techniques during the post independent period the agriculture sector has been able to cater to the domestic and international markets. In the light of the focus on commercial farming the rich tradition of crop diversity of Indian farming lasts its glory. Few crops are occupying major production area and are grown repeatedly year after year. This has resulted in emergence of several field levels biotic and abiotic constraints and overall reduction in the benefits realized from farming.

Crop diversification provides the farmers with a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to bring down the possible risk. Crop diversification in India is generally viewed as a shift from traditionally grown less remunerative crops to more remunerative crops. The crop diversification is also taking place due to governmental policies, thrust on some crops, market reforms, infrastructure development, government subsidies, certain other price related support mechanisms, higher profitability and stability in production also induces crop diversification. Crop diversification and growing of large number of crops are practiced in dry-land areas to reduce the risk factor of crop failures due to recurring droughts. Crop substitution and crop shift are also taking place in the areas suffering with some specific soil related problems.

➢ There are two approaches to crop diversification in agriculture :

Horizontal diversification – The primary approach to crop diversification used in production agriculture. In this approach, diversification normally takes place through crop intensification which means adding new high-value crops to existing cropping systems as a way of improving the overall productivity of a particular farm or a region's farming economy as a whole.



Vertical diversification approach - In which value is added to the products by farmers through various methods such as processing, regional branding, packaging, merchandising, or other efforts to enhance the product.

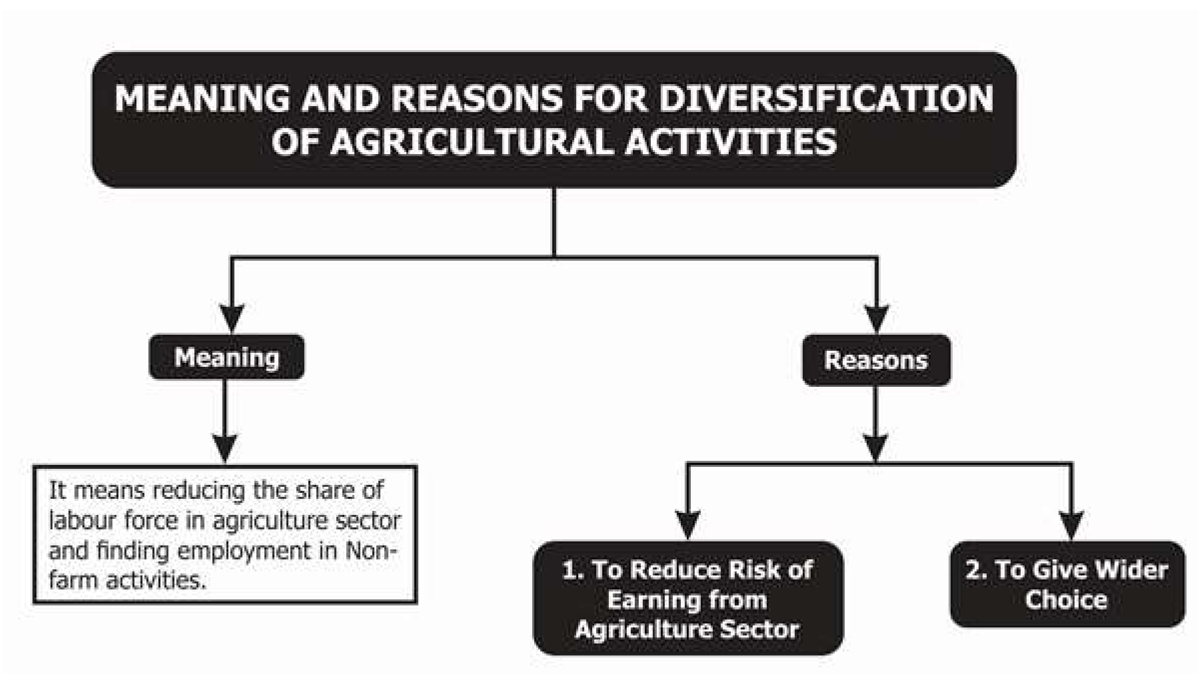
NEED FOR CROP DIVERSIFICATION :

In India, crop diversification in agriculture takes place vertically or horizontally, depending upon the market forces and also occasionally due to the domestic needs. With regards to use of land and water use and quality, there is an immediate need to consider the following factors:

- Farm produce processing into value added products will offer employment scope in non-farm works as in distillation of active ingredients from medicinal and aromatic plants (herbal products), scope of industrialization in agriculture for sugar, paper board manufacturing, etc.
- There is a need to find place-based approaches for diversifying the farming situations under various socio-economic conditions, infrastructure of market, domestic needs, supply of inputs, etc.
- The research and development on crop diversification is best done in a farmer-participatory mode where a multi-disciplinary team consisting of

scientists will involve farmers from the project planning phase till arriving at conclusions and solutions.

- The concept of sustainable productivity for each land and water units through crop diversification needs to be fostered.
- There is critical need for promoting co-operatives in rural areas to solve micro-level and demographic problems.
- Strengthening food processing and other value-added industries in rural areas is a means to provide employment to rural youth.
- Alternate cropping systems and farm enterprise diversification are most important for environment protection.
- There are abundant opportunities in adopting the subsidiary occupations to the rice-wheat cropping systems present in India. They are vegetable farming, fruit cultivation, floriculture, medicinal and aromatic plants cultivation, mushroom farming, dairying, piggery, goatery, poultry and duckery, fishery or aquaculture, bee-keeping, to provide ample scope for diversification of rice-wheat cropping system in north-western and south India and north-eastern states.
- Farm enterprise diversification will generate more income opportunities and rural employment round the year.



DRIVERS OF DIVERSIFICATION:

The key drivers of diversification that are identified are :

- Food Security;
- Employment generation through creation of off-farm and non-farm investment opportunities within the capabilities of the resource-poor farmers;
- Changes in crop patterns and farming systems;
- More effective use of land and water resources;
- Market access initiatives replacing risk aversion with risk acceptance;
- Changing consumer demands irrespective of the nature of habitation and standards of living due to spread-effect of health consciousness caused by the visual media and non-discriminatory demand for quality goods. and
- The role of urbanization in fast developing countries like India.

Crop diversification can better tolerate the ups and downs in the market value of farm products and may ensure economic stability for farming families of the country. The adverse effects of aberrant weather, such as erratic and scanty rainfall and drought are very common in a vast area in agricultural production of the country. Incidence of flood in one part of the country and drought in the other part is a very frequent phenomenon in India. Under these aberrant weather situations, dependence on one or two major cereals (rice, wheat, etc.) is always risky. Hence, crop diversification through substitution of one crop or mixed cropping/inter-cropping may be a useful tool to mitigate problems associated with aberrant weather to some extent, especially in the arid and semi-arid drought-prone/dry land areas

PATTERNS OF CROP DIVERSIFICATION :

With the advent of modern agricultural technology, especially during the period of the Green Revolution in the late sixties and early seventies, there is a continuous surge for diversified agriculture in terms of crops, primarily on economic considerations. The crop pattern changes, however, are the outcome of the interactive effect of many factors which can be broadly categorized into the following five groups:

a) Resource related factors covering irrigation, rainfall and soil fertility.

b) Technology related factors covering not only seed, fertilizer, and water technologies but also those related to marketing, storage and processing.

c) Household related factors covering food and fodder self-sufficiency requirement as well as investment capacity.

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d) Price related factors covering output and input prices as well as trade policies and other economic policies that affect these prices either directly or indirectly.

e) Institutional and infrastructure related factors covering farm size and tenancy arrangements, research, extension and marketing systems and government regulatory policies.

Obviously, these factors are not watertight but inter-related. For instance, the adoption of crop technologies is influenced not only by resource related factors but also by institutional and infrastructure factors. Similarly, government policies - both supportive and regulatory in nature - affect both the input and output prices. Likewise, special government programmes also affect area allocation and crop composition.

Similarly, economic factors play a relatively stronger role in influencing the crop pattern in areas with a better irrigation and infrastructure potential. In such areas, commercialization and market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses.

What is most notable is the change in the relative importance of these factors over time. From a very generalized perspective, Indian agriculture is increasingly getting influenced more and more by economic factors. This need not be surprising because irrigation expansion, infrastructure development, penetration of rural markets, development and spread of short duration and drought resistant crop technologies have all contributed to minimizing the role of non-economic factors in crop choice of even small farmers.

STRATEGIES FOR CROP DIVERSIFICATION :

The main strategies for crop diversification, are –

1. **Replacement of low yielding value crops with high yielding high value crops with longer shelf life.**
2. **Intercropping in rainfed area**
3. **Diversion of high water requiring crops with less water requiring crops**
4. **Legume intervention**
5. **Inclusion of crops having both domestic and international demand**
6. **Inclusion of energy efficient crops**
7. **Systems with high productivity, profitability and sustainability**
8. **Shift high risk crops with short duration pulses and drought resistant oilseed crops.**

CONSTRAINS OF CROP DIVERSIFICATION :

The concept of crop diversification in the country is taking the form of increased areas under commercial crops including vegetables and fruits since independence. However, this has gained momentum in the last decade favouring increased area under vegetables and fruits and also to some extent on commercial crops like sugar cane, cotton and oilseeds crops specially soybean. The major problems and constraints in crop diversification are primarily due to the following reasons with varied degrees of influence:

- More than 60 per cent of the cropped area in the country is rain fed and is dependent on rainfall
- Sub-optimal and over-use of resources like land and water resources, causing a negative impact on the environment and sustainability of agriculture
- Inadequate supply of improved and quality seeds and planting material of improved cultivars
- Fragmentation of land holdings and lack of mechanization of agriculture due investment constraints and land holding sizes
- Poor basic infrastructure like rural roads, power, transport, communications etc
- Inadequate post-harvest technologies and inadequate infrastructure for post-harvest handling of perishable horticultural produce

- Very weak agro-based industry
- Inadequate research - extension - farmer linkages
- Inadequately trained human resources and large scale illiteracy amongst farmers
- Emerging species of diseases and pests affecting most crop plants
- Poor database for horticultural crops and insufficient investments in the agricultural sector.

GOVERNMENT POLICIES AND STRATEGIES FOR CROP DIVERSIFICATION :

Considering the importance of crop diversification in the overall developmental strategy in Indian agriculture, the government of India has taken several initiatives for agricultural development in general and crop diversification in particular. These initiatives are as follows:

i) Launching a Technology Mission for the Integrated Development of Horticulture in the Northeastern Region: The programme will establish effective linkages between research, production, extension, post-harvest management, processing, marketing and exports and bring about a rapid development of agriculture in the region.

ii) Implementing National Agriculture Insurance Scheme: The scheme will cover food crops and oilseeds and annual commercial and horticulture crops. Small and marginal farmers are eligible for 50 percent subsidy under the Scheme.

iii) Operationalizing Technology Mission on Cotton: The Technology Mission will have separate Mini-Missions on technology generation, product support and extension, market infrastructure and modernization of ginning and pressing units.

iv) Provision of Capital Subsidy of 25 percent for construction/modernization/expansion of cold storages and storages for horticultural produce.

v) Creation of Watershed Development Fund: At the National level for the development of Rainfed lands.

vi) Infrastructure Support for Horticultural Development with emphasis on Post-harvest Management.

vii) Strengthening Agricultural Marketing: Greater attention to be paid for development of a comprehensive, efficient and responsive marketing system for domestic marketing as well as exports by ensuring proper quality control and standardization.

viii) Seed Crop Insurance: A pilot scheme on Seed Crop Insurance has been launched which will cover the risk factor involved in production of seeds.

ix) Seed Bank Scheme: About 7-8 percent of certified seeds produced in the country will be kept in buffer stock to meet any eventualities arising out of drought, floods or any other form of natural calamities.

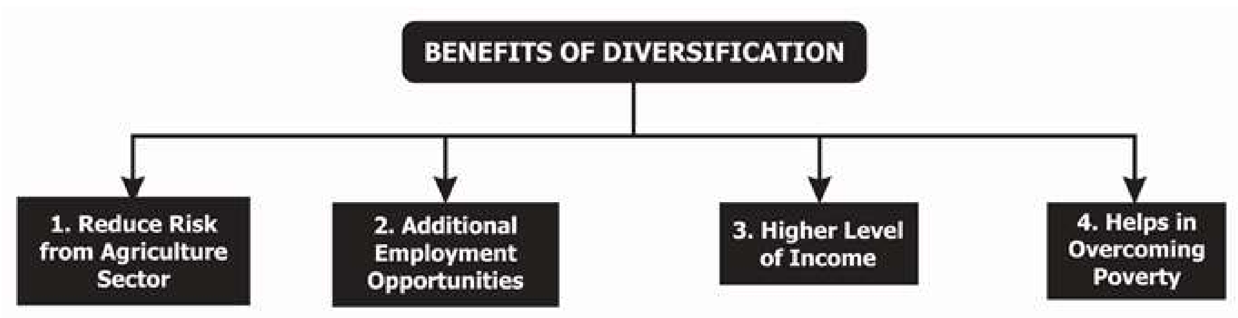
x) Cooperative Sector Reforms: Amendment to the National Cooperative Development Corporation (NCDC) Act, 1952, and Replacement of the Multi-State Cooperative Societies (MSCS) Act, 1984.

All these measures will lead to crop diversification and increase the production and productivity of crops.

BENEFITS OF CROP DIVERSIFICATION :

Diversifying your cropping operation can provide several benefits. Crop rotation, for example, can break pest cycles, including plant diseases, insects and weed infestations. The Sustainable Agriculture Network has reported that crop rotation also can:

- **Reduce risk in every possible way**
- **Create additional employment opportunities**
- **Higher level of income**
- **Helps in overcoming poverty**
- **Reduce erosion**
- **Improve soil structure**
- **Conserve soil moisture**
- **Create new markets and strengthen rural communities**



Another reason to diversify crops is to spread your risk. When housing starts plummeted during the economic crisis, turf grass sod producers, for example, planted more of their acres to soybeans.

Economic incentives to diversify are not always clear or available, however. The bulk of agricultural subsidies in the United States are geared toward corn, wheat, soybean, cotton and rice—"thereby incentivizing greater production of these few crops," notes Brenda Lin, in *Bio Science*. Lin is formerly of the Environmental Protection Agency (EPA), and is now at the Australian Commonwealth Scientific and Industrial Research Organisation.

Lin adds that "developing policy that incentivizes the diversification of agricultural crops and landscapes may be a more rational strategy for developing resilient agricultural systems and protecting food production in the future under climate change." But, it's important to remember that crop diversification can be implemented in different forms and at a variety of scales, Lin suggests. The growing interest in cover crops is evidence.

More growers around the United States are using cover crops to increase soil organic matter, reduce soil erosion, reduce compaction, control weeds and provide a nitrogen source. A 2013-2014 report on cover crops published by North Central Sustainable Agriculture Research and Education and the Conservation Technology Information Center summarizes the benefits and challenges related to the use of cover crops.

CONCLUSION :

Diversification in agriculture will have a tremendous impact on the agro-socio-economic areas and also in the uplifting of resource-inadequate farming communities. It will be able to generate income and employment opportunities for rural youth around the year for the utmost benefits of the Indian farmers. It shows the use of local resources in a bigger mix of diversified cropping systems and livestock, aquaculture and other non-farm sectors in the rural areas. As in the WTO era along with the globalization of markets, diversification in agriculture is an ace means to step up the total production and productivity with respect to quality, quantity and monetary benefits under diverse agro-climatic state of affairs in the country. There are still numerous opportunities for crop diversification present in both- irrigated and non-irrigated vast areas in the rural India.

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ASSIGNMENT ON FARM MECHANIZATION STATUS AT BAHADURPUR VILLAGE IN BIRBHUM

PREPARED BY:

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ROLL NO.- BAG (SEM VIII) 05

REG. NO.- VB 0411 OF 2016-17

GUIDED BY:

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PALLI SIKSHA BHAVANA, VISVA BHARATI

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ACKNOWLEDGMENT

I, **Atanu Sarkar**, a student of B.Sc. (Ag.) Honours, Sem-VIII, feel proud to present my assignment on the topic **“farm mechanisation status at Bahadurpur village in Birbhum district”** which aims to observe the mechanisation status of village.

I gratefully acknowledge my sincere thanks to our respected teacher, **Dr. K. C. SWAIN** for his remarkable, valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard.

I place my thanks to villagers, whose co-ordination & co-operation help me to complete my work successfully.

I also take this opportunity to place on record my deep gratitude to my parents for their countless blessings showered on me while doing the work and to complete it. & last but not the least I thank the almighty for whatever I have achieved till now.

Rigorous hard work has been put in this project to ensure that it proves to be the best. I hope that this project will prove to be a breeding ground for the next generation of students and will guide them in every possible way.

ATANU SARKAR

ROLL NO.-BAG (SEM VIII)05

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TOPIC: FARM MECHANISATION STATUS AT BAHADURPUR VILLAGE IN BIRBHUM

- **What is farm mechanisation:**

Mechanised agriculture is the process of using agricultural machinery to mechanise the work of agriculture, greatly increasing farm worker productivity. In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labour or by working animals

- **scope of farm mechanization:**

There is a good scope of farm mechanization in India due to the following factors: 1) Improved irrigation facility in the country. 2) Introduction of high yielding varieties of seeds. 3) Introduction of high dose of fertilizers and pesticides for different crops.

- **Objective of farm mechanisation:**

The main objective of the Scheme is to bring farm machinery within the reach of small and marginal farmers of the state by popularizing the use of Agricultural Machineries such as Power Tillers, Tractors, Bulldozers, Power Reapers, Power Pumps, Paddy Threshers, etc.

- **Status of farm mechanisation in India and major limitation of farm mechanisation in India:**

India ranks second in the world as far as farm production is concerned but the economic contribution of agriculture to India's GDP is declining continuously with the country's broad-based economic growth. In India, 63 per cent holdings are less than 1 ha accounting for 19 per cent of the total operated area whereas; over 86 percent holdings are less than 2 ha accounting for nearly 40 per cent of the total area. Fragmentation of farm holdings is major concern in this respect and the average size of holdings has shrunk from 2.82 ha in 1970-71 to 1.1 ha in 2010-11 and it will shrink to 0.1 ha in 2025.

Table 2: Agriculture GDP and level of farm mechanization in different countries

Country	Agricultural GDP (%)	Level of mechanization (%)
USA	1	95
Western Europe	<5	95
Russia	4	80
Brazil	5	75
China	10	48
India	14	40

Source: World Bank indicators, CIA fact book, Mechanization and Farm Technology Division of Department of Agriculture and Cooperation, Trading Economics, FAO Year book 2013.

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The overall level of farm mechanization in India is 40-45 per cent (i.e. tillage about 40 per cent, seeding and planting about 30 per cent, plant protection 35-45 per cent and harvesting and threshing about 60-70 per cent for rice and wheat and less than 15 per cent for other crops).

Limitation Of Farm Mechanization in India are:

- Economic Limitation
- Technical Limitation
- Lack Of Maintenance
- Small Farms Holding

1. Introduction:-

Farm mechanization has been identified as a key tool to increase the agricultural production. It can saves inputs like seeds upto 15-20% fertilizers up to 15-20% and increase cropping intensity by 5-20%-It increases the efficiency of farm labours, reduces drudgery and saves time: In order to study the farm mechanization status, I am Atanu Sarkar the student of VIIIth Semester , B.Sc. (Ag) Hons Visited the Bahadurpur Village in Birbhum district and interacted with different farmers to have an idea about the farm mechanization status of the concerned village.

2. Observation:

SL. NO.	NAME	AMOUNT OF LAND HOLDING(ha)	MACHINARIES OWNED	REMARKS
1	Ram Chandra Majhi	0.2	Pump set, Desi plough	He is a marginal farmer and all equipments are hired but he is satisfied from farming
2	Bikash Chandra Bhandari	0.8	Pump set, Desi plough, Knapsack sprayer, Thresher machine	He is also marginal farmer and goes for aman paddy, mustard cropping pattern. Land preparation is done by hired bullock or hired tractor.
3	Swapan Chowdhury	0.267(owned) + 0.267(leased)	Nil	All the equipments are hired but he is more or less satisfied from his farming
4	Unnati Mandal	0.133(owned) + 0.05(leased)	Desi plough, Submersible pumpset	Some of the equipments are hired and she is more or less satisfied from his farming
5	Biswanath Ghosh	1.6	Pump set, Desi plough, Knapsack	He is well mechanised and he gives his pumpset as well as thresher on rent.

			sprayer, Thresher machine,Bullock cart with one pair of bullock, Mini submersible	He depends on hired tractor for land preparation, He is found to be a progressive farmer and he will purchase more machinaries on the availability of fund.
6	Abani Mete	0.133	Sickle, Reeper-harvestor	Not so well mechanised but he is satisfied from what he had.
7	Sushanta Mete	1.33	Pump set, Desi plough, Knapsack sprayer, Thresher machine,motor reeper	He is also well mechanised and he is very satisfied from his farming.

3. Discussion:

It has been found that Bahadurpur village has mostly marginal and small farmers and major land holdings of the village resides with a few medium to large farmersTherefore, the farm mechanization status of the village is moderately good.

For Ploughing they either use desi-plough (for small plot) or tractor drawn cultivators or rotavator which is hired in most cases. Sowing is done manually. No planter or driller is used. All the intercultural operations are done by small implements like spade , khurpi etc. Pesticide application is carried through knapsack sprayer mainly.

For irrigation Pumpset is used and main source is Canal. Few submersible Pumps are also there in the village. Harvesting is carried out by either sickle or hired com -bine harvestor in very few cases.

4. Constraints:

Generally, Lack of fund with the marginal and small farmers is the main constraint in Purchasing agro-machineries, inadequate land holding is another constraint for use of large machineries and implements in Bahadurpur village.

5. Suggestion:

- Contact with local financial institute for any financial help like machinery loan.
- Contact with local agricultural institute, ADA office for further information about farm mechanisation.

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6.Conclusion:

The farm mechanization has been well-received throughout the world as one of the most important elements of modernizing agriculture. The level and appropriate selection of agricultural machinery has direct impact on land and labour productivity, farm output and income, environmental safety and the quality of life of farmers in India. Agricultural machines also ensure timeliness of farm operations and increase work output per unit time. Suitability to small and medium farms, simple design and technology, versatility for use in several farm operations, affordability in terms of cost and profitability and most importantly, repair and maintenance services are the basic requirement for the expansion of farm mechanization.

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- Field note book of RAWE 01.

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SRINIKETAN

RAWE – 01

CROP PRODUCTION

ASSIGNMENT

ON

‘NON-CHEMICAL METHODS OF WEED MANAGEMENT PRACTICED BY THE FARMERS IN RABI CROPS’

Prepared by: Avralima Sarkar
BAG (Sem – VIII) – 06

Submitted to: Prof. B. K. Saren

ACKNOWLEDGEMENT

*I,**Avralima Sarkar,** a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my project in RAWE Programme on the topic* **'NON-CHEMICAL METHODS OF WEED MANAGEMENT PRACTICED BY THE FARMERS IN RABI CROPS'**

*I gratefully acknowledge my sincere thanks to our respected teacher**Prof. B. K. Saren,** for his remarkable, valuable guidance and supervision throughoutthe assignment work. It wouldbe my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard.*

*I would also like to extend my sincere thanks to **Dr. Joydip Mandal**, the course leader of RAWE-01 for his valuable guidance and supervision throughout the work.*

AVRALIMA SARKAR
BAG (SEM-VIII) - 06

INTRODUCTION

RAWE-01 (Crop Production) includes all the subjects under agriculture related to cropproduction.Under the programmes of RAWE-01 we were scheduled to visit the cultivated lands of the nearby villages (in Birbhum) and interact with our farmer friends to collect information about different aspects of the practical field of agriculture. During this course of activities, we also gathered knowledge about the different weeds of rabi crops and their management. We were exposed to the weed management methods adopted and implemented by the farmers.

OBJECTIVE

To write about the non-chemical methods of management of weeds in rabi crop, observed to be in practice by the farmers in the cultivated land.

THEORY

WHAT ARE WEEDS?

Weeds are plants that are unwanted in a given situation and may be harmful, dangerousoreconomically detrimental. Weeds are a serious threat to primary production and biodiversity. They reduce farm and forest productivity, displace native species and contribute significantly to land and water degradation. Weeds are of different types. Some of them are as follows:

- Some weeds are perennial (Cynodon*dactylon, Sorghum halepens)*
- Some are season bound (*Chenopodium alum, Phalaris minor)*
- Some are crop specific (*Anagalis arvensis* for Rabi grams)
- Some are mimicry weeds (*Avena fatua* and *Phalaris minor* in wheat)
- Contamination of crop seeds with that of weeds
- The presence of seeds of the crop grown in the previous season are also considered as weeds for the present crop.
- Seeds of other varieties of a particular crop.

- Some of the rabi crops and the weeds found in their plots:

CROPS	WEEDS
Wheat	• *Avenafatua* • *Phalarisminor* • *Anagallisarvensis* • *Carthamusoxycantha* • *Convolvulusarvensis* • *Chenopodiumalbum*
Barley	• *Convolvulusarvensis* • *Chenopodiumalbum* • *Avenafatua* • *Cyperusrotandus*
Rapeseed, Mustard	• *Convolvulusarvensis* • *Anagallisarvensis* • Carthamus oxycantha

	• *Argemone Mexicana* (seed)
Vegetables	• *Rumexcrispus* • *Euphorbiahelioscopia* • *Convolvulusarvensis*

HARMFUL EFFECT OF WEED:

Weeds have serious impacts on agricultural production. It is estimated that in generalweeds cause 5% loss in agricultural production in most of developed countries, 10% lossin less developed countriesand 25% loss in least developed countries.
In India, yield losses due to weeds are more than those from pest and diseases.

- Weeds reduce the quality of marketable agricultural produce.
- Weeds also causes allergic effect on humans.
- Seeds of *Argemone Mexicana* get mixed with those of mustard and cause Dropsy disease on consumption by man. ***DROPSY TRAGEDY*** *has occurred in Delhi in 1998.*

WHAT IS WEED MANAGEMENT?

Weed management is an important component of plant protection improving the production potential of crops. It includes management of the weeds in a way that the crop sustains its production potential without being harmed by the weeds. Weed management practices can be classified into the following groups:

- Mechanical methods
- Cultural methods
- Chemical methods
- Biological methods, etc.

NON-CHEMICAL WEED MANAGEMENT:

From detailed conversation with our farmer friends, we have noticed that, they mainly use chemical fertilisers for weed management in their field. However, non-chemical methods of weed management are also applied by them to a large extent.
Non-chemical weed management includes all the methods, except chemical herbicides, applied by the farmers to control weeds in the field. This includes:

- Mechanical process
- Cultural process, and
- Biological process

Some of the non-chemical practices used by the farmers in Rabi season (mainly) are as follows:

MECHANICAL METHODS:

- **Tillage**: Before sowing the farmers practice tillage on the field, which removes weeds from the soil resulting intheir death. It may weaken plants through injury of root andstem pruning, reducing their competitiveness orregenerative capacity. Tillage also buries weeds.

- **Hand weeding:**This is the oldest technique of weed management used by the farmers. It is done by physical removal or pulling out of weeds by hand or removal by implementscalled *khurpi.*
- **Sickling:**Sickling is also done by hand with the help of sickle to remove the top growth of weeds. This is also a common method applied by the farmers.
- **Earthingup:**In fields of potato, earthing up is practiced to control weed.Earthing up is done when the plants are 15 to 22 cm high. The ridges are made broad, loose and high enough to cover the tubers. This practice uproots the weeds, expose them and further buries them thereby leading to their death.
- **Mechanical weeders:**There are a numbers of mechanical weeders which can be used for the purpose, but the farmers are either unaware or cannot afford them. However, we have seen the use of **Tractor drawn weeding cum earthing up equipment** in the fields of potato of some highly progressed farmers.

PHYSICAL METHODS:

- **Burning:** We also noticed the practice of burning the weeds for their management. Generally, before sowing the residuals of the previous crops present on entire field are burnt but sometimes, after hand picking the residual weeds are also burnt.
- **Dredging and chaining**: It is used to control aquatic weeds. This removes weeds along with their roots and rhizomes. The floating aquatic weeds are removed by chaining.
- **Digging:** weeds are removed by digging up to deeper layers so as to remove underground storage organs. It is useful against perennial weeds.

CULTURAL METHODS:

- **Field preparation:** the farmers prefers weed free plots for sowing. To ensure that no weed stubbles or seeds remained in the soil they practice tillage operation. They also practice such other activities during field preparation.
- **Maintenance of optimum plant population:**They try to maintain an optimum plant population in the field to reduce weed growth and competition. Generally, the seed rate is increased.
- **Crop rotation:**The possibility of a certain weed species or group of species occurring is greater if the same crop is grown year after year. The growth or existence of rabi weeds are reduced by growinglow land rice in kharif season. This kills the rabi weeds by providing an unfavourable (submerged) condition for survival.
- **Growing of intercrops:** Inter cropping suppresses weeds better than sole cropping and thus provides anopportunity to utilize crops themselves as tools of weed management. Many short durationpulses viz., green gram and soybean effectively smother weeds without causing reduction in theyield of main crop.

BIOLOGICAL METHOD:

This method of weed management is still not popular among the farmer friends of the visited villages. Majority of them do not know about the method and the rest of the progressive farmers do not practice this due to lack of clear knowledge.

MERITS OF NON-CHEMICAL WEED MANAGEMENT:

There are may advantages of applying non-chemical methods of weed management. Some of them are as follows:

- It is environment friendly.
- It conserves the soil ecosystem as it is less harmful to the organisms living in soil.
- It is non-residual in nature. Thereby, does not degrade soil fertility rather restores the same.
- Is does not affect the crop plants adversely.
- Facilitates the survival of natural enemies and predators in the soil.
- Tillage, which is a mechanical weed management practice, reveals the insects living in the soil that further helps in pest management as well.
- It does not lead to drift hazard.
- Does not contaminate water
- Does not lead to health hazards.
- It is sustainable in nature.
- Low cost
- Maintains the ecological balance

DEMERITS OF NON-CHEMICAL WEED MANAGEMENT:

Some of the demerits of non-chemical weed management are as follows:

- It is labour intensive.
- It is tedious and time taking
- It has low efficiency
- Does not lead to full eradication of weeds
- It does not provide immediate result.

CONCLUSION

- After green revolution, there has been a sharp increase in the use of chemical herbicides for weed management. Since herbicides are cost effective and gives early results, they are preferred by the farmers and are used extensively by them.

- But now, through detailed studies it has been concluded that extensive use of chemical herbicides has a large number of adverse effect on the environment. Not only the environment but the associated crops, animals and human beings are also affected adversely in many ways. Also, many weeds have become resistant to the commonly used herbicides.

- From detailed conversation with our farmer friends, we have observed that they mainly use chemical herbicides for weed management but are well aware of the different mechanical, physical and cultural weed management practices and apply them to a large extent.

- However, the knowledge of biological weed management is not available to all of them. Some are not aware of this concept while others, mainly the progressive farmersknow about the practice but do not apply them due to lack of proper information and infrastructure.

- The marginal farmers prefer cultural and mechanical weed management practices. The small and large farmers use chemical practices.

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- However, they have witnessed the degradation of soil fertility due to the residuals of the chemicals used in the field. Also the have observed the decline in crop quality due to the same.

- We have observed that some of the farmers still use herbicides on large extent due to lack of awareness and information, while others do the same out of compulsion due to lack of infrastructure.

- Keeping these in view, it has now become necessary to shift the focus from chemical weed management to non-chemical weed management practices as soon as possible. More information regarding non-chemical weed management should be provided to the farmers. They should also be encouraged to practice these in their fields.

- Many steps have been taken for reduction in the use of herbicides, one of them is the imposition of ban on a number of herbicides in the recent past.

- On the budget of 2019, our Finance Minister Nirmala Sitharaman briefed us about **Zero Budget Natural Farming**, the main objective of which is to reduce the cost of production to the minimum. To implement this, one of the very useful step can be reduction in the use of chemical herbicides, since many of them are costly enough and adds on to the cost of production. Therefore, complete shift from chemical to non-chemical weed management will turn out to beneficial.

REFERENCES

- Observations gathered from visit to the above mentioned topic.
- Notes on the topic provided by our institution.
- agritech.tnau.ac.in

RAWE 01

PROCESSING AND VALUE ADDITION OF HORTICULTURAL CROPS

Submitted by:

BAIBASWATA DEY

Roll No:07

Submitted to: Dr. Joydip Mandal

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Introduction

Fruits and vegetables are important supplement to the nutritional requirements in the human diet as they providethe essential minerals, vitamins and fiber required for maintaining health. India is the second largest producer of fruits and vegetables in world after China. Huge quantity of produce is wasted due to inadequate facilities for preservation as only 1.5 to 2% of the total produce is processed in the country. Fruit and vegetable preservation is thus one of the major pillars of food industry. The food preservation and processing industry has now become a necessity rather than being aluxury.

Status of fruits and vegetables in India

Fruits and vegetables are the important category of horticulture crops grown in our country.

- Out of total cropped area of 184 million hectare, horticulture crops cover about 20.7 million hectares (about 11.25% of the total gross croppedarea).
- Horticultural crops contribute about 18-20% of the gross value of India's agriculturaloutput.
- India is the largest producer of mango, banana andlime.
- The country produces 41% of world mangoes, 23% banana, 24% cashew nut and accounts for 12% of world fruit production (MOFPI,2009).
- India is the world's second largest fruit and vegetable producing country accounting for 79.97 million tons of fruit and 129.1 million tons of vegetables (FAO,2009).
- Besides, about 5.66 million tons of loose flowers, spices, mushroom and aromatic plants arealso produced.
- The export of fresh fruit and vegetables from India in 2006-07 was estimated at 9.84 lakh tons and valued at Rs 2411.70 crores.
- Mango, grapes, apple, onion, potato, green vegetables like okra, bitter gourd and green chilies are themajor items ofexport.
- India also exported 9.53 lakh tons of processed foods comprising of mango pulp, juices, concentrates, dried and processed vegetables, pickle and chutney, alcoholic and non-alcoholic beverages worth Rs 2,757.74 crores (APEDA, 2007).

Status of fruit and vegetables processing industry inIndia

The food processing industry in India accounts for 14% of the total industrial output with 6.3% contribution in the national GDP. The food processing industry plays an important role in the Indian economy and is establishing as one of the largest sector in terms of production as well as returns. The installed capacity of processing fruit and vegetable in our country from more than 6600 FPO licensed units is about 3.85 million tons which is less than 2% of total fruit and vegetable production against 60-83% in many horticultural advanced countries like 60-70% in USA, 70% in Brazil, 78% in Philippines, 80% Saudi Arabia and 83% in Malaysia. Further, the actual production of processed products from these units stood at only 1.33 million tons (Table-1.2) which accounts for less than 35% capacity utilization of the installed processing units.

Objectives of fruit and vegetable processing

1. To reduce wastage and losses: Fruit and vegetable industry is the backbone of horticulture industry as it takes care of all possible waste that occurs in spite of improvement in the distribution and marketing of freshproduce.
2. To handle glut: Produce during glut season utilized for making different processed products, thus fruit processing helps in reducing wastage and handling excess produce during glutseason.
3. To stabilize farm prices and income: It stabilizes farm price by utilizing the excess produce invalue addition to provide additional income to thefarmers.
4. To utilize marketable surplus: Processing utilizes marketable surplus as well as cull and deformedproduce, to ensure remunerative returns to thegrowers.

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5. To generate employment: Processing of fruits and vegetables being a laborintensive helps to generate both direct and indirect employment for themasses.
6. To add variety to the diet: Value addition/processing make the food more attractive andpalatable.
7. To ensure nutritionalsecurity.
8. To earn foreign exchange through export of processed fruit and vegetableproducts.

Major constraints in expansion of food industry

1. Variation in fresh produce quality involving frequent changes in productionschedules.
2. Low productivity and high cost of raw material: Low production percent area in our country in comparison to horticulturally advanced countries is one of the major factors leading to high cost of raw material (Table- 1.5).
3. Lower quality of raw material (low in soluble solids) in our country leads to requirement ofcomparatively more raw material for production of equivalent quantity of finished products, thus resulting in higher cost of production (Table1.5).
4. Non availability of cost effective technologies for processing and packaging of fresh and processed products.
5. Lack of infrastructure for post-harvest management, cool chain and coldstorages.
6. Non-availability of trainedman-power.
7. Low domestic demand of processed fruit and vegetable products due to highcost.
8. Irregular in supply and non-uniform quality of processed products due to variation in raw material quality and use of batch processes.
9. High cost of packaging material, higher taxes and exciseduties.
10. Low capacity utilization in foodindustries.
11. Financial and fiscalconstraints.
12. Infra-structural constraints inprocessing.
13. Inadequate farmer-processor linkage; leading to dependence onintermediaries.
14. Lack of strategies for marketpromotion.
15. Lack of strategies for utilization of processing industries waste (pomace, peel, core, stones/seed) forvalue addition.
16. Lack of R&D in food processing sector and its linkage with the foodindustry.

Prospects for growth of processing industry

In spite of large number of constraints, the prospects for growth of processing industry are very high due to following factors:

1. Increasedurbanization.
2. Changing life style and foodhabits.
3. Increase in purchasing power of thepopulation.
4. Change in consumptionpattern.
5. Increased awareness of population about health promotingfoods.
6. Increased demand for functional foods, organic foods, convenience foods and dietfoods.
7. Expansion of organized foodretail.
8. Increase in population of working women having less time for spending in the kitchen. Thus need forprocessed convenience foods.

Unit operations in processing:

1. RAW MATERIALHANDLING

Material handling include varied operations as hand or mechanical harvesting on the farm, transportation in trucks or refrigerated vehicles of perishable produce to the market or to the processing plant or to store/go-downs. For conveying, wide variety of mechanical conveyors is used depending upon the type of material. Common conveyors used in the processing plant

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include screw conveyor, bucket conveyor, belt conveyor and vibratory conveyor.
Throughout these operations care is taken to maintain sanitary conditions, minimizing bruises and product loss, maintaining raw material quality like physical appearance, vitamin contents, minimizing microbial growth and minimizing other detrimental changes to the product quality during handling etc. It also includes other unit operations like receiving, cleaning/washing, sorting, grading, peeling, halving, slicing, blanching etc. for preparation of fruit and vegetables for processing.

Raw material selection/receiving

- Fruitsandvegetablesshouldberipebutfirm,evenlymatured,freefromblemishes,insectdamageand malformation.
- Harvesting at proper maturity is an important step in selection of rawmaterial.
- Most of the fruits are harvested at soft ripestage.
- Vegetables except peas, beans etc. are harvested at mature stage to enable them to withstand cooking duringsterilization.
- Some vegetables like green beans, greens peas, ladies finger should be tender and free from soil, dirt etc.

2. WASHING/CLEANING

Cleaning is the unit operation in which contaminating materials are removed from the food and separated to leave the surface of the food in a suitable condition for further processing. Cleaning can be performed by using:

- Wet procedures: Soaking, spraying, floatation, washing and ultrasoniccleaning.
- Dry procedures: Separation by air, magnetic attraction of metal contaminants or by physical methods depending upon the product and nature of thedirt.
- Fruitandvegetablesaregenerallywashedwithwatertoremovedust,dirtandadheringsurfacemicro- flora.
- Fruits like peach, apricot etc. that are lye peeled are not washed beforepeeling.
- Washing after peeling removes vitamins and minerals and should bediscouraged.
- Different methods of washing include soaking or agitating in water, washing with cold or hot water sprays etc.
- Mechanical washers involve agitating or tumbling the commodity on moving belts or revolving screens while they are immersed in water or subjected to watersprays.Washing by using high pressure sprays is most satisfactory.
- Detergents are frequently used in the wash or rinsewater.
- Vegetables may be soaked in dilute solution of potassium permanganate or chlorine (25-50 ppm) for disinfection.

3. SEPARATING

It involve separating a solid from a solid like peeling of potatoes, separating a solid from a liquid as in filtration or a liquid from solid as in pressing of juice from a fruit. It might involve the separation of a liquid from a liquid as in centrifugation of oil from water. It might also involve removing gas from a solid or liquid as in vacuum removal or air from canned food during canning. Common separating methods used in fruit and vegetable processing are discussed as under:

- Sorting: Sorting is the separation of foods into different categories on the basis of a measurable physical property. Sorting and grading ensures the removal of inferior or damaged commodity. For sorting, inspection belt can be used, in addition to trained personnel who detect poor quality produce unsuitable for canning. Automatic Colour sorters can be used for sorting to reduce labourcost.
- Grading: After preliminary sorting, the fruit and vegetables are graded to obtain uniform quality with respecttosize,colouretc.Gradingcanbedoneeithermanuallyorwiththehelpofmechanicalgraders. Different types of mechanical graders include screen grader, roller grader, rope or cable grader, conveyor graderetc.
- Peeling, coring and pitting: These are the primary unit operations for preparing fruit and vegetables forprocessing.
- Peeling of fruit and vegetables is carried out to remove unwanted or inedible material and to improve the appearance of the finalproduct.
- Themainconsiderationforpeelingistominimizecostbyremovingaslittleoftheunderlying food as possible and reducing energy, labour and material cost to aminimum.
- The peeled surface should be clean andundamaged.
- Depending upon the commodity, peeling and coring methods can be selected such as 1)hand orknifepeeling2)machine/abrasivepeeling3)flashsteampeeling4)lye(caustic)peeling5) flamepeeling.
- Cores and pits in fruits like apple, peach, apricot etc. are removed by hand or by machine(de- corer).


4. DISINTEGRATING

It covers wide range of operations that are used to sub-divide large masses of foods into smaller units or particles. It may involve cutting, slicing, chopping, grating, pressing to extract juice, pulping, homogenizing etc.

- Slicing,chopping,cuttinganddicing:Fruitandvegetablesareslicedtoadesirablesizeeithermanually or by using semi or automatic slicing/chopping or dicing machines. These unit operations are collectivelycalledassizereduction.Theseunitoperationsincreasetherateofdrying,heating,cooling and improve the efficiency and rate of extraction of liquid components like fruitjuices.
- Juice extraction: For juice extraction, the fruits and vegetables like apple, pear, carrot, aonla etc. are grated in fruit grater to reduce their particle size. The grated mass is then pressed through basket press/hydraulic press to extractjuice.
- Homogenization:Homogenizationofmilkcausesdisintegrationoffatglobulesinmilkorcreamfrom largetominuteglobules.Thesmallerfatglobulesthenremainevenlydistributedthroughoutthemilk orcreamwithlesstendencytocoalesceandseparatefromthewaterphaseofthemilk.Di

sintegration of fat globules is done by forcing the milk or cream under high pressure through a valve with very small openings. Similarly, fruit juices are homogenized to prevent sedimentation duringstorage.

- Pulping: For extraction of pulp, the fruits like apple, pear, apricot, guava, plums, tomato etc. after preliminary treatment (crushing with or without heating), are passed through the pulper. With the action of blades/flights in the pulper, the fine pulp is forced through the openings of the screen/sieve which is collected at one end, while, seeds, skin and core is forced through another end of the pulper. Depending upon the type of fruit, various types of pulper like baby pulper, tomato pulper, mango pulper etc. can beused.

5. PUMPING

This unit operation is used for moving liquids from one processing step to another. Single screw type and gear type pump are used for this purpose.

6. MIXING

There are different types of mixers depending upon the type of material to be mixed. They may be used for mixing solids with solids, liquid with liquids, liquids with solids, gases with liquids etc.

- For simple mixing of dry ingredients, a conical blender may beused.
- A ribbon blender with rotating mixing elements is used to mix sugar with other dry components to produce fluffy drymix.
- Propeller type agitator mounted within stainless steel vat is used for mixing solids into liquids to dissolve them as in case of salt and sugarsolution.

7. HEATING

Heating of foods is carried out to destroy the micro-organisms, to preserve the food as in case of pasteurized milk and canned peas and to make them more tender and palatable as in cooking operations. Foods are heated by conduction, convection, radiation or their combination. Most of the foods are sensitive to heat and prolonged heat may cause burnt flavor, dark colour or nutrition loss. It is therefore desirable to heat such foods rapidly and cool immediately. Foods may be heated or cooled by using hot water toasters, direct steam, direct contact to flame or microwave cookers.

a. **Blanching:** Treatment of fruit and vegetables by dipping in boiling water or steam for short periods followed by immediate cooling is called blanching. The basic objectives of blanchingare:

- Inactivation of enzymes, to cleanse the product initially to decrease the microbialload.
- To preheat the product beforeprocessing.
- To soften the tissue for facilitating compact packing in thecans.
- To expel intercellular gases in the rawfruit.
- To prevent excessive pressure built up in thecontainer.
- To allow improved heat transfer during heatprocessing.
- To ensure development of vacuum in the canand
- To reduce internal cancorrosion.

b. Pasteurization: Pasteurization is a relatively mild heat treatment in which the food is heated below 1000C to destroy selected vegetative microbial pathogens or to inactivateenzymes.

- The pasteurization of liquid foods (fruit juices, milk, milk products, liquid egg etc.) is carried out in continuousheatexchanger.Theproducttemperatureisquicklyraisedtothepasteurizationlevelsinthe first heat exchanger, held for the required length of time in the holding tubes, and quickly cooked in a second heatexchanger.
- For viscous fluids, a swept surface heat exchanges (SSHE) is used to promote faster heat transfer and to prevent surface foulingproblems.
- Inpackagepasteurizationissimilartoconventionalthermalprocessingoffoods,butiscausedatlower temperatures.
- The extent of heat treatment required to stabilize a food is determined by the D value of the most heat resistant micro-organism or enzyme present in thefood.
- Milk pasteurization is based on D60 and a12 logarithmic cycle reduction in the numbers of Coxiella Brunetti while liquid whole egg is treated to produce a 9 D reduction in numbers of Salmonella softener.Sincecolour,flavourandvitaminsarealsocharacterizedbyDvalues,therefore HTST(High temperature short time) process is used for retention of nutritional and sensoryquality.
- In milk processing, the low temperature long time (LTLT) process operating at 630C for 30 minutes (holderprocess)causegreaterchangestoflavourandlosstovitaminsthanHTSTprocessingat71.80C for 15 seconds.
- Flashpasteurizationuseshighertemperatureandshortertimes(HTST)forexample880 Cfor1s,940 C for 0.1 sec or 100 0 C for 0.01 sec. for milk and is known as Higher heat shorter timeprocessing.
- For milk pasteurization, inactivation of alkaline phosphatase is used as indicator ofpasteurization.
- Liquid egg pasteurization is based of measurement of a- amylaseactivity.

c. Processing: Heat processing consists of heating cans to a predetermined time and temperature combination of heating to eliminate all possibilities of microbialspoilage.

- Over cooking should be avoided as it spoils the texture, flavour and appearance of theproduct.
- In continuous non-agitating cookers, the cans travel in boiling water in crates carried by over-head conveyors on a continuous movingbelt.
- Incontinuousagitatingcookers,thesealedcansmovingonthebeltarerotatedbyaspecial mechanical device to agitate the contents of the cans. This helps in reducing the processingtime.
- Generally all fruits and acid vegetables can be processed satisfactorily in boiling water (100oC) and non-acidic vegetables (except tomato and rhubarb) are processed at higher temperatures of about 115- 121oC underpressure.

d. Sterilization: Sterilizationisamoresevereheattreatmentgiventoafoodtodestroybothspoilageandpathogenic micro-organisms, after packaging the food in a hermetically sealed container. The thermal processing criterion for acid and medium acid foods (pH<4.5) is the destruction of heat resistant vegetative micro-organisms orenzymes.

- The low acid foods such as mushrooms, potatoes, peas and other vegetables are processed at elevated temperatures(115-1210C).
- Acidfoodslikepeaches,pears,pineappleandotherfruitsareprocessedat1000Corlowe rforadequate inactivation ofenzymes.

8. COOLING

Cooling is the subtraction of heat energy which is added during processing. The cooling may be done to the degree where food is chilled to refrigerated temperature. The milk is cooled by passing them in thin layers through heat exchangers or through coolers (cold water or refrigerants are pumped). Fruits such as apple slice, berries, and cherries are frozen. Thawing will be done by the unit operations of heating or disintegrating.

- Air blast freezers automatically freeze peas, beans and other vegetables, mushroomsindividually.
- Freezing of canned or packaged foods may be done by direct immersion inrefrigerants.

9. EVAPORATION

Evaporation in the food industry is used principally to concentrate foods by removal of water. All liquids boil at lower temperature under reduced pressure and are the key to modern evaporation. Vacuum evaporators and multi stage evaporators can easily remove water.

10. DRYING

Drying involves the removal of water with minimum damage to the food. Evaporators will concentrate the food 2-3 folds or more while driers take the foods very close to total dryness that is to 97-98% solids. Driers are used to prepare well known products like milk powder and instant coffee. Subdivision of a liquid is the basic principle behind the widely used spray driers. The liquid is atomized by a spray nozzle and at the same time the hot air is passed, which results into drying. Sun and solar drying, atmospheric dehydration including stationary or batch processes (kiln, tower, and cabinet driers) and continuous processes (tunnel, continuous belt, belt-trough, fluidized- bed, explosion puffing, foam-mat, spray, drum, and microwave-heated driers) are used. Vacuum shelf, vacuum belt, vacuum drum and freeze driers are the type of driers that can be used for drying and dehydration of products. Prior to drying, the fruits are pretreated in Sulphur fumigation chambers by burning Sulphur or are dipped in a solution of potassium metabisulphite.

11. FORMING

It is an important unit operation in the breakfast cereals and snack food industries. The characteristic shapes of the popular breakfast cereals are the result of pressure extrusion through dies, together with adherence operating conditions like pressure, temperature, dough consistency and other variables. The special kind of forming is known as extrusion cooking. Further examples of forming are shaping of butter, bars, pressing of cheese curd into various shapes, bread dough shapes and shaping of sausages.

12. PACKAGING

The packaging of food is necessarily required to protect the food from microbial contamination, dirt, dust, light, moisture and the losses. The foods are packaged in metal cans, glass, plastic bottles, paper and metallic films, pouches etc. Now a days the packaging of food products has emerged as an important industry and automatic packaging units are in great demand. The containers for packaging are automatically formed, filled and sealed by passing through machines. Such packages are easy to open and dispose of. The newer packaging systems have some advantages like saving of space in food plants, during transportation and marketing.

Thus, for preparation of any furnished product, different unit operations are used. Depending upon the availability of facilities, the processing can be carried out as a batch process, semi-continuous process or as an automatic continuous process.

VALUE ADDITION:

Value Addition in Horticulture is the process in which a high price is realized for the same volume of a primary product, by means of processing, packing, upgrading the quality or other such methods. For example: Making Jam of Pomegranate and Strawberry.

Need for value addition in Horticulture:-

- To improve the profitability of farmers.
- To empower the farmers and other weaker sections of society especially women through gainful employment opportunities and revitalize rural communities.
- To provide better quality, safe and branded foods to the consumers.
- To emphasize primary and secondary processing.
- To reduce post-harvest losses.
- Reduction of import and meeting export demands.
- Way of increased foreign exchange.
- Encourage growth of subsidiary industries.
- Reduce the economic risk of marketing.
- Increase opportunities for smaller farms and companies through the development of markets.
- Diversify the economic base of rural communities.
- Overall, increase farmers’ financial stability.

Importance of Value Addition in Horticulture:-

- Horticulture deals a large group of crops having great medicinal, nutritional, health promoting values.
- India as second largest producer of fruits and vegetables, only 10 per cent of that horticultural produce is processed, but other developed and developing countries where 40-80 per cent produce is value added.
- Horticultural crops provide varied type of components, which can be effectively and gainfully utilized for value addition like pigment, amino acids, oleoresins, antioxidants, flavours, aroma etc.
- Post-harvest losses in horticultural produce are 5 to 30 per cent which amounts to more than 8000 crore rupees per annum. If we subject our produce to value addition the losses can be checked.
- Horticultural crops are right material for value addition because they are more profitable, has high degree of process ability and richness in health promoting compounds and higher potential for export.

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Types of value added products:

- **Fruit jams and jellies:**
    - Prepared by boiling the fruit pulp with sufficient quantity of sugar to a moderately thick consistency.
    - Jams, jellies and marmalades share approximately 17% of the total processed fruit and vegetable products.
    - Fruits and vegetables like pineapple, papaya, banana, local fruits, roselle etc. can be used.



- **Semi-processed products:**
    - Pulp/puree from banana, pineapple, jackfruit, tomato, papaya, passion fruit.
    - Juice concentrates from oranges, Assam lemons, pineapple, local fruits like jamun, peach, plum, pear etc.
    - Juice powders.


- **Dehydrated vegetables and spices:**
    - Controlled dehydration of vegetables consists of grading/ sorting, washing, blanching, chemical treatment, dehydration and packing unit.
    - Cabbage, cauliflower, mushroom, carrot, roselle calyces, potato, tapioca, sweet potato, chilies, onion, ginger, garlic, turmeric etc. are good for drying.

- **Beverages:**
    - RTS and other beverages have an emerging market.
    - Oranges and other citrus fruits, banana, pineapple, jackfruit, indigenous fruits like Garcinia, peach, plum, pear, jamun, bael, carambola, passion fruit etc. are promising sources.
    - Vegetables can also be used. Good sources are watermelon, roselle, carrot, leafy vegetables etc.

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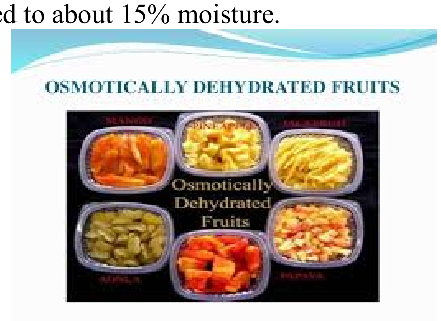
❋ Osmo-air dried fruits:

- Novel approach towards dehydration.
- Osmo-air dehydration product is near to the fresh fruit in terms of colour, flavour and texture.
- Products like slices of pineapple, jackfruit etc. processed.
- Osmotic agent like sugars used.
- Finally air dried to about 15% moisture.



❋ Waxing of fruit and vegetables:

- The wax emulsion is diluted with cold water and used for dipping fruits and vegetables.
- Enhances the shelf life, protects fruit from fungal attack, and reduces desiccation and weight loss.
- Simple and economical.
- Various fruits like oranges, vegetables and spices like ginger can be waxed.

❋ Pickles and Chutneys:

- Various dry and oil-based pickles can be prepared from fruits and vegetables of the region.
- Bamboo shoot, lemons, jalpai, roselle, ginger, garlic, tomato, carrot, local fruits etc. can be pickled.

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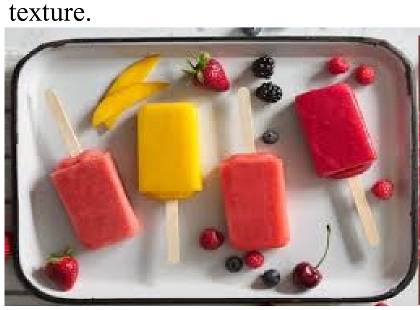
- **Potato/Sweet Potato/ Tapioca Flour:**
  - Potato and tapioca are grown in large areas.
  - The process involves peeling, cutting, pre-treatment with salt and permitted preservatives, soaking, granulating, drying, grinding and packing.

- **Banana Chips:**
  - Chips from plantain cultivars of banana has emerging market.
  - The process is simple and can be easily adopted at rural areas.

- **Fruit Toffees and Bars:**
  - Made from pulp of many local fruits along with certain ingredients.
  - Any variety of pulpy fruits like papaya, banana, pineapple and other indigenous fruits, singly or in combination, can be used to manufacture fruit bar.
  - Fruit bars are becoming increasingly popular due to good shelf life, taste, flavor and texture.

- **Tutti Frutti:**
  - Colorful confection containing various chopped and usually candied fruits, or an artificially created flavoring simulating the combined flavor of many different fruits.
  - It is often used for making a tutti frutti ice-cream.
  - Papaya is largely used to make tutti frutti, maraschino cherry etc.
  - Other local fruits can also be used.

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- Consumption of these products is rapidly increasing.

Tomato products:

- Puree, paste, ketchup, sauce and ready-to-eat products can be prepared.
- Good domestic and export market.

Minimally processed products:

- Meets the consumer's demand for more fresh, natural, and convenient foods.
- Pineapple slices, cubes etc.
- Jackfruit pieces
- Cucumber slices
- Carrot discs
- Garlic cloves
- Orange segments

Processing of Some Value-added Products

1. Processing of JAM:

Fresh ripe fruits

↓

Washing, Cutting, Peeling

↓

Blending

↓

Simmering

↓

Stirring(to draw out pectin in fruits)

↓

Addition of sugar/water

↓

Rapid boiling/ concentration+ Lime

↓

Jam product

2. Processing of JELLY:

Ripe firm fruits

↓

Washing and Peeling

↓

Pulping(remove seed)

↓

Addition of sugar(add water if necessary)

↓

boiling

↓

Addition of citric acid

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↓

Judging of End-point(68-70% TSS)

↓

Filling in bottles and sealing

3. Processing of PICKLES:

Mature Fruits/vegetables

↓

Washing, peeling

↓

Slicing

↓

Add salt, spices, oil

↓

Mix and put in glass jar

↓

Shaking the jar twice a day

↓

Add more oil and salt

↓

Sealing and storage

4. Processing of BANANA CHIPS:

Fresh mature banana

↓

Washing and peeling

↓

Slicing

↓

Blanching

↓

Dewatering

↓

Chips frying

↓

Chips De-oiling

↓

Seasoning

↓

Packing

5. Processing of TOMATO SAUCE:

Fully ripe red tomatoes

↓

Washing and Sorting

↓

Cutting and Chopping

↓

Heating at 70-90^{0}c for 3-5 min

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↓

Straining of pulp

↓

Cooking pulp with one-third quantity of sugar

↓

Putting Spice bag

↓

Cooking to one-third of original volume of pulp

↓

Removal of spice bag

↓

Cooking and addition of remaining sugar and salt

↓

Judging of end point

↓

Addition of vinegar/ acetic acid and preservative

↓

Filling and cooling

↓

Pasteurization

↓

Sealing and storage

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Palli Siksha Bhavana,
Institute of Agriculture

RAWE-05:Research Station/KVK/DATT Centre Activities and Attachment to Agro-based Industries

TOPIC:-A comprehensive report on entire RAWE-05 programme

NAME-Bhaskar Ghosh

YEAR-4th Year,VIII Semester   Roll-08

--Submitted to:-Dr.Anindita Saha

[This report consists of the importance of the RAWE-05 programme and the experience undergone by me as astudent while doing the different surveys of various institutions.]

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Acknowledgement:

I would like to show my gratitude to our course instructor Dr.Anindita Saha for her help and valuable guidance for the completion of this assignment.I would like to expand my gratitude to all other office bearers and other people of different institution who has guided me in the course to understand the working and different activities undertaken by them. Many people, especially my classmates have made valuable comment and suggestions which gave me an inspiration to improve the quality of the assignment.

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Introduction:

Rural Awareness Work Experience Programme (RAWE) is an important competence and confidence building programme introduced in the Institutes of Agriculture and the SAUs in India. With a view to giving the real-life exposure to the students Palli Siksha Bhavana (Institute of Agriculture) has also introduced this programme for the students of VIIIth Semester B.Sc (Ag.) Hons. This Programme is a sequel of the recommendation made by the 'Randhawa Committee' constituted by ICAR. The Rural Agricultural Work Experience (RAWE) programme is a flagship activity for the final year B.Sc. (Ag.) students during the last semester. Building self-confidence in the agricultural graduates by honing their professional skills is the key objective of introducing RAWE at the under graduate level by ICAR. Accordingly, this semester-long programme has been evolved. The most important area in which the development needs to be continuously accelerated is agriculture, which is the backbone of country's economy. In order to bring about changes in the knowledge, skill and attitude of the people engaged in farming, a sustained effort is necessary and thus could be achieved only through purposeful education. Rural Agricultural Work Experience (RAWE) Programme is a key component in the B.Sc. (Ag.) degree programme. The students are given rigorous orientation and familiarization on various issues and problems they can expect in the farmers' field.

Approach for RAWE programme:

Experiential learning approaches towards problem solving and improving interaction with the world outside. Under the changing dynamics of economical and industrial growth agriculture has undergone a sea change with new approaches. Therefore, this experiential system in agricultural academia has become imperative for better training to the agricultural technocrats with high level of skill in combination with the modern out-look and management capacity.

The learning process essentially provides a direction to the students to think and act and eventually creates self-confidence. It helps the students develop their competence, capability, capacity building, skills, expertise, in short a holistic development.The experiential approach is a learner-centred approach and allows an individual student to be responsible for his own learning minimizing the role of his *teachers and hosts. Effective work experience training strategies incorporating rural agricultural experiential learning approach provide opportunities to a student to experience the fieldwork activity and to review and analyze critically his own work experience so that they prove to be useful in their real-life situation.*

About RAWE-05:

Under this RAWE programme,we the students under sincere guidance of our course coordinator Dr.Anindita Saha have studied the following under different Institutions:

- *Activities of research station - mandate, organisational structure, research projects: ongoing and completed, research achievements, varieties developed, technology transfer, training, linkage, extension activities, financial performance, constraints.*
- *Activities of Krishi Vigyan Kendra (KVK) - mandate, details of district, organisational structure, technical achievements- i) target and achievement of mandatory activities ii) abstract of intervention undertaken based on thrust area, on farm tests- i) number of technologies assessed ii) achievement on technologies assessed and refined iii) results of technologies assessed, front line demonstration- i) FLDs implemented during current year ii) results of front line demonstrations, demonstration on crop hybrids, training, extension activities, production of seeds, plants and livestock, success stories, impact, linkages, financial performance, constraints.*
- *Study of Community Development Block - demographic analysis, institutional analysis, livelihood analysis, critical analysis of various development programmes, constraint analysis.*
- *Attachment to the Agro-based Industries - profile of agro-processing unit, economics of agro-processing unit, marketing behaviour of agro -processing unit, risk management of agro-processing unit, constraints of agro -processing unit.*

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Overview of KVK Visit:

On 21st and 22nd of December,we visited the Rathindra Krishi Vigyan Kendra(RKVK) which is at a walking distance from our PSB,under the supervision of our course coordinator Dr.(Ma'am)Anindita Saha.On the first day we were elucidated by Dr.Prabuddha Roy(SMS in Agriculture Extension) on topic of KVK with reference to its genesis and development and functions with special reference to RKVK.On the second day Dr.Subrata Mandal (SMS in Agronomy) gave us a detailed idea about the implementation of On-Farm trials and On-Station trials in KVK system.

Rathindra Krishi Vigyan Kendra (RKVK) ,Palli Siksha Bhavana, Visva Bharati was established on 4th October,1994 sponsored by Indian Council of Agricultural Research, New Delhi. The KVK is named after Rathindranath Tagore,the eldest son of Gurudev Rabindranath Tagore. The foundation stone of Rathindra Krishi Vigyan Kendra (RKVK) was laid out by late Dr. Shankar Dayal Sharma, Former Hon'ble President of India.

During the placement of students at Rathindra Krishi Vigyan Kendra (RKVK), Palli Siksha Bhavana, Sriniketan, the entire facet of KVK was understood. We got an orientation of this KVK since its inception in 1994 and studied the detail activities of it during recent past. Discussion with the subject matter specialist (SMS) has helped the students to know the multi-disciplinary and participatory approach of agricultural extension. During the visit to farm, students have seen mango orchard, guava orchard, Azolla unit, poultry unit, portable fish breeding unit, vermin-compost unit, soil and water testing laboratory, plant diagnostic laboratory, medicinal plants unit, on-farm trial plots, etc.In-detailed study about how On farm research,Frontline demonstrations are carried out by the KVK and the dissemination of technologies were learned from the SMS.We got a clear idea about the experimental process before any varietal release. The organizational structure, mandate, thrust areas, salient achievements including conduction of on-farm trial, frontline demonstration, training and extension activities have given the opportunities to the students to understand the significance of KVK in national agricultural education, research and extension system. Some of the success stories of RKVK enlightened the student's viz. fresh water giant prawn in composite fish culture, glass jar hatchery for carp eggs in rural areas, cultivation of crops like broccoli, capsicum, etc. The concept of market development through 'Kisan

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We have studied various activities of Sub-divisional Adaptive Research Farm (SARF) under the Department of Agriculture, Govt of West Bengal, managed by Assistant Director of Agriculture located at Sriniketan, Dist. Birbum.We got to know about the Organizational structure of the SARF. This research farm having 25 acre farm (16.63 acre cultivated area) caters the need of agricultural research and transfer of technology in Red and Lateritic Zone of West Bengal. Students have discussed with the officials and scientists as well as visited the research farm to understand and witness the ongoing research activities including cropping pattern, organic farming, soil health management, aromatic rice production, system of assured rice production (SUDHA method or SARP) , etc. The on-going research projects are mainly based on agronomy, entomology, pathology and soil health aspects. The cropping intensity is 151.9%. Improving economy of neighbouring villages, information exchange and imparting training, technology transfer, etc are found to be the priority areas. Lack of efficient irrigation facilities, coordination and participation, labour shortage, finance, etc are few problems faced by this research farm; however, the station has been performing well and contributed immensely in the field of aromatic rice production. The farm is having well developed agro-meteorological observatory facilities.

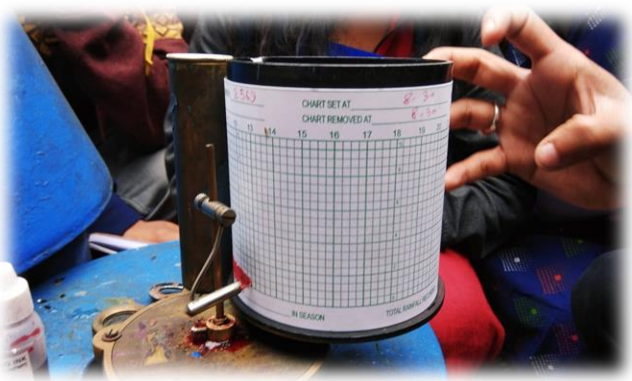
Two trials being conducted under SARF during our visit are:

a)Aromatic rice (Pusa basmati):- Against this 7 cultivars are being tested. These are not yet released as varieties. RBD is done and duration of 50% flowering, spikelet fertility, number of tillers etc. of the standard variety that is Pusa basmati are compared against the other 7 cultivars. Then it is determined which cultivar is suitable for which zone.

b) SUDHA method or SARP (System of assured rice production):- In this process 500g seed is sown in nursery against 2.5-3kg seed which is followed in conventional method. In conventional method, 5-10kg loss is observed if bigger seedlings are transplanted after every 25days. But seedlings can be kept in bed upto 45days in sudha method as the seedlings are stout enough to withstand the transplanting shock even until 45 days. This is because the seedlings are sown singly and they grow to be stouter than the conventional ones.

Agrometeorological observatory is a place where all the necessary instruments are maintained to observe and record different weather elements/parameters at stipulated time interval. when the observations are recorded for a sufficiently long time and analysed statistically, reliable crop-weather relations can be obtained.Here we got to know about the use of various instruments which are very much related to the impact of environmental conditions on agriculture.Instruments like Campbell-Strokes Sunshine Recorder,Anemometer,Windvane,Stevenson Screen,Raingauge,Dewgauge,Thermohydrograph were seen and their functions and way of taking measurements were nicely explained to us.

It was a very pleasant visit to the SARF,Bolpur.We came to know about the ways and different mechanized methods crop production such as the transplanter,SUDHA method and etc.We saw the various fenced plots of crops being raised for seed purposes.The various meteorological devices which we saw there for knowing prevailing weather and climate conditions are very helpful in practicality of agriculture purpose.





Visit to SARF,Bolpur

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Overview of CDB visit:

Under the RAWE-05,I visited the Dhaniakhali Development Block to gather necessary data and practical knowledge about the workings of the block and the various aspects of the community development carried out in the block.The visit was made on 22 January,2020. I would also like to expand my special gratitude to Ma'am Priyanka Bala of Dhaniakhali Block Development Office for her cordial behaviour and who guided us in understanding the organizational structure and departmentation of activities of the CD Block under study.

As a part of RAWE programme study, Community Development Block has a great importance to understand rural development work procedure carried out by a block. The main aim of this programme is to gather practical knowledge how the key development works are going on this block. The block carries out developmental works on agriculture, live stocks, women & child health & nutrition rural reconstruction, etc.

It was altogether a very pleasant experience interacting with the various staffs and knowing the rural development process from grassroot level.We got to know about the various schemes under operation and how plans are drawn up by the CDB and how much success it gets in its implementation.After visiting the developmental institution of Dhaniakhali Development Block and discussion with officers,we understood the present situation and corresponding problems related to pests attack and yield loss of the block. In this regards we can say that many developmental works are carrying out by different Dept. implementation of developmental programmes like BGREI, RKVY, MGNREGA, NFSM, NAIS are not going on at the desired level. After interacting with the ADA of the block and a quick survey of the adjacent fields,it was observed that fertility problem is an important constraint throughout the area,and agriculture being an uncertain outcome,people are being promoted to adopt various Cattle grazing and goat rearing activities for additional income.Any new technique cannot incorporate in cropping scheme for lack of awareness and financial problem. But now-a-days Pulses are included in cropping pattern.Alongwith,high value crops like Capsicum growing is largely done in here.Livestock scenario of this Block indicates its subsistence nature as there is lack of commercial rearing of animals and poultry. But presently Animal Resource Development Dept. has taken initiative like up gradation of

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breeds through AI, regular vaccination, Commercial animal Rearing (Goatery, Poultry)for the improvement of live stocks.No Duckery was seen practised.Maybe if it is started,it could benefit the economically poor class.There are a large no. of cottage industries,maximum being the Handloom weaving.Rural people weave the cloth in their house and proper market outlets are there for selling their produce.In this block the main problem is lack of irrigation facilities. To combat this problem of crop cultivation new techniques like SRI, introduction of Rabi pulse in cropping system, mixed cropping are promoting gradually.

We have collected primary as well as secondary data on different aspects like demography, institutions, agriculture, horticulture, animal husbandry, fisheries, on-going rural development programmes, NGOs, self-help groups and cooperative societies. Students have also collected detailed information regarding various activities, working pattern, administrative structure, constraints, target and achievement of different line departments of State Government.I have learnt about the institutional issues and linkage mechanisms among various line departments.It was a great field level experience and survey that helped us even in our capacity building and rapport building abilities.



Visit to Dhaniakhali Community Development Block

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Overview of the Agro –Industry visit:

Under this course we also had an opportunity to study the process of ant agro-processing industry.I have chosen the Bengal Rice Mill Private Ltd. located in Hooghly Dist near Harit .I paid a visit on one of the working days.The proprietor of the industry Nur Habib Halder was highly cooperative and made sure that he explained all the process of rice milling in detail to me.

Agriculture and industry have traditionally been viewed as two separate sectors both in terms of their characteristics and their role in economic growth. Agriculture has been considered the hallmark of the first stage of development, while the degree of industrialization has been taken to be the most relevant indicator of a country's progress along the development path.

It helped me to gather practical knowledge on key performances of an agro-industry and agri-business.I have studied the organisational structure (staffing), functioning (production, processing, marketing), managerial aspects, etc.I have visited different units of the industry and witnessed their functioning in association with the concerned persons and manager. The rice mill I visited is profitable as it is using upgraded technology through which loss is minimum and it can produce processed rice with less cost.It is very well structured and enough room space is there to stack the paddy beforehand.Markets are nearby so no problem of transport cost is there.Moreover,they receive Govt.subsidies on transport when procured from Government.The main aim is to increase the quality of the product and decrease the cost of the product. Here it is applicable. This agro-processing industry is running well with good risk management and marketing strategy.


Visit to Bengal Rice Mill Pvt.Ltd

Conclusion:

I would like to conclude my report saying that the RAWE programme under RAWE-05 has helped me a lot in learning several things visiting operational institutions where actual work of research,development and functioning takes place.

RAWE is an exposure to the principles of "learning by doing" and "seeing is believing", which provides a direction to the students to think and act on their own. It offers a direction to the students to develop their knowledge, attitude and skill to graduate out as an expert and contribute in holistic development of agriculture. This experiential system in agricultural education has a strong potential to prepare a better agricultural technocrats with high level of skill in combination with the modern out-look and management capacity. A learner-centered approach like RAWE is proved to be a significant in building the competence and confidence of agriculture graduates and developing human resources in the field of agricultural education, research and extension in the country.

We with the ADA of Bolpur,Ma'am Koyel Bramha

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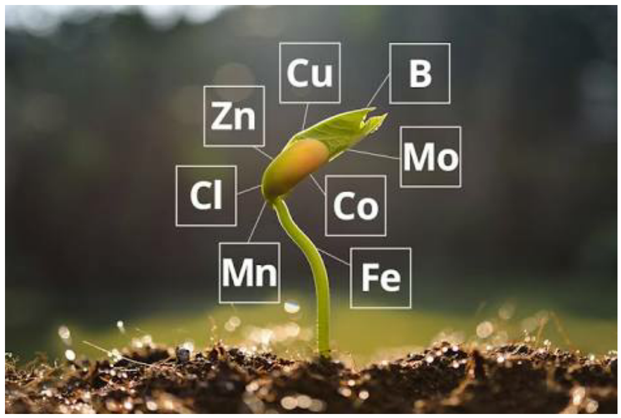
PHYSIOLOGICAL FUNCTIONS AND DEFICIENCY SYMPTOMS OF MICRO-NUTRIENTS AND THEIR CORRECTIONAL MEASURES



RAWE 01: CROP PRODUCTION (VILLAGE ATTACHMENT) (0+5)

PALLI SIKSHA BHAVANA

(INSTITUTE OF AGRICULTURE)

VISVA BHARATI

Submitted by - Bipadtaran sutradhar

Roll no.- BAG (SEM -VIII) 09

Registration no.- vb 1974 of 2014-15

Submitted to -Dr.Debasish panda

Assistant professor ,crop physiology

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ACKNOWLEDGMENT

I, Bipadtaran Sutradhar, a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my assignment in RAWE 01 Programme on the topic

"Physiological functions and deficiency symptoms of micro-nutrients and their correctional measures "

I gratefully acknowledge my sincere thanks to our respected teacher Dr. Debasish panda for his remarkable, valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard.

This assignment wouldn’t have been feasible without the proper and rigorous guidance of Dr. (Mrs)Sananda mondal, who guided me throughout this project in every possible way.

BIPADTARAN SUTRADHAR

BAG (SEM-VIII) - 09

Vb 1974 of 2014-15

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INTRODUCTION:

Plants, like all other living things, need food for their growth and development. Plants require 17 essential elements. Carbon, hydrogen, and oxygen are derived from the atmosphere and soil water. The remaining 13 essential elements (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, zinc, manganese, copper, boron, molybdenum, and chlorine) are supplied either from soil minerals and soil organic matter or by organic or inorganic fertilizers. For plants to utilize these nutrients efficiently, light, heat, and water must be adequately supplied. Cultural practices and control of diseases and insects also play important roles in crop production. Each type of plant is unique and has an optimum nutrient range as well as a minimum requirement level. Below this minimum level, plants start to show nutrient deficiency symptoms. Excessive nutrient uptake can also cause poor growth because of toxicity. Therefore, the proper amount of application and the placement of nutrients is important. Soil and plant tissue tests have been developed to assess the nutrient content of both the soil and plants. By analyzing this information, plant scientists can determine the nutrient need of a given plant in a given soil. In addition to the levels of plant-available nutrients in soils, the soil pH plays an important role in nutrient availability and elemental toxicity . This topic describes the essential nutrients, the chemical forms in which they are available to plants, their function in plants, symptoms of their deficiencies, and recommended nutrient levels in plant tissues of selected crops.

Plants require nutrients which are essential for successful growth and optimum yields. Without their presence, the consequences can range from stunted growth, leaf discoloration and loss of fruiting bodies, all of which lead to reduced crop yields.

Plants must obtain the following nutrients from the soil: Primary macronutrients - nitrogen (N), phosphorus (P), potassium (K),

Secondary macronutrients - sulphur (S), calcium (Ca), and magnesium (Mg)

Micronutrients - boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn) and nickel .

Macronutrients are required in larger amounts, whereas micronutrients are only required in very small amounts (parts per million). Plants require a proper balance of all the essential nutrients for normal growth.

Most soil conditions across the world can provide plants with the majority of nutrition they require. However due to things like, intensive agricultural methods and crops designed to grow bigger and more rapidly, nutrients are being stripped from the soil.

Nutrients can be present in different ratios, which may not be suitable for a particular crop. If a particular nutrient is lacking from the soil or if farmers want to promote vigorous growth and increase yield then fertilizers and micronutrient products can be applied.

To make the nutrient more available to the plant, micronutrients are typically formulated as liquid products. They have a high solid content and the active ingredients (i.e. the micronutrients) are usually very dense. This means they are very susceptible to sedimentation and other destabilising forces. Therefore choosing the correct dispersant is important to being able to produce a successful formulation.

Micronutrients are often formulated as suspension concentrates (SC) and oil dispersions (OD). We have numerous products that are capable of performing in these conditions and example formulation recipes that you can follow.

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Micronutrients - boron (B), chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) and zinc (Zn) and nickel is now recently added. Manu scientists sometime concluded that cobalt as a micronutrient.

❖ BORON :

Symbol: B. Available to plants as borate, H3BO3

❖ NUTRIENT FUNCTIONS

B is necessary in the synthesis of one of the bases for RNA formation and in cellular activities.

• B has been shown to promote root growth.

• B is essential for pollen germination and growth of the pollen tube.

• B has been associated with lignin synthesis, activities of certain enzymes, seed and cell wall formaion, and sugar transport.

❖ DEFICIENCY SYMPTOMS :

• Generally, B deficiency causes stunted growth, first showing symptoms on the growing point and younger leaves. The leaves tend to be thickened and may curl and become brittle.

• In many crops, the symptoms are well defined and crop-specific, such as:

• peanuts: hollow hearts

• celery: crooked and cracked stem

• beets: black hearts

• papaya: distorted and lumpy fruit

• carnation: splitting of calyx

• Chinese cabbage: midribs crack, turn brown

• cabbage, broccoli, and cauliflower: pith in hollow stem.

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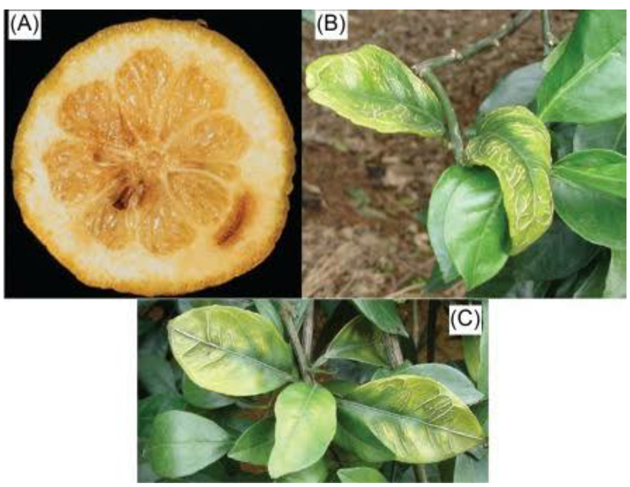
Boron deficiency in tomato

Boron deficiency in cabbage



BORON DEFICIENCY IN FRUIT CROPS.

BORON DEFICIENCY IN PLANT LEAVES

- ## Deficiency symptoms:

  RICE: YOUNG LEAVES ARE DEFORMED AND GROWING POINTS UNDERGO DRYING AND WITHERING.

WHEAT: BORON DEFICIENCY CAUSES THICKENING OF STEMS AND LEAVES, SHORTENED INTERNODES AND REDUCED FLOWERING AND SEED FORMATION.

PULSES: STEM THICKENS, GROWING POINTS DIE, LEAVES BECOME SLIGHTLY CHLOROTIC AND MOTTLED, SEED SETTING IS REDUCED.

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❖ SOURCES:

BORAX (SODIUM TETRABORATE); CONTAINS 10.5 % BORON.

BORIC ACID; CONTAINS 17.0 % BORON.

DI-SODIUM OCTABORATE TETRAHYDRATE; CONTAINS 20 % BORON.

❖ DOSE AND APPLICATION METHOD:

¨ BORON SHOULD BE APPLIED TO A DEFICIENT SOIL AS BORAX @ 10 KG/HA THROUGH BROADCASTING AT THE TIME OF PLANTING RICE, WHEAT OR PULSES.

IT CAN ALSO BE APPLIED THROUGH FOLIAR SPRAY AS 0.5 % SOLUTION OF BORAX 15 DAYS AFTER PLANTING AND AT FLOWER INITIATION STAGE.

❖ CHLORINE:

SYMBOL: CL; AVAILABLE TO PLANTS AS THE CHLORIDE ION, CL

❖ NUTRIENT FUNCTIONS:

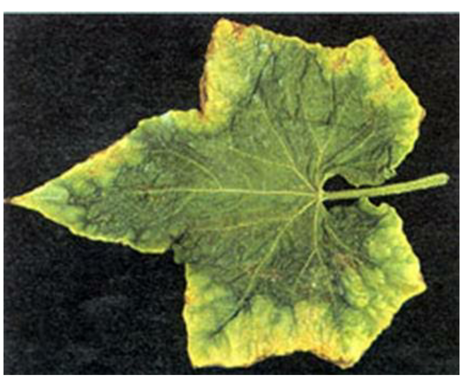
• CL IS ESSENTIAL IN PHOTOSYNTHESIS, WHERE IT IS INVOLVED IN THE EVOLUTION OF OXYGEN.

• CL INCREASES CELL OSMOTIC PRESSURE AND THE WATER CONTENT OF PLANT TISSUES.

• CL IS FOUND IN MANY BACTERIA AND FUNGI.

• CL REDUCES THE SEVERITY OF CERTAIN FUNGAL DISEASES, E.G., TAKE-ALL DISEASE OF WHEAT.

CL DEFICIENCY IN PLSNTS



CL DEFICIENCY IN PLANTS

❖ DEFICIENCY SYMPTOMS :

• CHLOROSIS OF YOUNGER LEAVES AND WILTING OF THE PLANT.

• DEFICIENCY SELDOM OCCURS BECAUSE CL IS FOUND IN THE ATMOSPHERE AND RAINWATER.

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MANAGEMENT:

LIST OF CHLORIDE-CONTAINING COMMERCIAL FERTILIZERS:

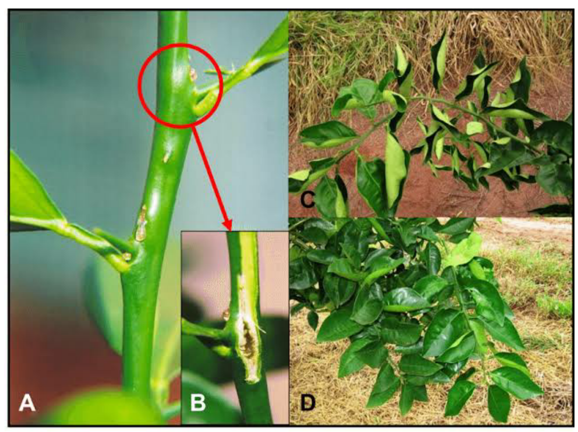
SOURCE	FORMULA	WATER SOLUBILITY	%CL
CALCIUM CHLORIDE	CACL2.	SOLUBLE.	50
POTASSIUM CHLORIDE	KCL.	SOLUBLE.	48

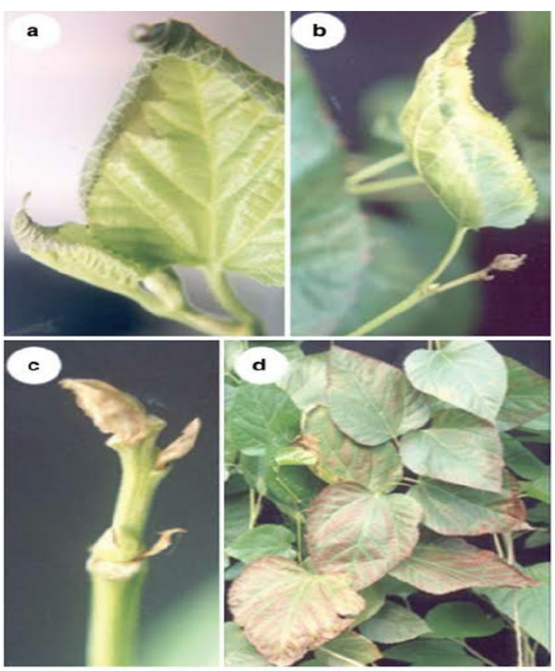
❖ COPPER :

- Copper (Cu) activates enzymes and catalyzes reactions in several plant-growth processes. The presence of copper is closely linked to Vitamin A production, and it helps ensure successful protein synthesis.Copper is involved in chlorophyll formation and is a part of several enzymes. It is also required for symbiotic nitrogen fixation.

❖ DEFICIENCY SYMPTOMS:

- Leaves become light green and develop twisted tips. Panicles are poorly filled and may even remain empty if the deficiency is severe.





COPPER DEFICIENCY SYMPTOMS IN PLANT

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- **SOURCES:**
  - ✓ Copper sulphate pentahydrate; contains 24 % copper.
  - ✓ Copper sulphate monohydrate; contains 35 % copper.

- **Dose and application method:**
  - Foliar spray of 0.025 % solution of copper sulphate (pentahydrate) at appearance of symptoms or soaking of seeds in 0.25 % copper sulphate solution in case of rice or soil application of 1.5-2 kg copper sulphate / ha once in 4-8 years is recommended.

- **IRON**
  - symbol: Fe; available to plants as Fe^{2+}, Fe^{3+}

- **NUTRIENT FUNCTIONS**
  - Fe is essential in the heme enzyme system in plant metabolism (photosynthesis and respiration). The enzymes involved include catalase, peroxidase, cytochrome oxidase, and other cytochromes.
  - Fe is part of protein ferredoxin and is required in nitrate and sulfate reductions.
  - Fe is essential in the synthesis and maintenance of chlorophyll in plants.
  - Fe has been strongly associated with protein metabolism.

- **DEFICIENCY SYMPTOMS**
  - Interveinal chlorosis in younger leaves. The youngest leaves maybe white, because Fe, like Mg, is involved in chlorophyll production.
  - Usually observed in alkaline or over-limed soils


IRON DEFICIENCY IN PLANT

Deficiency symptoms:

Rice: Interveinal chlorosis in streaks is noticed. Drying of leaves starts from tips and margins. Under severe conditions, leaves become white and die.

Wheat: Deficiency of iron is manifested as interveinal chlorosis of upper most leaves. As deficiency intensifies, leaves turn almost white and die.

Pulses: Yellowing of interveinal areas of young leaves is commonly noticed in iron deficient plants. Severity leads to pale-white discoloration of leaves.

IRON DEFICIENCY IN RICE

IRON DEFICIENCY IN WHEAT

IRON DEFICIENCY IN PULSES

❖ SOURCES:

Ferrous sulphate ($FeSO_4 \cdot 7H_2O$); contains 20 % iron.

Fe-EDTA chelate; contains 12% iron.

❖ DOSE AND APPLICATION METHOD:

Ferrous sulphate is most commonly used source of iron. Soil application @ 50 kg/ha to rice, wheat or pulses every 3 years or 15 kg/ha every year is recommended. However, it is more effective when applied as foliar spray of 1 % solution, 2-3 times at weekly interval in rice, wheat or pulse crops.

❖ MANGANESE

symbol: Mn; available to plants as Mn^{2+}, Mn^{3+}

❖ NUTRIENT FUNCTIONS:

- ✓ Mn primarily functions as part of the plant enzyme system, activating several metabolic functions. It is a constituent of pyruvate carboxylase.

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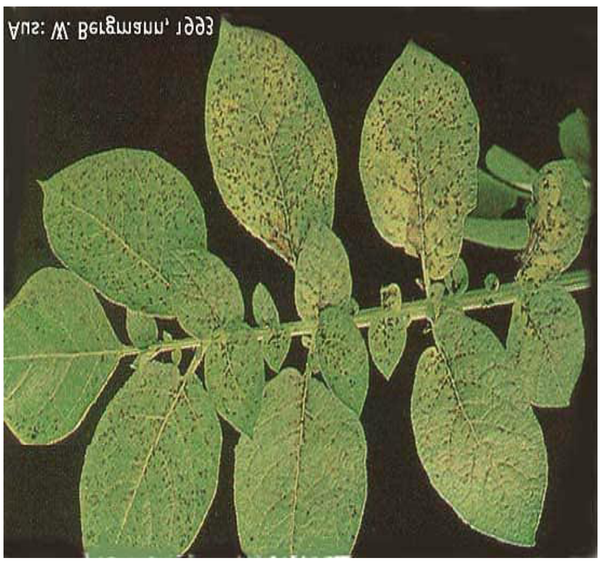
- ✓ Mn is involved in the oxidation-reduction process in photosynthesis.
- ✓ Mn is necessary in Photosystem II, where it participates in photolysis.
- ✓ Mn activates indole acetic acid oxidase, which then oxidizes indole acetic acid in plants.

❖ DEFICIENCY SYMPTOMS :

- ✓ Symptoms first appear as chlorosis in young tissues Unlike Fe chlorosis symptoms, in dicots Mn chlorosis shows up as tiny yellow spots.
- ✓ In monocots, greenish-grey specks appear at the lower base of younger leaves. The specks may eventually become yellowish to yellow-orange.
- ✓ In legumes, necrotic areas develop on the cotyledons, a symptom known as marsh spots.



Mn DEFICIENCY IN POTATO

Mn DEFICIENCY IN VEGETABLES

- ★ Rice: Chlorotic patches between veins are first noticed on younger leaves.
- ★ Wheat: Leaves show interveinal chlorosis with grayish yellow to pinkish brown specks of variable size confined largely to lower portion. At later stage, specks coalesce forming streaks or bands in-between the veins which remain green. Acute deficiency may lead to drying of whole plant.
- ★ Pulses: Interveinal chlorosis and mottling in young leaves is noticed. Brown lesions in cotyledons are commonly noticed.

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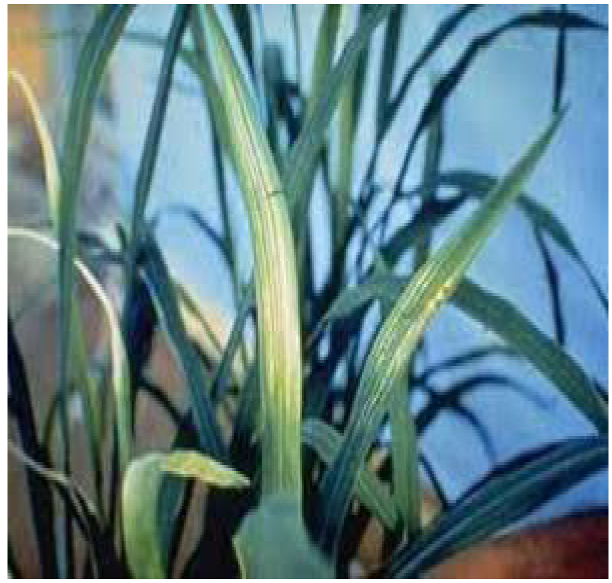

Mn deficiency in wheat

Mn deficiency in rice

Mn deficiency in pulses

❖ SOURCES:

- ✓ Manganese sulphate; contains 30.5 % Mn.
- ✓ Mn-EDTA chelate; contains 5-12 % Mn.
- ✓ Manganese chloride; contains 17 % Mn.

❖ DOSE AND APPLICATION METHOD:

- ✓ Foliar spray of 0.5 % manganese sulphate solution at tillering in rice and crown root initiation in wheat is recommended.

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❖ MOLYBDENUM

symbol: Mo; available to plants as molybdate, MoO4

❖ NUTRIENT FUNCTIONS

• Mo is a necessary component of two major enzymes in plants, nitrate reductase and nitrogenase, which are required for normal assimilation of N.

• Mo is required by some soil microorganisms for nitrogen fixation in soils.

❖ DEFICIENCY SYMPTOMS :

• Deficiency symptoms resemble those of N because the function of Mo is to assimilate N in the plant. Older and middle leaves become chlorotic, and the leaf margins roll inwards.

• In contrast to N deficiency, necrotic spots appear at the leaf margins because of nitrate accumulation.

• Deficient plants are stunted, and flower formation may be restricted.

• Mo deficiency can be common in nitrogen-fixing legumes.

MO DEFICIENCY IN TOMATO

MO DEFICIENCY IN PLANTS

❖ SOURCES:

Ammonium Molybdate; contains 52 % Mo.

Sodium Molybdate; contains 39 % Mo.

❖ DOSE AND APPLICATION METHOD:

Apply 2-4 kg/ha sodium molybdate or 2-3 kg of ammonium molybdate at the time of planting or treat seed with 10-20 g sodium molybdate per 25 kg of seed.

Alternatively, 0.1- 0.3 % ammonium molybdate solution may be foliar sprayed 2-3 times at 10 days interval.

❖ ZINC

symbol: Zn; available to plants as Zn++

❖ NUTRIENT FUNCTIONS

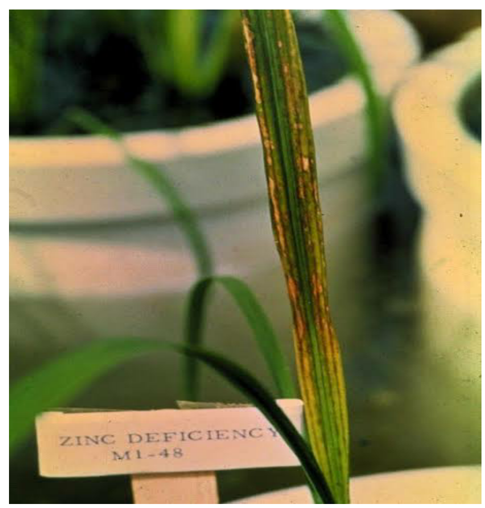
- ✓ Zn is required in the synthesis of tryptophan, which in turn is necessary for the formation of indole acetic acid in plants.
- ✓ Zn is an essential component of several metallo-enzymes in plants (variety dehydorgenases) and therefore is necessary for several different function in plant metabolism.
- ✓ The enzyme carbonic anhydrase is specifically activated by Zn.
- ✓ Zn has a role in RNA and protein synthesis.

❖ DEFICIENCY SYMPTOMS :

Zn deficiency in maize

- ✓ Interveinal chlorosis occurs on younger leaves, similar to Fe deficiency. However, Zn deficiency is more defined, appearing as banding at the basal part of the leaf, whereas Fe deficiency results in interveinal chlorosis along the entire length of the leaf.

- ✓ In vegetable crops, color change appears in the younger leaves first. The new leaves are usually abnormally small, mottled, and chlorotic.
- ✓ In citrus, irregular interveinal chlorosis occurs with small, pointed, mottled leaves. Fruit formation is significantly reduced.
- ✓ In legumes, stunted growth with interveinal chlorosis appears on the older, lower leaves



Zn deficiency in rice

- ★ Rice: Appearance of rusty-brown spots and discoloration of older leaves beginning 2-3 weeks after transplanting is noticed. Under acute conditions leaf margins of older leaves dry up. New leaves are smaller in size. Crop maturity is non-uniform and delayed.
- ★ Wheat: Plants become stunted and bushy. Interveinal chlorosis of new leaves is seen. In severe cases, leaves turn white and die.

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- Pulses: Stunted growth, development of light green, yellowish, bleached spots, little leaf condition, shortening of internodes and delayed reproductive phase are commonly noticed.

SOURCES:

- Zinc –EDTA chelate ; Zn content -12 %
- Zinc sulphate monohydrate; Zn content-33 %
- Zinc sulphate heptahydrate; Zn content-21 %; included in the Fertilizer Control Order, 1985.

DOSE AND APPLICATION METHOD:

- Zinc sulphate heptahydrate (Zn-21%) is recommended for soil application at the rate prescribed by the State Agricultural Universities/Soil Testing Laboratories. The dose varies across the states from 25 to 60 kg/ha depending on soil type, cropping intensity and crop productivity levels, to be applied once in two years. Use of 10 kg/ha zinc sulphate every year has also been recommended in some States.
- It should not be mixed or applied with phosphate fertilizers, as water soluble zinc is transformed to relatively insoluble zinc phosphate.
- Drilling, band placement or broadcasting of zinc sulphate are popular application methods. However band placement is most effective.
- Basal (soil) application is always preferred. However, in the absence of basal application, foliar spray of 0.5 % solution of zinc sulphate heptahydrate 15 days after transplanting of rice and 30 days after planting of wheat should be practiced. The foliar application should be repeated after 15 days. One kg zinc sulphate plus 0.5 kg unslaked lime dissolved in 200 l water will give 0.5 % zinc sulphate solution. About 500 l of solution will be adequate for one foliar spray of 1 hectare cropped area.
- The material should conform to FCO/BIS specifications.

- In plants a micronutrient deficiency (or trace mineral deficiency) is a physiological plant disorder which occurs when a micronutrient is deficient in the soil in which a plant grows. ... Some of the best known trace mineral deficiencies include: zinc deficiency, boron deficiency, iron deficiency, and manganese deficiency.

CONCLUSION :

Micronutrient is an important elements for plant growth and health. Well being knowledge about the nutrients and their role,deficiency symptoms helps the farmers to improve their farming . By increasing the knowledge in this topic farmers can increase their production as well as benefits from farming.

REFERENCE:

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“COMPREHENSIVE REPORT ON ENTIRE RAWE-05 PROGRAM

RAWE-05: Research Station/KVK/DAATT Centre Activities and attachment to the Agro-based industries

ABSTRACT

[In this report a brief analysis regarding RAWE-05 course has done. Significance and impact of the same has been discussed on the basis of practical experience]

SUBMITTED BY-

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SUBMITTED TO-

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Assistant Professor of Agril. Extension
RAWE Coordinator

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ACKNOWLEDGEMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and I am extremely privileged to have got this all along the completion of my project. All that I have done is only due to such supervision and assistance and I would not forget to thank them.

I respect and thank **Dr. Anindita Saha** for providing me an opportunity to do this report and giving me all the support and guidance, which made me complete the project duly.

I also owe my deep gratitude to **Mr. Arindam Mukherjee** (BDO), Hasnabad Block, **Dr. Pushpita Roy (ADA)** Sriniketan, Bolpur, **Mr.Haidar Sardar & co.** owners of Sagar oil mill, Hasnabad, **Dr. Prabuddha Sarkar** and **Dr. Subrata Mandal (SMS)** RKVK, Bolpur who helped me by providing various information related to the study in every possible way. Without their kind help, the project could never be completed.

I am very much thankful to my mother **Aparna Dutta** for helping me in completing this report work within stipulated time.

I also express my sincere gratitude to all other officials at the BDO office, ADA office, KVK and to all staffs of Sagar Oil Mill who helped me in the best possible way.

Bratati Dutta

B. Sc (Ag) Hons., Semester – VIII

Roll no.: BAG (Sem-VIII)-10

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CERTIFICATE

This is to certify that, Bratati Dutta, student of semester-VIIth, B. Sc Agriculture, Palli Siksha Bhavana Of Visva Bharati University has made the report entitled

"Comprehensive report on entire RAWE-05 program"

This is the result of her efforts and endeavour. She has prepared the report under the guidance of me.

Signature of Guide ……………………………………….

Signature of Departmental head ………………….

Signature of Principal …………………………………..

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CONTENT

INTRODUCTION

Agricultural Sciences attempt to provide a systematic understanding of the agricultural phenomena in order to make the cultivation of plants and rearing of animals a profitable endeavour. Agricultural graduates are prepared to acquire knowledge of the fundamental principles of Plant Breeding and Genetics, Plant Pathology, Plant Physiology, Entomology, Soil Science, Agronomy, Horticulture, Agricultural-Engineering etc. and their relevance to crops and Animal Husbandry. Agricultural graduates are among the professionally oriented human resources of the country. Therefore, the education and training imparted through Agricultural Universities bear special significance. In the curricula developed for undergraduate degree programs, all the courses -specially have practical content-based laboratory exercises, field practical, visits to villages, agro-industrial attachment and skill-oriented training courses etc.

The Review Committee, popularly known as "Randhawa Committee", pointed out certain inadequacies in providing required practical training and acquisition of skills by the graduates. In order to overcome these inadequacies, the need for providing rural work experience to the students was identified. Work experience includes physical and mental efforts exerted for a purposeful activity through training, observation, practice, experience and personnel participation or involvement. One of the ways by which this can be achieved is the Rural Awareness Work Experience. The rural work experience is basic for developing a graduate's competence in functioning as an effective teacher/researcher/extension professional in the transfer of technology to farmers and therefore, this type of practical training and experience of working with farmers in villages becomes inevitable. Recently it is being realized that job opportunities are tilling in favour of self-employment and private sector. This has necessitated enhanced skill and self-reliance to satisfy the needs of user agencies.

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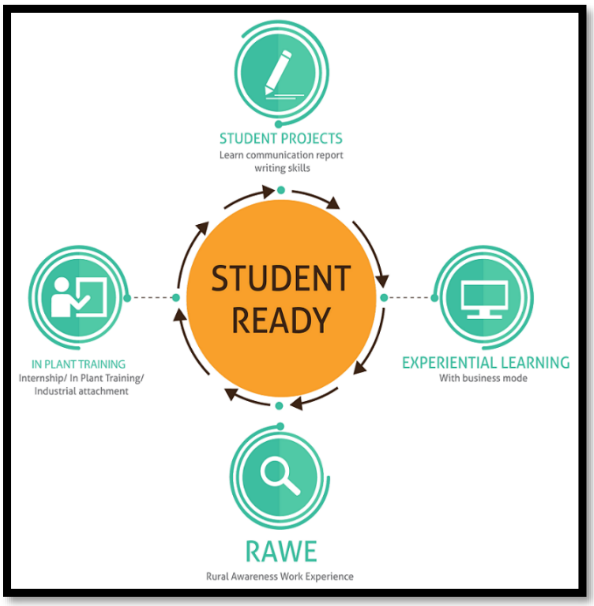
Thus, the RAWE Programme has been made compulsory for U.G. students of Agriculture as a part of curriculum for the award of the degree since 1990.

Initially the RAWE used to be of 45 days but with changing scenario of expectations from the agriculture sector and agriculture graduates the curricula have been revised to devote a complete semester (6 months) to RAWE.The Hon'ble Prime Minister of India launched 'Student READY' programme on 25th July 2015.

Student READY (Rural Entrepreneurship Awareness Development Yojana) is a new initiative to reorient graduates of agriculture and allied subjects for ensuring and assuring employability and develop entrepreneurs for emerging knowledge intensive agriculture. To reorient graduates of agriculture and allied subjects for ensuring and assuring employability and develop entrepreneurs for emerging knowledge intensive agriculture, the component envisages the introduction of the programme as an essential prerequisite for the award of degree to ensure hands on experience and practical training.



The components are as follows:

- Rural Awareness Work Experience (RAWE)
- In-Plant Training/Agro Industrial Attachment (AIA)

The Rural Awareness Work Experience (RAWE) helps the students primarily to understand the rural situations, status of Agricultural technologies adopted by farmers, prioritize the farmer's problems and to develop skills & attitude of working with farm families for overall development in rural area.

OBJECTIVES OF RAWE PROGRAM

1. To develop among the students an understanding of rural community life and different situations prevailing in villages with special reference to agriculture.
2. To help students to get familiarity with the socio-economic conditions of farmers and their problems with reference to agricultural development.
3. To provide an opportunity to students for practical training in Crop Production, Plant Sciences, Plant Protection, Social Sciences, Animal Production & Dairying, Agro-based Industries and Skill Oriented Training through work experience.
4. To develop communication skill among students in using extension teaching methods in transfer of technology in the village.
5. To take students to understand the agricultural technologies being followed by farmers and to prepare alternate farm plans to suit to the local situations in consultation with the farmers.
6. To develop confidence and competence in students for solving problems related to agriculture at farmers field.
7. To help students to acquaint with the on-going thrust agricultural programmes and related transfer of technology programmes in agriculture.
8. To familiarize the students with various Materials, Machines, Processes, Products and their applications along with relevant aspects of shop management.
9. To make the students understand the psychology of the workers, and approach to problems along with the practices followed at factory.
10. To expose various aspects of entrepreneurship during the programme period.

OUTLINES OF RAWE PROGRAMME

The RAWE Programme has been implemented for a period of six months in the VIIIth Semester. It comprises following courses:

COURSE NO.	COURSE NAME	CREDIT
RAWE 01	Crop Production [village attachment]	5
RAWE 02	Crop Protection [Village attachment]	4
RAWE 03	Rural Economics [village attachment]	3
RAWE 04	Extension Program [village attachment]	4
RAWE 05	Research Station/KVK/DAATT Center Activities and attachment to the agro-based industries	4

The programme has been managed by the Principal/ Dean, Institute of Agriculture, RAWE Coordinator, Course Leaders, Course facilitators and supporting staff like Gram Karmis (village level worker for extension activities).

RAWE-05 RESEARCH STATION/ KVK/ DAATT CENTER ACTIVITIES AND ATTACHMENT TO THE AGRO-BASED INDUSTRIES

Under this module of RAWE we were placed to Community Development Block, Krishi Vigyan Kendra, Agro-based industry and to the Sub-divisional Adaptive Research Farm and came to know about detail functioning of the same in terms of agricultural research, extension, and developmental activities performed there & to understand the different aspects of agribusiness too.

OUTLINES OF THE COURSE (RAWE 05)

The detail study of all the institutions and research farm (mentioned before) was done fruitfully as follows-

A. **Study of Community Development Block** –
- General information of the block (Name, year of establishment, District, Location etc.)
- Demographic analysis (Total no. of families, Total no. Of populations, Total populations engaged in agriculture etc.)
- Institutional analysis (Cultural institutions, Educational Institutions, Religious Institutions, Economic Institutions, Panchayati Raj etc.)
- livelihood analysis (Agriculture, Animal husbandry etc.)
- critical analysis of various development programmes (related to agriculture, horticulture, animal husbandry & rural development-based programmes)
- Organisational structure of the concerned block, it's functions and major achievement of the block.
- constraint analysis & evaluation.

B. **Attachment to the Agro-based Industries –**
- General information
- Profile of agro-processing unit
- economics of agro-processing unit
- marketing behaviour of agro -processing unit
- risk management of agro-processing unit
- constraints analysis and evaluation.

C. **Activities of Krishi Vigyan Kendra (KVK) –**
- Genesis and mandate
- Status of KVK in WB (details of district, location and geography, demographics, economy etc.)

- organisational structure & ideal flow of action
- technical achievements-
  - target and achievement of mandatory activities
  - abstract of intervention undertaken based on thrust area, on farm tests-
    - number of technologies assessed
    - achievement on technologies assessed and refined
    - results of technologies assessed, front line demonstration-
      - FLDs implemented during current year
      - Results of front-line demonstrations, demonstration on crop hybrids, training, extension activities, production of seeds, plants and livestock, success stories, impact, linkages,
- financial performance
- constraints.

D. **<u>Activities of research station –</u>**

- Brief information
- Mandate
- organisational structure
- technologies promoted by concerned SARF
- Facilities provided to the farmers
- research projects (ongoing and completed), research achievements, varieties developed, technology transfer, training, linkage, extension activities
- Mini-meteorological observatory and their functioning
- financial performance
- constraints analysis and evaluation

ACTIVITIES PERFORMED, EXPERIENCE GATHERED & EVALUATION

A. COMMUNITY DEVELOPMENT BLOCK-

We were told to visit a Block Development Office (B.D.O) and Block Livestock Development office (B.L.D.O) to gather first-hand information regarding the concerned block and to have a cross-sectional study about the same within stipulated time.

- **EXPERIENCE GATHERED**-

I have chosen Hasnabad block, present under Basirhat subdivision of North 24 Parganas district for study purpose, which covers an area of total 153.07 sq. km. During this job I got the opportunity to meet with **Mr. Arindam Mukherjee** (BDO), who have helped me a lot to gather all the necessary information under the heads mentioned before and finally, I came to know about the organisational structure & functioning system of the concerned block in a very well manner.

- **EVALUATION**- The block under study seems to function pretty well with regards to provision of different services to the people and coordinating different spheres of governance. Though there is always scope for improvement, people in the block are content with the infrastructure of the office and the conduct of the officials at the office.

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DIFFERENT AWARNESS PROGRAM CONDUCTED BY B.D.O. (HASNABAD):

A. DISTRIBUTION OF 3-WHEELER VEHICLE FOR THE FISHERMAN OF THE BLOCK
B. DISTRIBUTION OF BICYCLE UNDER SABOOJ SATHI PRAKALPA
C. AWARNESS PROGRAM REGARDING RUPASHREE PRAKALPA

Hasnabad is one of the progressive block of the district North 24 Parganas and this block seems to have made a good contribution to the development.

B. ATTACHMENT TO THE AGRO-BASED INDUSTRIES –

We were asked to made a detail study on the agro-based industry, which has helped me to gather practical knowledge on key performances of an agro-industry and agri-business.

- **EXPERIENCE GATHERED**-

I visited to a mini OIL MILL named as "SAGAR OIL MILL", which covers an area of 800 square feet & run by SAGAR F.I.G, a brain child of a "Farmer interest group" of progressive farmers and govt. officials of Hasnabad block. Total 30 farmers of this block were convinced by the Assistant Director of agriculture and other renowned officials of this block and thereafter, finally in 2019 they were able to form such a unit together, with the help of 100% subsidy (~Rs.5.5 lakh) a from West Bengal

Government. This F.I.G is also provided with seeds of mustard, sesame, linseed, sunflower etc. in free of cost. Then, the farmers of this group use the same to sow on their own field through scientific practices as recommended by the ADA office. And after harvesting of the crop the same farmers go for post-harvest operations i.e., expelling the seeds in expeller machine of their own **OIL MILL**, to extract out oil and oilcake from there. Then they sell the oil and oilcake in the market at reasonable price. Local farmers also come at **SAGAR OIL MILL** for seed oil extraction purpose at reasonable prices.

Besides collecting this basic information, I have studied the organisational structure (staffing), functioning (production, processing, marketing), managerial aspects, etc.

- **<u>EVALUATION</u>**-

Though The present study was limited both in its expanse and scope. However, it was effective in giving me an idea of the functioning of an agro-industry like a modern mini oil mill, its impact and its constraints. Through this study I got an idea of how oilseeds are processed into various products, especially oilcake and oil. I got a glimpse of the forward and backward linkages, organizational structure and marketing mechanism of the firm.

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As it has been rightly said, Agro-industries are the "***Sunrise-Industries***" of modern day. So, I think, this needs to be kept in mind while taking policy decisions by the Government, since any effect on agro-industries is likely to have a major impact on the masses.

C. ACTIVITIES OF KRISHI VIGYAN KENDRA (KVK) WITH A SPECIAL REFERENCE TO RKVK (RATHINDRA KRISHI VIGYAN KENDRA)

During the course, we were placed to Rathindra Krishi Vigyan Kendra, Sriniketan, Bolpur to study about its structure and functioning briefly.

- **EXPERIENCE GATHERED**-

We got an orientation of this KVK since its inception in 1994 and studied the detail activities of it during recent past. We got the golden opportunity to have a Discussion with the subject matter specialist (SMS) **Dr. Prabuddha Sarkar** and **Dr. Subrata Mandal** regarding all the activities performed in RKVK and it has helped us lot to know the multi-disciplinary and participatory approach of agricultural extension of the same.

During the visit to farm, we have seen mango orchard, guava orchard, Azolla unit, poultry unit, portable fish breeding unit, vermi-compost unit, soil and water testing laboratory, plant diagnostic laboratory, medicinal plants unit, on-farm trial plots, etc. The organizational structure, mandate, thrust areas, salient achievements including conduction of on-farm trial, frontline demonstration, training and extension activities were discussed with us properly and it helps us to understand the significance of KVK in national agricultural education, research and extension system. Some of the success stories of RKVK enlightened us regarding the fresh water giant prawn in composite fish culture, glass jar hatchery for carp eggs in rural areas, cultivation of crops like broccoli, capsicum, etc. along with all this, we came to know about the concept of market development through 'Kisan Bazar' too.

Activities performed in RKVK: Field Trial, Vermicompost Unit, Progeny orchard of Mango

- **EVALUATION-**

The venture was highly useful in providing a good overview of the KVK, its organization, functioning and its place in the National Agricultural Research System. We were very well able to appreciate the thought and the efforts behind the development of the KVK, and its ongoing struggle to make farmers' lives better.

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D. ACTIVITIES OF RESEARCH STATION WITH A SPECIAL REFERENCE TO SUB-DIVISIONAL ADAPTIVE RESEARCH FARM UNDER THE DEPT. OF AGRICULTURE, GOVT. OF WEST BENGAL

Under this module of RAWE we were placed to Sub-divisional Adaptive Research Farm (SARF) under the Department of Agriculture, Govt of West Bengal, managed by Assistant Director of Agriculture located at Sriniketan, Dist. Birbum. This research farm having 25-acre farm (16.63 acre cultivated area) caters the need of agricultural research and transfer of technology in Red and Lateritic Zone of West Bengal.

➢ **EXPERIENCE GATHERED**-

We got the opportunity to know the functioning of the concerned SARF from **Dr. Pushpita Roy**, ADA (Farm). She explained to us the structure and functioning of the Directorate of Agriculture in West Bengal in general and the structure and functioning of the SARF, Bolpur in particular. We have discussed with other officials, scientists & workers to get first-hand information and we have visited the research farm to understand and witness the ongoing research activities including cropping pattern, organic farming, soil health management, aromatic rice production,

system of assured rice production (SUDHA method or SARP) etc. The on-going research projects are mainly based on agronomy, entomology, pathology and soil health aspects. We came to know that the main priority areas are focused mainly to Improve economy of neighbouring villages, information exchange and imparting training, technology transfer etc. Lack of efficient irrigation facilities, coordination and participation, labour shortage, finance, etc are few problems faced by this research farm. However, the station has been performing well and contributed immensely in the field of aromatic rice production. The farm is having well developed Agrometeorological observatory facilities too.

- **EVALUATION**-

In spite of the limitations of the scope of the assignment as well as time constraints, the present study was very helpful in developing a good picture of the various activities of the SARF, its impact on the farmers and its place in the agricultural extension network of the state.

OVERALL EXPERIENCE, EVALUATION & OUTCOME OF THE RAWE PROGRAMME (WITH SPECIAL REFERENCE TO RAWE-05)

The Rural Agricultural Work Experience (RAWE) provides exposure to me to the real-life situation of farmers, farming society and helped me a lot to build a concept regarding it based on my own experience.

From my perspective RAWE is really a wonderful programme of "READY" and all it's benefits can be summarised as follows-

1. It provides exposure about the rural life and impact of rural & agriculture development on livelihood.
2. It brings awareness about the rural community, farming society etc.
3. It gives me an opportunity to have both experimental and experiential learning.
4. It helps me to Understand about local institutions, their need and about their functioning status.
5. It gives me an Exposure to administration and management issues in context of rural and agricultural development
6. It helps me in Capacity building, Problem-solving attitude, Conflict management and negotiation skill.
7. It provides Knowledge on field-based research and extension methodologies

LIMITATIONS OF THE RAWE PROGRAMME (WITH SPECIAL REFERENCE TO RAWE-05)

1. The present study was limited both in its expanse and scope.
2. Moreover, we could only get the experience of rural and agricultural scenario of one season and selected region.
3. It could be better if we got the opportunity to visit more no. of Agro-based industries, warehouse, multi-purpose cold storages, greenhouse, polyhouse etc.

CONCLUSION

During our theory classes we came to know about one phrase i.e., ***"Learning by doing" and "Seeing is believing"***.

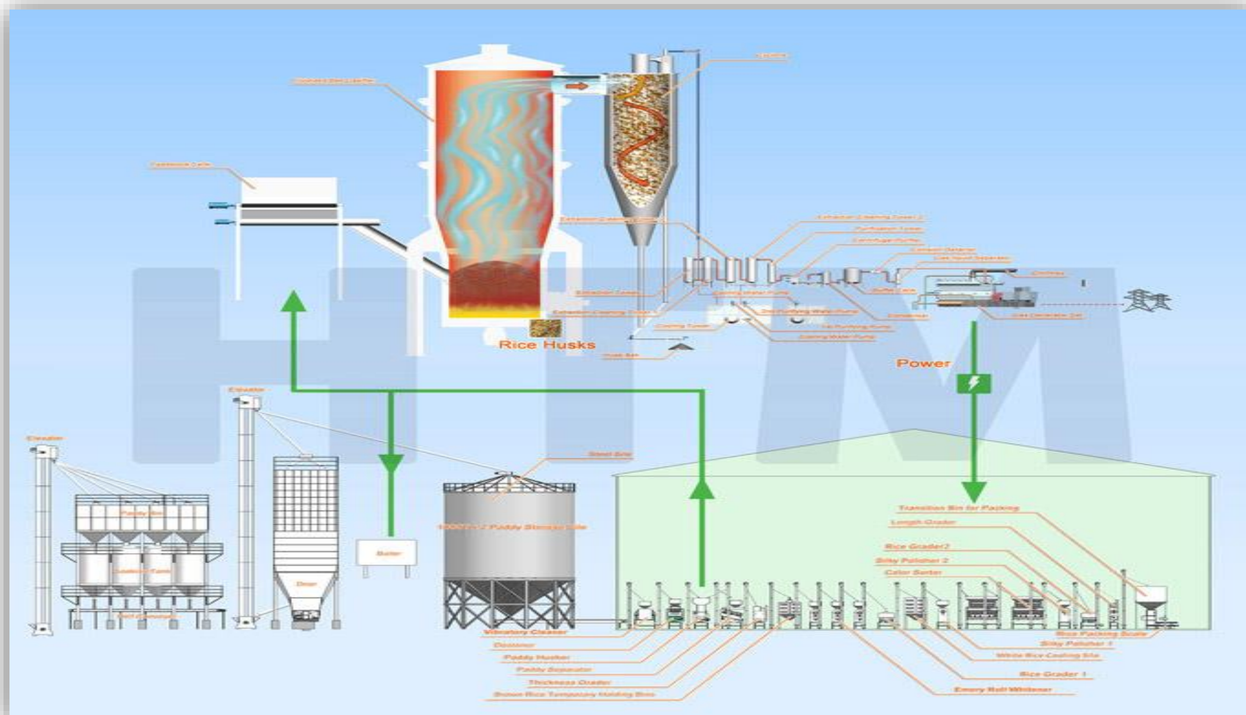
I think RAWE programme provides a perfect exposure of it to us. Under RAWE-05 course we got the opportunity to study the various on-going schemes related to agriculture and rural development and about organisational structure & their detail functions. We were given rigorous orientation and familiarization on various issues and problems expected on farmers' field and hence gain competence and confidence for solving problems related to agriculture and allied sciences.

Hence, a learner-Centred approach like RAWE program has all the potential to build confidence and competence among

"would be agricultural graduates"

and to prove its significance in developing human resources in the field of agricultural education, research and extension in the country.

PARBOILING OF RICE : METHOD AND ADVANTAGES



PALLI SIKSHA BHAVANA

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VISVA-BHARATI

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RAWE-01

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Acknowledgement

I, **Dipankar Barman** student of B.Sc. (Agriculture) Honours Semester-(VIII), offer my deep gratitude and regard to our Respected Teacher **Dr. Kishor Chandra Swain** ,Dept. of Agricultural Engineering, Palli Siksha Bhavana, Visva-Bharati for their constant guidance, support and motivation in completing the assignment on **Parboiling of rice : method and advantages** which was meticulously planned and arranged.

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PARBOILING OF RICE : METHOD AND ADVANTAGES

Introduction

Parboiled rice (also called converted rice and easy-cook rice) is rice that has been partially boiled in the husk. The three basic steps of parboiling are soaking, steaming and drying. These steps make the rice easier to process by hand, while also boosting its nutritional profile, changing its texture, and making it more resistant to weevils. About 50% of the world's paddy production is parboiled. The treatment is practiced in many parts of the world.

Rice is easier to polish by hand (removal of the bran layer) after parboiling but mechanical processing is harder since the bran becomes somewhat oily and tends to clog machinery. Most parboiled rice is milled in the same way as white rice.

Parboiling drives nutrients, especially thiamin, from the bran to the endosperm, hence parboiled white rice is mostly nutritionally similar to brown rice. Because of this, parboiling was adopted by North American rice growers in the early 20th century.

Chemistry about Parboiled rice

The starches in parboiled rice become gelatinized, then retrograded after cooling. Through gelatinization, amylose molecules leach out of the starch granule network and diffuse into the surrounding aqueous medium outside the granules which, when fully hydrated are at maximum viscosity. The parboiled rice kernels should be translucent when wholly gelatinized. Cooling brings retrogradation whereby amylose molecules re-associate with each other and form a tightly packed structure. This increases the formation of type 3-resistant starch which can act as a prebiotic and benefit good health in humans. However, this also makes the kernels harder and glassier. Parboiled rice takes less time to cook and is firmer and less sticky. In North America parboiled rice is either partially or fully precooked before sale. Minerals such as zinc or iron are added, increasing their potential bio-availability in the diet.

History

Parboiling of rice originated in ancient India and is still popular in the region. It is also being practiced in Bangladesh, Pakistan, Sri Lanka, Burma, Malaysia, Thailand, Italy, Spain, Uruguay, Brazil, France and United States. About 20% of the paddy produced world wide and more than 50% of paddy produced in South Asia is parboiled. About 50% of the total rice production in India is parboiled,

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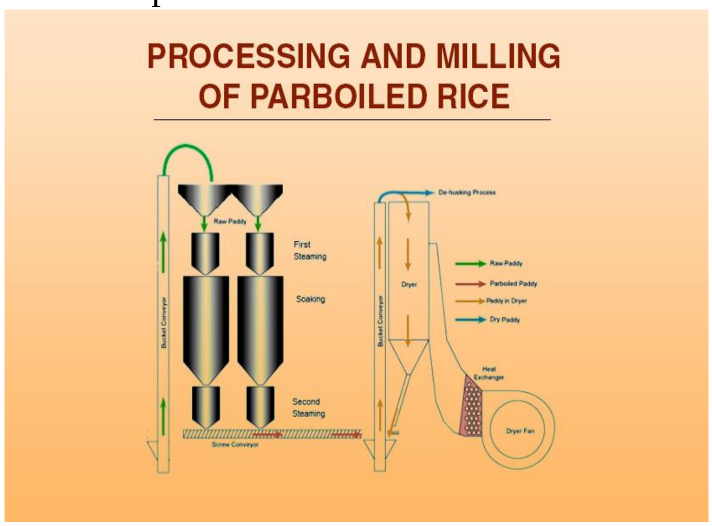
predominantly in Kerala, Tamilnadu, Orissa, Assam, Bihar, Andhra Pradesh and West Bengal states. Parboiled rice is also eaten in Punjab, UttarPradesh, MadhyaPradesh, Maharastra, Gujarat and Karnataka. Thus, Parboiling is one of the most widespread food industries in the world. Parboiling is essentially. Cooking rice in paddy form. The process consists of giving a hydrothermal treatment to the threshed paddy followed by drying to bring the moisture content back to an optimum level for milling and storage.

Methods of parboiling paddy rice

The survey showed that the processes of parboiling have been categorized into three forms. These were the traditional methodology, improved methodology and modern methodology of which the first two are practiced in Ghana. The traditional methodology uses simple tools like earthen or metal cooking pots and a nearby stream or dam serves as source of water. The paddy is not cleaned before soaking and the intensity of heat supply was high Also the volume of water used at soaking and steaming stage is the same. The modern parboiling method employ sophisticated tools like tanks, electric heaters, steam pipes etc and state of the art equipment to do the soaking, steaming and drying processes. The improved methodology is a combination in bits of the traditional and modern methods. In the improved methodology, pre-soaking activities such as washing, de-stoning, separation of immature seed etc. are carried out. Soaking is done in warm water not boiling water. Also, little water is used at the steaming stage as compared to the high volume of water used in traditional methodology that will usually cooked the paddy at the end of process.



Procedures and processes of parboiling paddy rice

The observed unit operations involved in paddy rice parboiling processes includes.

Sieving: This is done if there are broken grains in the paddy. A wire netting is used to sieve to separate the broken kennels so that they will not get cooked and stick the content together during parboiling. Thick viscous liquid arising from cooked broken-kernels usually stack the paddy together and hampers effective speedy drying. This could lead to fungal growth and spoilage of the rice if care is not taken.

Washing, Floatation and Sedimentation: The paddy is submerged in water and stirred vigorously for the soil and other dirt to dissolve out. The lighter debris float whiles the heavier materials settle at the bottom. The floating debris (dead insect parts, weeds, unfilled seeds etc) are skimmed off while the paddy rice is scooped out leaving heavier materials (sand, stones, pieces of metals etc.) at the bottom and poured away. Washing is done twice or thrice depending on the extent of dirt in rice. Scientifically, the washing removes dirt, debris and fungal toxin found in the rice

Boiling: The washed paddy is then submerged in water on a pot and partially boiled to a warm temperature of 35°to 40°C. This enhances uptake of water by the paddy, and also deactivates certain enzymes activities. Some microbes and their cellular products could be killed or inactivated at this temperature.

Soaking: The paddy rice is left to stay in the warm water overnight (10-24 hours) for the paddy to imbibed water and become moisture saturated. The scientific principles here are enzymes activation. A conducive environment is created after content is cooled down for enzymes and pigments transformation. Toxins are diluted and microbial pathogens may be inactivated or removed at such high moisture level. The saturated grains expand and fill the hull's lemma making it lose in the process.

Steaming: The soaked paddy is then steamed in a pot with little water lining the pot. The high moisture content in the grain is used to gelatinize the starch during the steaming process. The steam is made to reach all sections of the pot by covering with jute sacks and polythene sheets. The covering prevents the steam from escaping easily thereby creating a partial pressure over the content that aid in inward movement of molecules in each gelatinous kernel. When paddy begins to crack open their husks and there is steam vapor arising all over pot it is an indication that steaming is enough. The heat also evaporates extra moisture in the grain leaving concentrated nutrients in the kernel. The high temperature up to 80oC is able to inactivates or kill some microorganisms and degrade toxins and other poisonous substances present in the rice. Physico-chemical reaction processes e.g. gelatinization, starch retrograding, pigment transformations, enzymes deactivations etc. are all facilitated by the pressurized steaming process. This brings about improved flavor, color change and cooking characteristics of the rice.

Drying: The steamed paddy is spread out quickly at an airy place to dry. Excessive sunshine is avoided otherwise non uniform drying of kernel which results in breakage during milling. Other scientific advantages of the drying processes could be the art of drying evaporate the moisture and this concentrates solutes in the kernel drying will also stop microbial pathogens from developing on steamed paddy. It compresses the gelatinous amylase starch together in a compact mass and delocalizes it from the husk making de-husking (milling) easier.

Milling: The dried paddy is milled using a milling machine or, at the local level is pounded using mortar and pestle to separate the kennels from the husk. This process also has the ability to removes pathogens and other dirt's that stick to the hulls.

Winnowing: Winnowing is done either mechanically or manually. Where milling is done manually using mortar and pestle to pound the paddy rice, the rice is winnowed to separate the husks and foreign materials away. Winnowing help to removes dirt, dead insects, and other impurities still present in the rice

Sorting/Grading: Commercial parboiling groups go further to do handpicking of discolored rice and foreign materials before sorting in to grades (grade 1, 2 and 3) as, very few, few and many broken grains respectively).

Steps in the rice parboiling process using the improved equipment Principles of paddy parboiling:

Step-1: Washing Paddy is washed clean in a basin containing a large quantity of water (about 3 liters of water for 1 kg of paddy rice). This washing makes it possible to remove all types of dirt or residues from the paddy (sand particles, grass, etc.) as well as unripe grains. These unripe grains, which float at the surface during washing, are collected using a small basket or a sieve. Sand found at the bottom of the basin is discarded after carefully retrieving the clean paddy. Depending on the amount of dirt it contains, paddy can be washed 2 to 4 times.

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Step-2: Soaking in hot water; After draining, the paddy is poured in a cast aluminums pot containing clean water. This water should be floating above the product. The solution is then put on a fire and left until temperature reaches approximately 60°c. At this temperature, the women processor can hardly dip her fingers in the water as it is very hot. This marks the end of the heating process. This single operation, during which the paddy is occasionally stirred, will generally last 20 to 40 minutes for a quantity of about 25 kg of paddy. After heating, the paddy is removed from the fire, then left to cool down overnight, i.e. roughly for 12 hours.

Step-3: Pre-cooking the paddy with steam;The drip-dry paddy is poured in the steaming pan which has been inserted into a pot containing clean water (about 10 liters). Indeed, water contained in the pot should not touch the bottom of the pan so that the product will not be wet. The water is heated to its boiling point and the vapour generated passes through the holes in the pan to pre-cook the paddy rice. This process will end when it is observed that the husks of some paddy grains have burst or a heavy sound is heard when tapping the grains using the palm of one's hand. Duration of this process is about 13 minutes for 24 kg of paddy.

Step-4: Drying the Paddy Steamed paddy is first dried in the sun for about 1 hour 30 minutes, then collected and dried in the shade for the remaining period, which can last for about 16 hours before hulling takes place. For both purposes, paddy should be properly spread on tarpaulin, canvass or drying areas. Drying the paddy in the sun then in the shade will reduce water content of the paddy to about 21% and 10% respectively. According to the women involved in this process, the end of the period of drying in the shade can be determined when the husk can be easily removed by rubbing the paddy between the palms of both hands; this signals the end of the entire paddy rice parboiling process and hulling of the paddy can then start or paddy can be stored.

Principles of paddy parboiling

The process therefore is divided into three separate operations:

1. Soaking or steeping of paddy
2. Heat treatment to raise the temperature of wet grains beyond the gelatinization temperature, and

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3. Drying of grains to 14% moisture content

- **Soaking:** The paddy rice is left to stay in the warm water overnight (10-24 hours) for the paddy to imbibed water and become moisture saturated. The scientific principles here are enzymes activation. A conducive environment is created after content is cooled down for enzymes and pigments transformation. Toxins are diluted and microbial pathogens may be inactivated or removed at such high moisture level. The saturated grains expand and fill the hull's lemma making it lose in the process.

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Methods of parboiling and Effect of parboiling on milling quality

The method of parboiling may be classified as follows;

- **Traditional method**

1. Single boiling
2. Double boiling

- **Modern methods**

1. CFTRI method (India)
2. Jadavpur university method (India)
3. Avorio process (India)
4. Converted process (India)
5. Malek process (America)
6. Cristallow process (Italian)
7. Fernandes process (Surinam)
8. Schule process (German)
9. Rice growers association of California process (America)

- **Methods under investigation**

1. Brine solution method (India)
2. Kisan continuous method (India)
3. Pressure parboiling method (India)
4. RPEC method (India)
5. Sodium chromate method (India)
6. Parboiling with heated sand method (philipines)

Traditional method

The traditional process consists of soaking paddy in water at room temperature for 24-48 hr. or more steaming in kettles under atmospheric pressure and drying under sun light. In a single boiling method paddy is soaked in ordinary water for 24-72hr. and then steamed. In double boiling method steam is first injected in to row paddy in the steaming kettle before soaking. Hot paddy raises the temperature of soaking water to 45-50 °C which helps to reduce the soaking time to24hr. There after soaked paddy is steamed sometimes, the soaking water is heated to about 50°C than the row paddy is put in to it and in this case first steaming is not required.

Modern method

1. CFTRI method - In this process, parboiling tanks are filled with clean water and heated to a temperature of about 85◦C by passing steam through the coils placed inside the tank. Sometimes hot water is pumped from other sources into parboiling tanks. The resultant temperature of paddy water mixture in tank stays around 70◦C. After soaking paddy for 3 to 3.5 hrs, water is drained out. The water discharge value is kept open in order to remove condensed water during steaming. Soaked paddy is exposed to steam at a pressure of about kg/cm2 through the open steam coils. Soaking and steaming of paddy are done in same. The parboiled paddy is taken out by opening the bottom door and dried either under sun or by mechanical drier.

<u>Flow Diagram</u>

Paddy

↓

Cleaning

↓

Soaking in hot water for 3 h (70 ^{0} C)

↓

Draining the water

↓

Steaming

↓

Shade drying (2-4 h)

↓

Dried paddy (15 % moisture)

2.Jadavpur University method - All the operations of this method is fully automatic and average processing time is five to six hours. Soaking of paddy is completed in high temperature water (60-70°C) within 1-3 hours, while the steaming time is limited to 3.5 minutes. After steaming and before drying, the paddy is rapidly cooled. Drying taken place in a rotary steam jacketed high temperature Air dryer. In this process two different may be applied with the first, the soaking and steaming take place in the same tank, where as in the second, these two operations are performed separately in a horizontal apparatus. In both the cases saturated steam is used. The steamed paddy is rapidly cooled in a drought of cold air.

3. Pressure parboiling method - This method of parboiling was developed at Tiruvarur in Tamil Nadu. The parboiling is achieved by penetration of moisture into the paddy in the form of water vapour under pressure. This results in gelatinization of starch of the kernel. The paddy is soaked for 40 minutes at 85-90 °C. There after it is steamed under pressure for 18 minute. The water vapor which penetrates the kernel drives out entrapped air. It is reported that the whole process is completed in 1 to 1.5 hrs. the rice obtained by this method has a slightly yellowish uniform color. Reduced soaking period of paddy is the main advantage of this method. It was also observed that such parboiled paddy has better shelling, has more fat in bran and increased storage life of rice grain.

4. Avorio process - Developed in Italy in the Avorio process, paddy is kept in a perforated basket and moved into a hot water tank for soaking, later steamed under pressure in a rotating cylinder and dried in hot air driers.

5. Corversion process -The process was developed in the USA. In this paddy is soaked in cold water, air in the soaked paddy is removed in vacuum, then steamed under pressure and dried in vacuum drier.

6. Malek process - Another method developed in the USA, which consists of soaking paddy at 100°F for 3 to 6 hours, steaming for 15 minutes and drying in hot air drier at low temperature.

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7. Fernandez process - The process used extensively in Latin America is similar to hot soaking methods.

Advantages –

Advantages of parboiled rice are below-

Carbohydrates

One cup of cooked parboiled rice provides 41 grams of total carbohydrates, or about one-third of the recommended daily intake of 130 grams. The same portion has 1.4 grams of fiber, which supplies 4 percent of men's and 6 percent of women's daily fiber. Parboiled rice has double the fiber than you'd get from cooked white rice. It has a low glycemic score of 38, compared with a high 89 for white rice, notes Harvard Health Publications. A low glycemic score indicates that the carbohydrates in parboiled rice do not cause a large spike in blood sugar.

B-Vitamins

Parboiled rice is especially rich in niacin, providing 4 milligrams, or 23 percent of the recommended daily intake in 1 cup of cooked rice. You'll also get 19 percent of the daily intake of vitamin B-6. These values are about double the amount you would get from non-enriched white rice. Your body needs B vitamins to metabolize food into energy, but they also fill other roles, such as helping make hormones and neurotransmitters. Vitamin B-6 removes the amino acid homocysteine from your bloodstream by turning it into other substances. This might help keep your heart healthy; high levels of homocysteine are associated with an increased risk of cardiovascular disease.

Minerals

One cup of cooked parboiled rice supplies 2 to 3 percent of the recommended daily intake of calcium, iron, magnesium and potassium. You'll get a slightly bigger boost of zinc, with 1 cup containing 0.58 milligrams of zinc. That amount represents 5 percent of men's and 7 percent of women's daily needs. Zinc performs vital roles throughout your body, from forming the structure of proteins to regulating DNA. If you don't get enough zinc, your immune system becomes impaired; it needs zinc to produce the cells that fight bacteria and infections.

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- Dehusking of parboiled rice is easy.
- Grain becomes tougher resulting in reduced losses during milling. By this, parboiling eliminates breakage completely.
- Milled parboiled rice has greater resistance to insects and fungus.
- Loss of nutrients due to the removal of husk and bran in milling are decreased. During harvesting the vitamin and mineral present in hull (outer covering of the paddy) and bran coat are dissolved and seeped into the endosperm. Part of the scutellum and germ which are rich in B vitamins get fixed to the grain and hence losses of B vitamins are less.
- Losses of water soluble nutrients due to washing of rice are less in parboiled rice compared to raw rice.
- Parboiling improves digestability and protein efficiency ratio is higher compaired to raw rice.
- Parboiled rice will not turn into glutenous mass when cooked
- Parboiled rice swells more when cooked to the desired softness.
- Parboiling stabilises the oil content of the bran. The discrete oil globules in the aleurone layer of the native rice grain are ruptured into a band by parboiling.

Disadvantages

1. It develops a relatively darker colour compared to raw rice.
2. The traditional parboiled process produces and undesirable smell.
3. Parboiled rice takes more time to cook to the same degree of softness than raw rice.
4. Because of long soaking in traditional process, mycotoxins may develop in parboiled rice and cause health hazards.
5. Heat treatment during parboiling destroys some natural antioxidants and hence parboiled rice develops more rancidity than raw rice during storage.
6. Shelled parboiled rice requires more power for polishing.
7. Parboiled paddy may choke the polisher because of the higher oil content of the bran.
8. Parboiling process requires and additional investment of capita.

------xxx-----

PALLI SIKSHA BHAVANA

(INSTITUTE OF AGRICULTURE)

VISVA BHARATI

Sriniketan, Birbhum

RAWE 05: Research Station/ KVK/ DAATT Centre Activities & Attachment to Agro-based Industries

Report on study of Community Development Block

Submitted to,
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Roll – 13,
Semester – VIII

2020

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guided me in writing this report. Many people, especially my classmates have made valuable comment and suggestions which gave me an inspiration to improve the quality of the assignment.

THE STUDY ON COMMUNITY DEVELOPMENT BLOCK

INTRODUCTION

I, Diptendu Garai, went to my community development block named Dhaniakhali Community Development Block on 24th January, 2020, for the study on it for the course of RAWE 05. The Dhaniakhali Community Development Block is a very vast and famous block in the Hooghly District as it consists of 18 Panchayats and the regions leading to a very dense population and unityin the diverse communitiesis found in the block. But the block is well developed with ample opportunities offered to the residents and the officials are very co-operative to the people who come to the Block Development Office for the aid.

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CONCEPT

As a part of RAWE programme study, Community Development Block has a great importance to understand rural development work procedure carried out by a block. The main aim of this programme is to gather practical knowledge how the key development works are going on this block. This study will help us in various aspects of future career development. This block carries out developmental works on agriculture, live stocks, women & child health & nutrition, rural reconstruction, etc.

1.GENERAL INFORMATION

Name of the Block: Dhaniakhali Community Development Block
Year of Establishment: 1980
Subdivision: Hooghly (Sadar)
District: Hooghly
Police Station: Dhaniakhali
Nearest Railway Station: Dhaniakhali Halt (6 kms)
Nearest Highway: NH-2 (Durgapur Expressway)
Total area: 265.36 km^2
Location of the Block: East – Belmuri
West – Gopinathpur I & II
North – Bhastara
South –Bhanderhati I & II
No. of Villages: 321 nos
No. of Mouza: 214 nos
No. of Gram Panchayats: 18
Time Zone: IST (UTC +05:30)

Political Map of Dhaniakhali Block:

2.OBJECTIVE AND METHODOLOGY

OBJECTIVES:

The general objectives of the present study are to know about the organizational structures of the block.
The specific objectives are-

- To study profile of the block
- To study demographic pattern of the block
- To study social institutions, present in the block
- To study agricultural situation of the block
- To study animal husbandry and dairy status
- To study cottage and rural industry of the block
- To study different ongoing programme of the block
- To know organizational structure of the block

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- To study pattern of co-ordination among various departments in block
- To study achievements of the block
- To identify the present constraints & overall evaluation of the block.

METHODOLOGY:

I have collected information mainly by:

- visiting the different departments and institutions of this block,
- formal and informal discussions with theBDO, Jt. BDO, BIO, IDO, WDO, BCW, ADA and KPS.
- By own observations and knowledge.

And collected the data in:

- Structured interview schedule given by.
- Also, data as given by the BDO and the Line Department Officials.

3.DEMOGRAPHIC INFORMATION

The Demographic details of the block are as below, as per the census of 2011 data and the voter details published by the Election Commission.

Sl. No.	Details	Value
1.	Total Population	320534
2.	Male Population	1607899
3.	Female Population	159745
4.	Literate Male	119539 (74.3%)
5.	Literate Female	99363 (62.2%)
6.	Total No. of Families	78260
7.	Total Literacy	68.3%
8.	Total Electors	267345
9.	Sex Ratio(per 1000 male)	994

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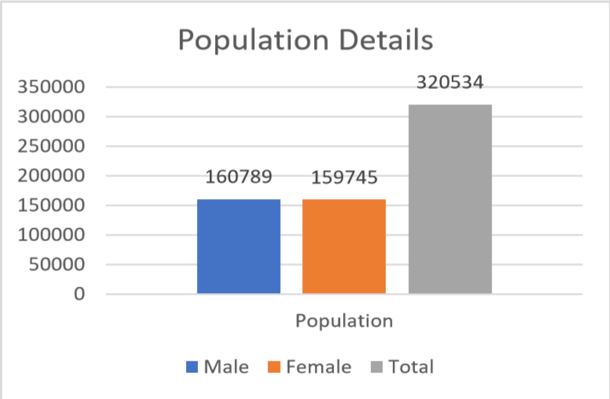
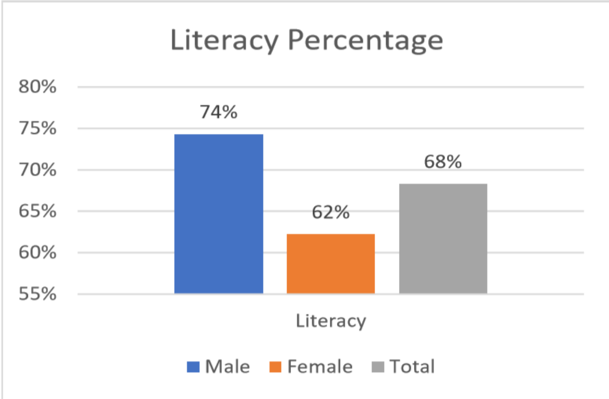
Bar Diagrams of Demographic Informations:





4.SOCIAL INSTITUTIONS

CULTURAL INSTITUTIONS

The details of the cultural institutions of the block are as follows:

- Nataraj Academy
- Moitry Sangha
- Arpita Sarkar Sampraday
- Durgaprasad Adibasi Club

EDUCATIONAL INSTITUTIONS

The details of the Educational Institutions of the district as per the ascending order of the growth stage in which a person takes admission in the said institution are as follows:

a. **PrimarySchool**: 200
b. **MSK**: 3
c. **SSK**: 2
d**. Secondary School**: 45
e**. Higher Secondary Schools**: 16
f. **Technical Institution**: 1
g. **College**: 1
h. **Vocational Training College:** 2
i. **Library**: 11
j. **Computer training Centres:** 2

RELIGIOUS INSTITUTIONS:

There are several religious institutions in the block where people gather to perform their daily rituals or occasional ceremonies.About 43 temples,11 mosques and 2 churches, but only three are notable with having some social impact in the nearby region. They are:

a.Ramkrishna Mandir
b.Keshabpur Kali Mandir
c. Bameswari Kali Mandir

ECONOMIC INSTITUTIONS:

a. **Punjab National Bank**-8 nos
b. **United Commercial Bank**-3 nos
c. **Bank of India**-1 no.
d. **Allahabad Bank**-2 nos
e. **HDFC Bank**-1 no.
f. **State Bank of India**-4 nos
g. **Union Bank**-1 no.

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h. **United Bank of India**-2 nos.
i. **Bandhan Bank**-2 nos
j. **Agriculture Development Bank**-1 no.
k. **Microfinance occurs through Mandra Unnayan Sansad**

PANCHAYATI RAJ:

1. **Total No. of Anchal**: 18
2. **Total No. of Gram Panchayats**: 18
    - **a. Belmuri**
    - **b. Bhanderhati-I**
    - **c. Bhanderhati-II**
    - **d. Bhastara**
    - **e. Dasghara-I**
    - **f. Dasghara-II**
    - **g. Dhaniakhali-I**
    - **h. Dhaniakhali-II**
    - **i. Gopinathpur-I**
    - **j. Gopinathpur-II**
    - **k. Gurbari-I**
    - **l. Gurbari-II**
    - **m. Gurap**
    - **n. Khajurdaho-melki**
    - **o. Mandra**
    - **p. Parambua-Sahabazar**
    - **q. Somaspur-I**
    - **r. Somaspur-II**
3. **Total No. of GP Sansad**:264.

YOUTH CLUBS:

There are 185 Youth Clubs in Dhaniakhali Development Block. 166 of them gets various money grants from the block office. Various activities such as Football distribution,Badminton rackets,Net,Carrom Board are given.Betterment of the football grounds is done.Various Youth Fest,Vivek Chetana Utsav,Subhash Utsav is also done as initiatives are taken by the block.

5.AGRICULTURE

Details of the Agriculture Related Information is available with the Assistant Director of Agriculture of the Block. At present, **Dr. Dipak Hazra** is serving as the ADA of the Dhaniakhali Development Block.

Sl. No.	Details	Value
1.	Gross Cropped Area	50910 ha
2.	Net Cropped Area	21660 ha
3.	Cropping Pattern	Paddy – Mustard – Sesame Paddy – Potato – Sesame
4.	Principal Soil Type	Clayey Loam
5.	Area under vegetable cultivation	5000 ha(approx.)

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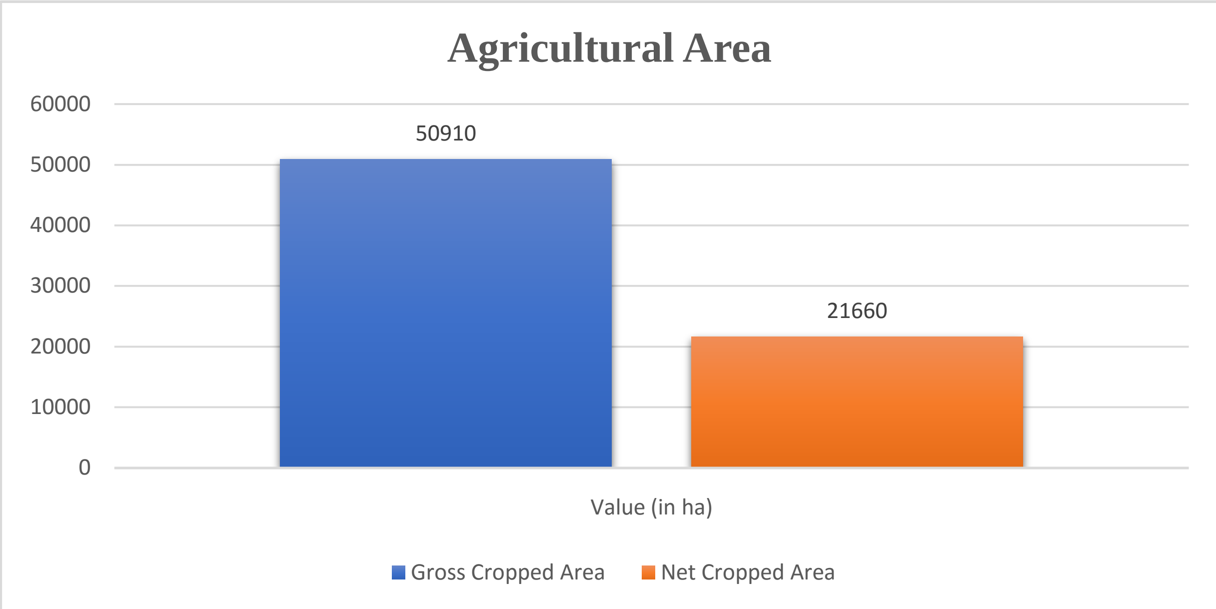

Agricultural Information of the Dhaniakhali Community Development Block in Graphical

6.ANIMAL HUSBANDRY

The details of the Animal Husbandry and all the relevant information are under Block Livestock Development Officer of the Block. At present, **Dr, Samarjeet Dutta** is serving as the BLDO of the Dhaniakhali Development Block.

Sl. No.	Details	Value
1.	Existing Breeds of Cattle, Buffalo, Goat, Poultry and Duck	Cattle – Jersey,Sahiwal Buffalo – Murrah Goat – Black Bengal Goat Poultry – Rhode Island Red Duck – no duck
2.	Total Population of Cattle, Buffalo, Goat, Poultry and Duck	253000(approx.) as per last census
3.	Area under fodder cultivation	N/A
4.	Total number of AI Centres	Government controlled: 8

Animal Type	**Number**
Cattle	76000(approx.)
Goat	99000(approx.)
Buffalo	8500(approx.)
Poultry	15000(approx.)

5.	Prevailing Diseases of cattle and poultry	Cattle – All types of parasiticdisease, Metabolic like Ca deficiency, Nonspecific fevers Skin Diseases- Mange etc. Systemic diseases - Bloat,Tymphany, impaction Poultry – Coccidea, Ranikhet,

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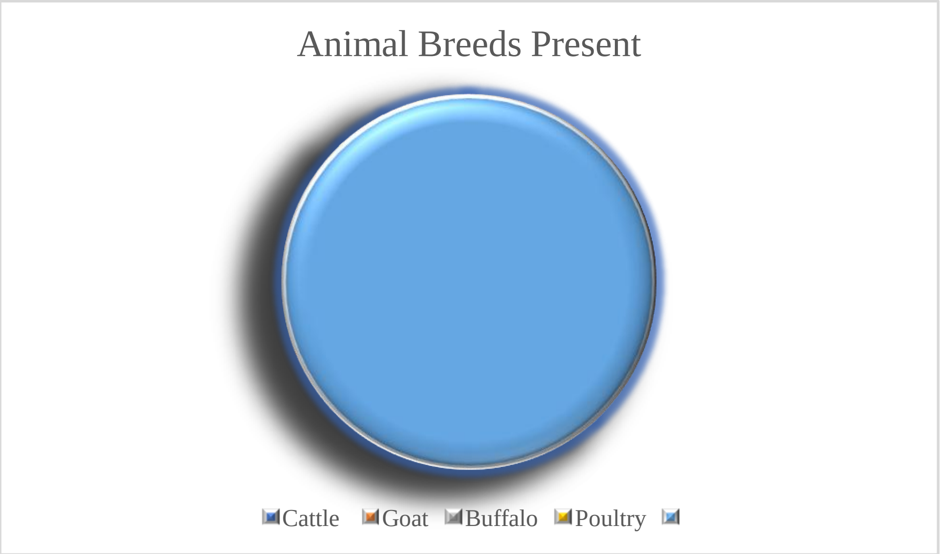

Animal Husbandry Animal Information of the Dhaniakhali Community Development Block in Graphical

7.COTTAGE AND RURAL INDUSTRIES

The Dhaniakhali CommunityDevelopment Block has the following cottage and rural industries:

a. Handloom Industries: Around 312
b. Hand embroidery:104
c. Tenant Bamboo Work:250(approx.)
d. Oxidised jewellery:90
e. Dairy:1(Kopila)
f. Namkeen Factory:8
g. Rice Mill:7
h. Oil Mill: -5
i. Bakery:50(approx.)

8.DEVELOPMENT PROGRAMMES

Sl. No.	Name of Programme	Target	Achievement
Agriculture			
1.	KCC	487(2018-19)	350(approx.)
2.	FSSM	44(2018-19)	Ongoing Registration
Animal Husbandry			
1.	Goatery Scheme	51	43
2.	Poultry Scheme	Chick – 2033	Chick – 1875
Rural development			
1.	MGNREGS	539650(2018-2019)	370531 (Ongoing)
2.	PMAY	3387	3161

Other Programmes are also undergoing in the block. They are:

a. **PMAY (Pradhan Mantri Awas Yojana)**
b. **PMGSY (Pradhan Mantri Gram Sarak Yojana)**
c. **NOAPS (National Old Age Pension Scheme)**
d. **BGREI (Bringing Green Revolution In Eastern India)**
e. **RKVY (Rastriya KrishiVikas Yojana)**
f. **SHG (Self Help Group)**
g. **NFSY (National Food Security Mission)**
h. **NAIS**

HOW WAS THE PRESENT PROGRAMME DRAWN UP?

Programme drawn up on the Govt. basis through Annual Action Plan and Supplementary Action Plan.

HOW THE PROBLEMS/FELT NEEDS DETERMINED?

The problems of the farmers community were determined making through the training meeting programme organized by office of the assistant director of agriculture, Dhaniakhali CommunityDevelopment Block and by the other line department.

WHAT IS THE BASIS OF FIXING TARGETS?

a. **Demand Basis**
b. **Problem/Felt need Based**
c. **Unfelt need Based**

Targets are fixed based on the fund available i.e how much it could benefit the people and also based on no, of people it needs to cover under the programme.

WHAT CHANNELS ARE USUALLY USED TO INFORM THE PUBLIB ABOUT THE DEVELOPMENT PROGRAMME?

Gram Panchayat. Panchayat Samiti and also by the Block Office.Micing is an important and most common activity done by the bodies to create awareness or information setting amongst people.

HOW ARE THE PEOPLE INVOLVED IN BUILDING UP OF THE BLOCK PROGRAMME?

Information and plans are drawn up from grass root level.i.e from gram sabhas and panchayats form the basis where the people make their demands clear for public utilities then through various standing committes,block programmes are approved.

9.ORGANISATIONAL STRUCTURE

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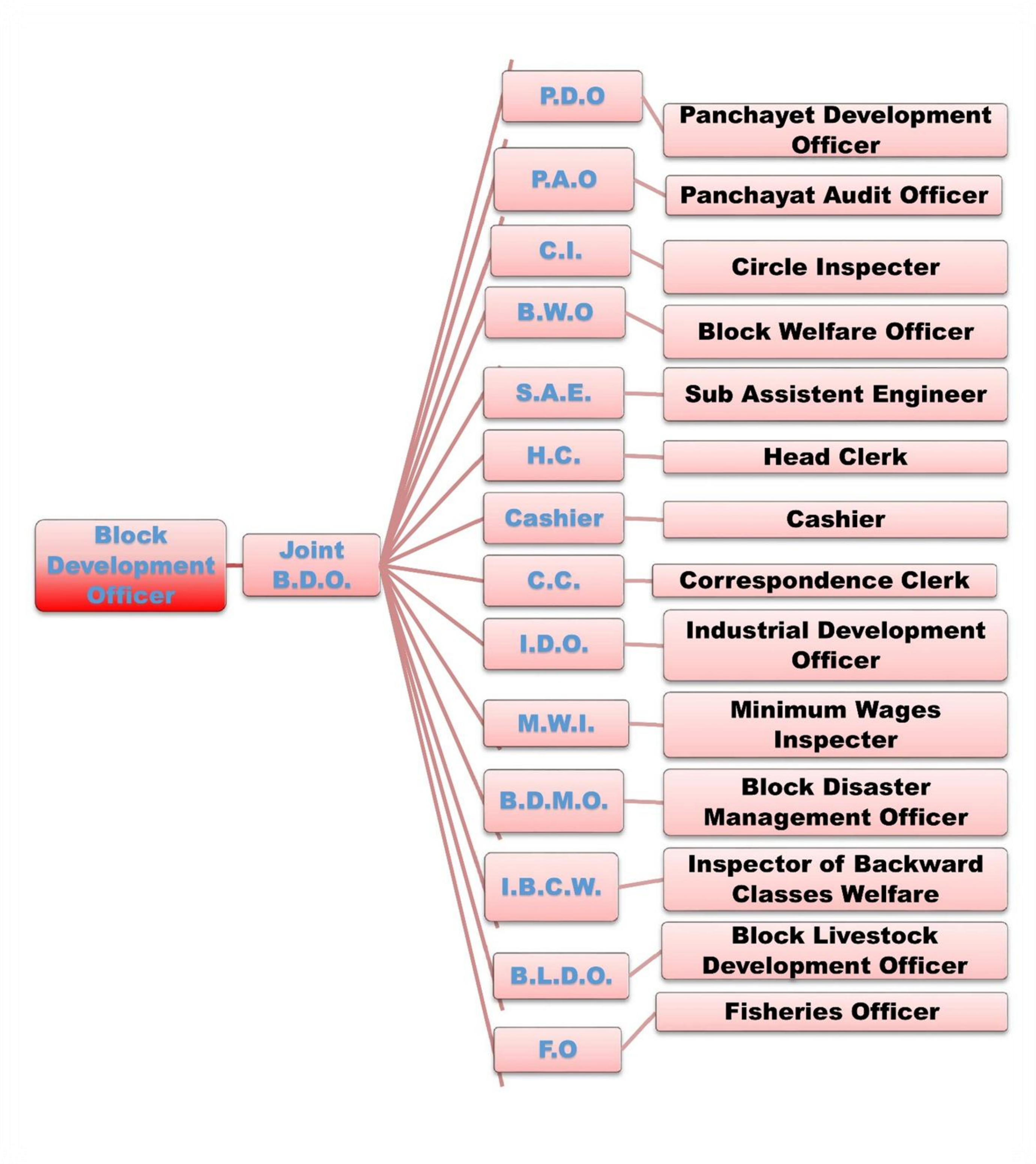
BDO is the chief co-ordinating Officer of the Block. Line Departments work in co-ordination with the BDO of the



block.

Several Other Line Departments are present: BMOH, ADA, FEO, CDPO, FS Inspector, Block Youth Officer and so on.

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10.CO-ORDINATION:

A. Efforts taken to have perfect co-ordination within the different development departments. Every Line Departments are working perfectly to have perfect co-ordination like SI, Agriculture Department, etc. Regular Meetings are conducted to discuss any problems if arise and in case of emergencies, BDO herself calls for meeting.

B. Problems of Co-ordination:
There is no such problem in co-ordination in the Dhaniakhali Community Development Block.

11.ACHIEVEMENTS

Major Achievements of the Block include:

a. Kanyasree
b. MGNREGS(won prize in the district in 2017)
c. Mid-day meal
d. Goatery formation
e. One of the major initiatives taken by the block was to set boundaries for the graveyards in the locality areas which previously was an open graveyard and animals used it to draw the corpse and create an unhygienic environment.So,amongst the major achievement was to cover up efficiently all the graveyards and burning Ghats in the block

12.EXISTING CONSTRAINTS

The existing constraints of the block include:

a. Local problems
b. Fodder cultivation is low in the block
c. Lack of fund or proper allocation of the fund
d. Farmers reluctant in using new technologies in some parts

13.REPORTS AND RECORDS

The KPS and the ADO maintain several records, which are mentioned below:

a. KCC
b. FYP
c. DC Register
d. Soil Testing Result & Registration
e. Crop Coverage
f. Weather Watch Report
g. Crop Cutting Report
h. Seed
i. Fertilizer
j. Pesticide Registration Certificate

14.PHOTO DOCUMENTATION

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With BDO ma'am Smt. Priyanka Bala

With BIO sir Mr. Pulak Karak & his staffs

The In- Service Training Building for whole Hooghly Dist. at block premises

With Jt. BDO sir Subrata Pal **With Vet. Doctor Dr. Samarjeet Dutta**

With the School Inspection office staffs

With ADA sir Dr. Dipak Hazra (left),

DDA sir of Hooghly Dist (middle) &

Head of ATMA of Hooghly Dist.(right)

- I can conclude after visiting the developmental institution of Dhaniakhali Community DevelopmentBlock and a discussion with officers I understand the present situation and corresponding problems related to yield loss of the block. In this regards we can say that many developmental works are carrying out by different Dept.

implementation of developmental programmes like BGREI, RKVY, MGNREGA, NFSM, NAIS are going on at the desired level.

- Any new technique cannot be incorporated in cropping scheme for lack of awareness and financial problem. But now-a-days Pulses are included in cropping pattern. For cash crop **Capsicum** took place a vital role in the income of the farmers.
- The worst situation is in livestock rearing and their breeding. But presently Animal Resource Development Dept. has taken initiative like up gradation of breeds through AI, regular vaccination, Commercial animal Rearing (Goatery, Poultry) for the improvement of live stocks. Duckery unit should be there.
- The main problem is the excess use of ground water for irrigation purpose. To get rid ofthis problems of crop cultivation new techniques like SRI, zero tillage, crop rotation, mulching, paira cropping, introduction of Rabi pulse in cropping system, mixed cropping isnow entering.

16.SUGGESTIONS

- Good co-ordination among the developmental institutions and wiliness of staffs are very essential for proper implementation of scheme. Merging of two more schemes to obtained overall benefit when needed.
- Organizing awareness camps for regular vaccination, concentrated feeds, maintaining health-hygiene of animals and taking loan from bank.
- Introduction of fodder crops in cropping system and adoption of diversified intensive cultivation technique.
- Proper distribution of KCC and other credit facilities to farmer.
- Increase awareness among farmers about the use of indigenous knowledge for eco-friendly production.
- Held regular meetings for judging the status of work done & take decisions accordingly.
- Regular soil testing & proper management and construction of rain water harvesting structures can be helpful to mitigate the soil and water problem.
- Good price judgement and good marketing facility can give a good hike in the farmers situation at this stage.

REFERENCES

Information is given by officials like (B.D.O, B.I.O, B.L.D.O and A.D.A) collected in the structured interview schedule.

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ACKNOWLEDGEMENT

I would like to thank each and everyone who has helped me in accomplishing this work.I would express my sincere gratitude to everyone.

I would like to thank to our respected teacher Dr. D. Panda for his remarkable, valuable guidance and supervision through out the assignment work. It would be my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard.

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Deviation from an accurate and uniform application can result in poor crop response to the fertilizer being applied and even in injury to the growing plants.

➢ Types of Fertilizer Materials

FERTILIZER MATERIALS: Not all fertilizers are suitable for use as a foliar spray , foliar fertilizer formulations should meet certain standards in order to minimize foliage damage. Qualifications for fertilizer materials follow:

A. Low salt index: Damage to plant cells from high salt concentrations can be considerable, especially from nitrates (NO3-) and chlorides (Cl-).

B. High solubility: Needed to reduce the volume of solution needed for application.

C. High purity: Needed to eliminate interference with spraying, solution compatibility, or unexpected adverse effects on foliage.

NITROGEN MATERIALS: Urea is the most suitable nitrogen source for foliar applications, due to its low salt index and high solubility in comparison to other nitrogen sources. Urea has been shown to stimulate absorption of other nutrients by increasing the permeability of leaf tissue . However, the urea utilized in foliar sprays should be low in biuret content (0.2 perent or less) to lessen urea foliage burn side effects . Other sources of nitrogen can be obtained from ammonium polyphosphates, ammoniated ortho-phosphates (liquid), ammonium thiosulfate (12-0-0-26S), and fluid ammonium sulfate (8-0-0-9S). These sources, when utilized at low foliar rates, are excellent supplemental nitrogen carriers with no/minimal foliage burn side-effects.

A relatively new nitrogen compound, Triazone®, has ideal uses in foliar applications due to its low-burn characteristics.

PHOSPHORUS MATERIALS: A combination of poly and ortho-phosphates has been shown to lessen leaf burn and aid in leaf phosphate absorption . Secondarily, the polyphosphate advantage may also be due to supplying both ortho and polyphosphate forms simultaneously.

POTASSIUM MATERIALS: Depending on availability, potassium polyphosphates are an excellent source of low salt index, highly soluble potassium. Potassium sulfate is suitable also, having a low

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❖ NITROGEN

Stimulates growth through protein formation; stimulates absorption of other nutrients by increasing leaf surface permeability. Higher percentage in foliar applications during early growth stages (10-18% N). Lower percentage at later growth stages (3-8% N).

SOURCES	PERCENT
Biruet free urea:	Less than 0.2%
Ammonium polyphosphates	10-21
Orthophosphates (liquid)	3-16
Calcium Nitrate	15

❖ PHOSPHORUS

Supplies energy for growth; higher percentages beneficial during early growth stages (8-16% P_2O_5); lower percentages required at later growth stages (4-8% P_2O_5). Absorption rate into leaf tissue is greatest when pH of the solution is 5.0 to 6.0 % P_2O_5 .

SOURCES	PERCENT
Ammonium polyphosphates	33-52
Orthophosphates (liquid)	4-18

❖ POTASSIUM

Aids in maturity and seed/fruit set. Sufficient percentages in fertilizer solutions range from 6 - 14% K_2O.

SOURCES	PERCENT
Potassium Nitrate	44.5
Potassium Thiosulfate	25
Liquid sol. potassium hydroxide	6-18
Potassium sulfate (17.6% sulfur)	54

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❖ CALCIUM

Aids in maturity and seed/fruit set. Essential element in plant cell wall structure. Foliar applications delay senescence/breakdown of plant tissue.

SOURCE	% CALCIUM
Calcium sulphate	23
Calcium nitrate	21
Promesol	8

❖ MAGNESIUM

Central element around which chlorophyll is manufactured; participates in the activity of enzymes (proteins) and in phosphorus translocation. Forage plants containing less than 0.2% magnesium prodiuce high incidences of grass tetany in ruminant animals (Hypomagnesemia).

SOURCE	% MG
Magnesium sulfate	10
Magnesium nitrate	6-3

(Low rates allow the nitrate concentrations to be low enough in this formulation to allow application without foliage burn.)

❖ SULFUR

Necessary for protein formation and sugar metabolism. Beneficial for both early and later growth stages.

SOURCE	% S
Ammonium thiosulfate	26
Ammonium sulfate solution	9
Potassium thiosulfate	17
Potassium sulfate	17-18

Proper Timing of Foliar Applications of nutrients

PROPER GROWTH STAGE: This is one of the most critical aspects of a foliar feeding program. Foliar applications should be timed to provide needed nutrients during the yield potential determining time frame of plant development, which will in turn favorably influence the postreproductive development stages.

PROPER CROP CONDITION: Crops that are nutritionally sound will be most likely to respond to foliar feeding. This is due to better tissue quality (allowing for maximum absorption of nutrients into leaf and stem) and better growth vigor (allowing for translocatable nutrients to be rapidly moved to the rest of the plant). Crops under heat or moisture stress show less response to foliar applications

due to lower leaf and stem absorption rates and/or poor vigor. However, foliar feeding does benefit crop performance and yield if an application was made prior to heat or moisture stress. Recovery from cold growing conditions and herbicide stress can be hastened with proper foliar applications .

PROPER METEOROLOGICAL CONDITIONS: Environmental influences, such as time of day, temperature, humidity and wind speed influence the physical and biological aspects of foliarapplications. Plant tissue permeability is an important factor in absorption of nutrients into the plant: warm, moist and calm conditions favor highest tissue permeability, conditions found most often in the late evening hours, and occasionally in the early morning hours.

METEOROLOGICAL CONDITIONS FAVORING FOLIAR APPLICATIONS

Time of Day:	late evening; after 6:00 p.m. early morning; before 9:00 a.m.
Temperature:	65-85½ F; 70½ ideal
Humidity:	greater than 70% relative humidity
Temperature/Humidity Index:	140-160
Wind Speed:	less than 5 mph

Rainfall within 24 to 48 hours after a foliar application may reduce the application effectiveness, as not all nutrient materials are immediately absorbed into the plant tissue. Table 5 gives rates of absorption or entry into the leaf tissue for various nutrients.

Foliar nutrition and postharvest quality of crop

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The influence of foliar application on nutritional, postharvest, and processing quality of crop yield is relatively complex to explain . The assessment of the effect of foliar nutrition on particular crop species requires consideration of various quality parameters. These characteristics or parameters may include the level of nutritional and healthpromoting compounds i.e., antioxidants, vitamins, essential oils, as well as those negatively affecting the consumer's health i.e., nitrates, heavy metals, mycotoxins.

Foliar nutrition combined with applied biostimulators or growth regulators could be used for the management of plant growth and crop quality, such as the reduction of nitrate level in edible parts of plants

➢ MATERIALS THOSE INCREASE FERTILIZER USE EFFICIENCY

Additives: Agents added to the foliar fertilizer solution which buffer the pH of the solution (preferably between pH of 5.0 and 6.0) and provide for quick and uniform coverage of the spray droplets are highly recommended. Foliage burn is caused by a high concentration of fertilizer salts (i.e., nitrate and chloride) rather than low pH in the fertilizer solution. Low pH fertilizer foliar solutions have been shown to increase the absorption rate of fertilizer materials . Leaf and stem tissues can inhibit initial nutrient absorption by means of waxy substances in the cuticle (outer layer of plant cells), pubescence (fine hairy growths) and drooping leaf angles. To achieve maximum nutrient absorption via foliar applications, a fine mist application with spreading and wetting agents is desired. These agents provide quick wetting of plant tissue and more uniform coverage with increased spray retention by reducing the surface tension of the spray droplets. Effective foliar applications depend on maximum absorption of soluble nutrients, avoiding losses due to evaporation and/or runoff as much as possible.

1 . **SURFACTANT.** A surfactant is a "surface active agent" and is the active ingredient in most adjuvants. Surfactants are either nonionic (do not ionize, but will have a slight electrostatic charge due to the polarity of dissimilar atoms in the molecule), anionic (ionized, with a strong negative charge), or cationic .

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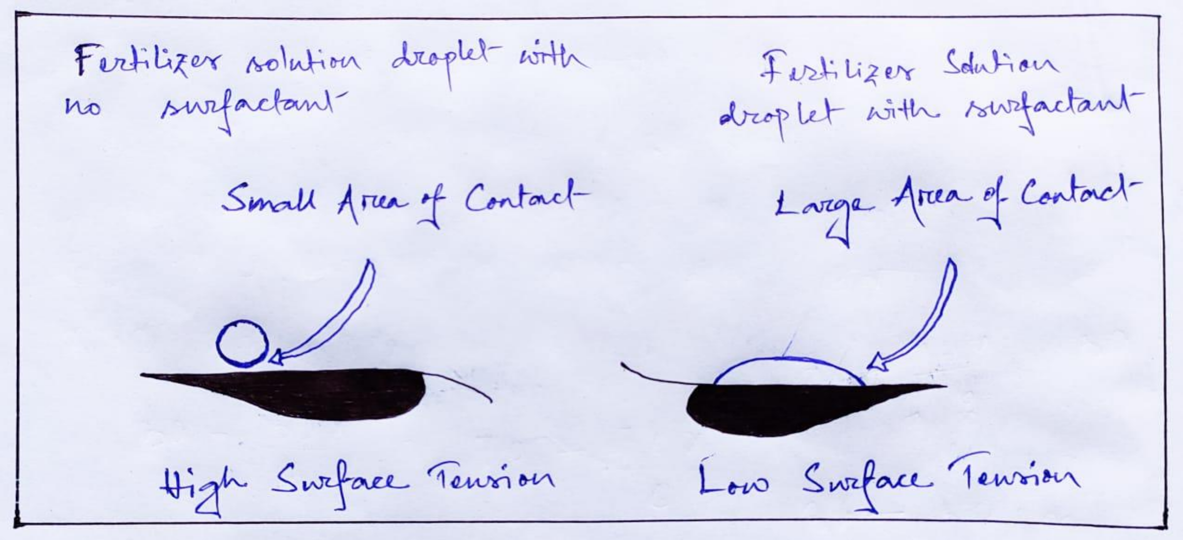

2 . **WETTER-SPREADER.** Ortho's X-77 is an example of a wetter-spreader, providing quick wetting and more uniform coverage by reducing surface tension of the spray droplets. A spray drop must be able to wet the foliage and spread out or cover an area of the leaf for the pesticide to perform its function.

3 . **STICKERS.** A sticker, like Loveland's Bond, can perform three functions. It can increase the adhesion of solid particles that might be easily dislodged from a leaf surface—sort of gluing them on. It can also reduce evaporation of the pesticide. Finally, a sticker may provide a waterproof coating for the pesticide.a of the leaf for the pesticide to perform its function. ized, with a strong positive charge).

4 . **EMULSIFIERS.** There are few emulsifiers on the market and few growers need to be concerned with these agents. Most often, the manufacturer includes an emulsifier (dispersant or suspending agent) in the pesticide (emulsifiable concentrate) to enhance the dispersion of particles from one phase into another--for example, from oil into water. For this reason, you hardly see these products on the market.

5 . **PLANT PENETRANTS .** It enhance penetration of some pesticides into plants, and may be found on wetter-spreader labels as plant penetrators or translocators.

Others

6 .**COMPATIBILITY AGENTS.** Pesticides can sometimes be combined with liquid fertilizers for application, saving a trip through the field. But an applicator must guard against unequal

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the relative mobility of the elements can be grouped as follows:

Freely mobile: N, P, K, Rb, Na, Mo.

Partially mobile: Fe, Mn, Zn, Ca, Mg, Mo, Cu, B.

Relatively immobile: Ca, Mg.

The elements Ca, Mg and Mo differ in their mobility depending on the plant systems .

Factors influencing foliar uptake of nutrients

1 . The first barrier to foliar uptake is the cuticle- the surface of which is however not smooth, and is covered with waxy layer, protuberances and structures like trichomes which increase the surface tension. Therefore, any additive included in the aqueous sprays should reduce the surface tension and increase the surface area of absorption. These are obtained by wetting agents and surfactants which are now commercially available for different nutrient elements and crops .

2 . There are environmental factors like light, temperature and relative humidity which directly and indirectly affect foliar absorption.

3 . Quantitative and qualitative differences in the leaf surface morphology are brought about by these factors, as a result of which the efficacy differs not only with the crop species but also by the stage of leaf development. Young leaves have been found to absorb nutrients more effectively than the old and mature ones. The temperature and relative humidity affect the uptake by providing a thin layer of moisture on the leaf surface through transpiration .

4 . The chemical forms in which the nutrients are supplied are also important.

Foliar nutrition as an agrotechnique for biofortification

It is well known that, the industrialization has been penetrated all our life fields including the agriculture through the agro-technological packages, producing high-input and high-output agro-systems. Foliar application was and still one of the most important agro-technological tools, where most new formulations or biostimulators or pesticides or nano-fertilizers or else could be applied. This agrotechnique could be considered a promising tool in plant biofortification. Concerning plant biofortification, it could be defined as producing different staple foods containing in their edible

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parts higher content of bioavailable minerals (Fe, Cu, Zn, Ca, Se, I, etc.), and some nutritional compounds such as folate , thiamin or vitamin B1 , vitamin B6 , provitamin A and vitamin E . The plant biofortification mainly is used in micronutrient malnutrition or enriching plants with desirable nutrients or against hidden hunger .

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Wet bed nursery

Wet Nursery

This is widely used in areas where water is abundant. The seed bed is usually prepared 25 to 35 days before transplanting. Steps involved in raising wet bed seedlings are as follows

- Land where both irrigation and drainage can be controlled should be selected for seed bed. The land should be fertile and free of excess salts or other soil problems.
- The seed bed area is ploughed twice either in dry or wet conditions and then puddle by giving two or three more ploughings. After 10 days, the field is again ploughed twice and leveled.
- When the field is brought to fine soft puddle condition, raised beds (4 - 5 cm high) of 1.2 m wide and of convenient length with 45 cm channel all around are constructed. Raised beds are not necessary in areas where water logging is not a problem. Excess water is drained off to maintain a water level just sufficient to cover the soil. The surface of the seed bed is so levelled that there is gradual inclination toward both sides to facilitate drainage of water during the first few days.
- For each 100 m^2 area of nursery bed, provide 1 kg N, 0.4 kg P_2O_5 and 0.5 kg K_2O. Double the P_2O_5 application in locations where cool temperatures retard the growth of seedlings. The fertilizers are mixed with soil before sowing.
- Sow (broadcast) pre-germinated seeds (soak the seeds for 24 hours, incubate in warm moist conditions for 36-48 hours until germination) on a drained bed at the rate of 50 - 70 g (unsoaked weight basis) per square meter depending upon the size of the seed. If seeds are sown too closely seedlings will be weak. It will be also more difficult to pull seedlings and there will be more chances of injury to the long roots of adjacent seedlings.
- Keep the beds moist for the first few days. Do not flood the beds. When the seedlings are about 2 cm high, keep the beds submerged in a shallow layer of water.
- Top dress the seed beds with 0.3 kg to 0.6 kg N per 100 square meter area, 6 days before transplanting.
- Appropriate control measures should be taken for pests and diseases in the nursery if they occur.

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Procedure for pulling the seedlings out of seed bed:

Seedlings are ready for transplanting from 20 to 25 days after sowing. Seedlings more than 30 days old when transplanted recover more slowly than younger seedlings, especially if they suffer stem and root injury. Seedlings less than 20 days old are too short to be pulled from the soil. The procedure is as follows:

- Two to three seedlings are grasped at a time.
- The seedlings are held between the thumb and forefingers, and as close to the base as possible.
- They are pulled gently and easily at an angle of about 30˚ on the horizon.
- If too much mud sticks to roots, it is washed by shaking the roots in water. The plant roots should not be thrashed against feet or any object to remove mud as this will injure the plants.
- Convenient size of seedling bundle (5 - 8 cm in diameter) is made by tying with any soft material may and the seedling should be protected from drying.

Raised seed bed preparation

Pre-germinated seed

Sowing of seeds

Advantages of Wet Bed Nursery:

- Less seed is required per unit area.
- It may be grown in any type of soil but the suitability will vary.
- Growth is quick with strong and sturdy seedlings. Number of seedlings per hill
- can be specified; therefore seedlings are not wasted.
- It can withstand slight salinity.

Disadvantages of Wet Bed Nursery:

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- Copious water supply is essential. This causes delay in transplanting.
- Seeds are easily carried away by rainwater if a heavy rain occurs shortly after sowing.
- Preparation and care of seed bed and pulling of seedlings are laborious.
- It is difficult to arrest seedling growth.
- Seedlings cannot be kept longer in the nursery as they tend to tiller and produce nodes under the favorable conditions.
- It requires more space and this entails in loss of space where crops are standing.
- Seedlings cannot withstand drought.

Dry-bed method

The nursery is prepared in dry soil conditions. Seed beds of convenient dimensions are prepared by raising the soil to a height of about 5-10 cm. A layer of half burned paddy husk could be distributed on the nursery bed to facilitate uprooting.

The site should be free of shade and with adequate irrigation facilities. Total seed bed area is also about 1/10 of the area to be transplanted but about 80 kg of seed are required to transplant 1 hectare (germination is lower). Uprooting of seedlings should be done between 15 - 21 days after germination. Nursery should be maintain without any moisture stress. A basal fertilizer mixture can be applied and incorporated between rows if the soil nutrient supply is low.

Advantages of dry bed nursery

The advantage of the dry-bed method is that seedlings are short and strong, with a longer root system compared with the wet-bed method. The seedlings can be raised even during periods of heavy rains.

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Disadvantages of dry bed nursery

A disadvantage is however that roots may get damaged during pulling. Seedlings of upland nurseries may also get infected with blast and are more prone to pests such as rodents etc.

Conclusion

Where water is abundant wet bed nurser of paddy seedlings is practiced.Dry bed nursery of paddy seedlings is practiced where water is not available.

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USE OF HYBRID SEEDS IN VEGETABLE PRODUCTION: PROSPECTS & LIMITATIONS

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India is the second largest populous country after China. In India the per capita land resources are decreasing due to the pressure of the population growth, therefore, it is very important to enhance the production and productivity per unit area. India is the second largest producer of vegetables with annual production of 162.9 million tonnes (NHB, 2015) but as compared with China weare still far behind in production and average productivity. The higher productivity in these countries is due to the coverage of maximum area under hybrids unlike open pollinated varieties in India. The major reason for lower productivity in India can be attributed to the limited availability of high quality seeds of released hybrids. In order to increase productivity, the seed availability of released hybrids at lower price is a prerequisite. Hence, in order to feed ever growing population there is a need to enhance the vegetable productivity (17.3 MT/ha) which is less than the average world vegetable productivity (19.6 MT/ha)(NHB, 2015).

Therefore, hybrid varieties can play a vital role in increasing total production and productivity due to their high yield potential, early maturing, superior quality, disease and pest resistance. The rapid increase in productivity per unit area can be achieved by the use of quality seeds with built in inbred and hybrid vigour along with the application of improved vegetable cultivationtechnologies and government policies. Therefore, growing of hybrid vegetable varieties are one of the better options because the complete potential of hybrids in vegetable crops has not been utilised. The major reason behind low productivity in vegetables and less commercialization of hybrids in India is may be due to the non-availability of quality seed of released improved hybrids. Another reason could be very high cost of hybrid seed of vegetables like chilli, capsicum, tomato, cucumber, musk melon, cabbage, cauliflower etc.

Hybrid breeding:

The mating or crossing of two plants of dissimilar genotype is known as hybridization. In plants crossing is done by placing pollen grain from one genotype (male parent) on to the stigma of flower of another genotype (female parents). The seed as well as the progeny resulting from the hybridization are known as hybrid. In other words, the progeny of a cross between genetically different plants is called hybrid or F1 hybrid. In self-pollinated crops, it is difficult to cross but in cross pollinated crops it is easier. For production of a hybrid, crossing between two parents with different economically important traits is important. Heterosis is superiority of F1 (offspring from cross) in one or more characters over its better parental or mid parental value.

Principles of hybrid seed production in vegetable:

A. **Isolation Distance:** For successful hybrid seed production the field must be isolated from other varieties of the same crop, cultivated species and their wild relatives if any to make sure the production of genetically pure seeds. Many of these crops are highly cross pollinated; hence isolation distance for both foundation and certified seed production should be maintained as per the seed production standard. The isolation distance between cross compatible varieties can be achieved by the following ways.
    - Time isolation: It will allow the seed production of different varieties of the same crop at the same place each year. If the season is too long enough to allow two production cycles of the cross compatible crops then they too are isolated by time. For example, early and mid-maturity group of cauliflower grown for seed production can be isolated by time.
    - Distance isolation: The isolation distance for self-pollinated varieties is comparatively less but, for cross-pollinated varieties the isolation distance from other variety should be relatively more. The isolation distance also varies with the direction of insect flight (in case of insect pollinated varieties) or the direction of winds (in case of wind-pollinated varieties).

B. **Selection of suitable season and areas for seed production:** For seed production the crop should be grown in areas where dry seasons prevail at the time of seed maturity and extraction. The locations are also important in seed production to enhance seed yield with better quality. Punjab, Haryana, U.P., Jalana (Aurangabad) in Maharashtra, Ranibenur and around Bangalore in Karnataka, Nandyal Valley in A.P., are the main areas of seed production for muskmelon and cucumber in India.

C. **Roguing:** Roguing is the removal of individual plant which do not confirm to the distinct limits of a particular variety. Therefore, rouging is a technique that is used in seed production to maintain genetic purity of the variety. The off-types may occur in a crop due to a variety of the morphological types within a crop. The cross-pollinated vegetable crops like Cole crops, Cucurbits and Onion) shows high morphological diversity

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than self-pollinated) crops (e.g. Peas, Tomato, Fenugreek). Therefore, the varieties of self-pollinated crops are generally more uniform and stable than varieties of cross-pollinated crops.

Different stages of rouging:

- *Before flowering:* On the basis of vegetative characters (plant growth, foliage morphology, colour etc.) the off types are removed from seed production field.
- *At flowering:* The early and late varieties can be easily identified on the basis of curd maturity and sex expression in cauliflower and cucurbits respectively, and flower initiation time in solanaceous crops.
- *At fruit development:* Trueness to type of developing fruit (Fruit shape, size, colour, colour of ripen fruit (green, yellow, red) is checked and on the basis off -type plants are rouged out.
- *At maturity:* The plants showing late maturity of fruits in the early variety and vice versa should be removed from seed production field.

D. **Threshing and seed extraction:** It varies from crop to crop. Threshing can be done by hand or machines. Threshing machines should be properly cleaned to avoid admixture. Generally, seeds should be extracted from dry fruits or from fruits in which the seeds are wet at the time of extraction.

E. **Seed Standards**: It refer to the field inspection of the harvested produce as well as the manner of harvesting, transporting, processing and packing. Unless, a seed certification agency keeps track of harvested produce until it is packed and sealed the identity of the lots cannot be assured. It is, therefore, necessary that the seed certification agency should lay down standard for processing plants. In addition, field and seed standards, such as isolation distances, inseparable other crop seeds, weeds, plants affected by seed borne diseases, genetic purity, percentage of pure seed, other crop and weed seeds, inert matter, moisture content, germination and insect damage, should be prescribed for successful accomplishment of the certification.

Mechanism for facilitating hybrid seed production in vegetable crops:

Commercial hybrid seed production demands crossing technique which is easy and also economical to maintain parental lines. These techniques are specific to crop floral biology and flowering behaviour. Different mechanisms adopted for commercial hybrid seed production of vegetable crops are discussed below:

1. Hand emasculation and pollination
2. Self-incompatibility
3. Male sterility
4. Manipulation of sex expression

1. Hand emasculation and pollination:

Most of the seeds of F1 hybrid vegetables are produced by hand-pollination. The method in principle is simple as it involves the manual emasculation of the pollen-producing organ, the anthers, followed by hand pollination with pollen of the male parent and then preventing other pollen from contaminating the pollinated flowers. Although, it is labor intensive method, this system is being practiced in all the solanaceous crops and cucurbits, wherein a single pollination of a female flower produces many seeds and remains cost effective.

2.Self-incompatibility:

Self-incompatibility (SI) refers to inability of a plant to set seed upon self-pollination despite male and female gametes are viable. Self-incompatibility is very common in Brassica. Self-incompatibility prevents self-pollination (in breeding) and promotes cross pollination (out breeding) and creates genetic variability. SI is seen in hermaphrodite and homomorphic flowers. The self-incompatibility response is genetically controlled by one or more multi-allelic loci, and relies on a series of complex cellular interactions between the self-incompatible pollen and pistil. Self-incompatibility (SI) can be classified as:

- Heteromorphic self incompatibility: In this system flowers are of different morphology of the reproductive parts. The morphological differences can be seen visibly in flowers. The characters affecting this type of SI are style length, filament length and pollen size etc.

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- Homomorphic self-incompatability: Flowers morphology is same, so mating types cannot be recognized by morphological features. This type of self-incompatibility is controlled by 'S' alleles. For crossing parental 'S' alleles should be different, then only fertilization takes places and seed sets. Two types of self-incompatibility:
  a. *Sporophytic self-incompatibility (SSI)*: In SSI, the incompatibility of pollen is due to genotype of the anther (the sporophyte) in which it was created. SSI is less common as compared to GSI. This form of SI was identified in the Brassicaceae and Convolvulaceae families.
  b. *Gametophytic self-incompatibility (GSI):* In GSI, the incompatibility of the pollen is determined by its own gametophytic haploid genotype. This is the more common type of SI, existing in the families: Solanaceae, Rosaceae, and Papaveraceae families.

3. Male sterility

Male sterility is defined as the absence or non-function of pollen grain in plant or incapability of plants to produce or release functional pollen grains. The use of male sterility in hybrid seed production of vegetables has a great importance as it eliminate the process of mechanical emasculation.

Types of male sterility:

The different types of male sterility are as follows:

i) Genetic male sterility: The pollen sterility, which is caused by nuclear genes, is termed as genic or genetic male sterility. It is usually governed by a single recessive gene 'ms'. A male sterile line may be maintained by crossing it with heterozygous male fertile plant and such a mating produces 1:1 male sterile and male fertile plants. This system has been reported in tomato, pepper, chilli, muskmelon, watermelon and okra and commercially exploited for chilli and muskmelon in India.

ii) Cytoplasmic male sterility: This male sterility is conditioned by the interaction of nuclear gene (Chromogene) and sterile cytoplasm but neither the genetic factor nor the cytoplasmic factor alone can regulate sterility. This male sterility has been utilized in carrot, sweet pepper, chilli, radish, turnip, cauliflower, cabbage, broccoli and Chinese cabbage and onion. This male sterility is sensitive to temperature and is unstable under fluctuating environments which hinders its utilization in hybrid seed production. Indian Institute of Horticultural Research (IIHR), Bangalore has released two F1 hybrids of onion Arka Kirtiman and Arka Lalima using cytoplasmic male sterility and Indian Agricultural Research Institute, New Delhi has developed a tropical carrot hybrid Pusa Vasuda.

iii) Chemical induced male sterility: A method of producing male sterile lines which circumvents the difficulties of genetic induction is the use of chemical sterilization agents. The principle involved here is that the chemical acts as a gametocide selectively altering the male gamete, i.e., pollen, by inducing physiological abnormalities, which in turn prevent pollen development, pollen shed, or pollen viability. A number of chemical compounds have been shown to have at least a partial effect in producing male sterility in plants. Among these are: Ethephon, FW 450 and Ethidium bromide.

iv) Transgenic male sterility: From the beginning of 1990's, new genetic approaches have been proposed and implemented to develop male sterility systems through genetic transformation. The ability to design new molecular strategies and their successful execution has been possible because of the isolation, cloning and characterization of anther or pollen specific genes and promoter sequences. These genes are expressed in pollen themselves (gametophytic expression) or cells and tissues (sporophytic expression) that directly or indirectly support pollen development, such as tapetum, filament, anther wall.

4. Manipulation of sex expression: Production of hybrid seeds in cucurbitaceous vegetables is possible through manipulation of sex expression. Gynoecious lines are available in cucumber and muskmelon and have been exploited for hybrid seed production commercially. Monoecious cultivars produce male and female flowers on same plants. Gynoecious lines produce only female flowers and can be easily used as female parent to produce hybrid seeds in large scale. Multiplication of gynoecious cucumber line is made possible by induction of male flowers through spraying of GA3 (2000 ppm) or silver nitrate at seedling stage. IARI has developed a cucumber hybrid Pusa Sanyog with the use of this mechanism but it is suitable mostly for temperate zones. Recently gynoecious lines of bittergourd have also been developed.

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Methods/Techniques of hybrid seed production in vegetables:

The manual pollination method of seed production on commercial scale is only feasible in the development of hybrids of vegetables like tomato, eggplant, and cucurbits (bottle gourd, watermelon, pumpkin etc.) where large number of F1 seeds can be obtained per pollination. The advance hybrid seed production techniques like, use of functional male sterility in tomato and brinjal, use of stable genic and sporogenous male sterility with marker character in watermelon and muskmelon can be utilized in these vegetables to reduce cost of F1 seed production. The functional male sterility has been exploited for hybrid seed production of tomato cv. Pusa Divya under poly house condition by Manjunath (2009). Hybrid seed in tomato, brinjal, capsicum and chilli are produced through hand emasculation and pollination. The hybrid seeds of bottle gourd, bitter gourd and pumpkin through protection of female flower and hand pollination; cucumber through natural pollination in case of gynoceious seed parent (Munshi et al., 2015); onion, cabbage and cauliflower by utilizing the CMS and SI system respectively. The hybrid seeds of summer squash are produced by use of ethephon for inducing the staminate flower and natural pollination. Cryopreservation of pollen in liquid nitrogen at -196°C offers many advantages to the hybrid seed production of vegetables. This method can provide a constant supply of viable and fertile pollen and can also allow supplementary pollinations for improving seed set

S.No.	Hybrid Seed Production Meechanism	Commercially exploited crops
1.	Hand emasculation and manual pollination	Tomato, Brinjal, Sweet pepper, Okra, Chilli
2.	Pinching of staminate flowers and hand pollination	Bitter gourd, Bottle gourd, Pumpkin
3.	Removal of staminate flower + emasculation + hand pollination	Watermelon and muskmelon
4.	Functional male sterility and hand pollination	Tomato, Brinjal
5.	GMS + Bee Pollination	Chilli
6.	CMS + Natural Pollination	Capsicum, Onion, Cabbage, Carrot, Radish
7.	Self-Incompatibility and Natural Pollination	Cauliflower, Broccoli
8.	Gynocecism and Natural Pollination	Cucumber, Bitter Gourd
9.	PGR and Natural Pollination	Squash
10.	Detasseling + Wind Pollination	Sweet Corn and Baby Corn

Bagging of female flower

dizatic

Hand pollination

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Selection of flower bud for hybridization

Emasculation

Collection of male flower for pollen

Pollen collection

Pollination

Fig: Hybridization in tomato

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The major advantages of hybrid vegetables seed production are:

1. Higher seed yield (generally 2-4 times more) and seed quality as compared to open field

2. Requirement of isolation distance in cross pollinated vegetables can be minimized.

3. Problem of synchronization of flowering can be minimized.

4. Maximum plant population can be maintained.

5. Seed production under adverse climatic conditions is possible.

6. Training, pruning and hand pollination practices are very easily manageable under protected conditions compared with to field seed crop.

7. Emasculation of female parents is not required as there are no insect pollinators.

8. Seed crops will not be damaged by un-seasonal rains at the time of their maturity.

9. Seed viability and seed vigour could be extended through better nutrient management in seed crops under protected conditions.

Prospectus and constraints in vegetable seed production of India

Indian seed industry has been growing awfully in quantity and value over the past fifty years. Both public and private sector corporations/companies are actively involving in quality seed production. The public sector component comprises National Seeds Corporation (NSC), State Farm Corporation of India (SFCI) and 15 State Seeds Corporations (SSCs), Indian Council of Agricultural Research (ICAR) institutions and State Agricultural Universities. ICAR launched an All India Coordinated Research Improvement project (AICRP) on seed production called National Seed Project in 1979 with 14 centres in different Agricultural Universities.

The worldwide production of vegetables has doubled over the past quarter century and the value of global trade in vegetables now exceeds that of cereals. India is emerging as the second largest producer of vegetables after China. In the past two decades, the vegetable production in India has been increased 2.5 times from 58.5 m t in 1991-92 to 146.5 m t in 2010-11 (Koundinya et al., 2014). Increase in yield is mainly attributed to expanding areas under high yielding vegetable varieties and hybrids. Total cultivated area under vegetables has been increased from 5.59 m ha in 1991-92 to 8.49 m ha in 2010-11 (Koundinya et al., 2014). Finally, it leads to ever increasing demand for the quality vegetable seed. Moreover, the yield of crops are higher when produced from and replaced seeds than own saved seeds. Seed replacement rates are high for vegetables like cabbage (100%), tomato (99.3%) compared to other cereals and oil seeds (Mazumdar, 2012). Total quantity of vegetable seeds produced in the country is not sufficient to meet the country's ever increasing demand. Currently quality seeds are met to the extent of 20% only.

Vegetable seed production particularly hybrid seed production demands much labour. Labour is needed for performing various cultural operations. Though mechanization reduces the human effort up to some extent, high cost fuel and energy limitations reduce full scale mechanization. Moreover, emasculation and pollination steps during hybrid seed production of vegetables solely depend on human labour India is ranked second in hand pollinated vegetable seed production in Asia next to China (Prasad et al., 2009 and Hazra et al., 2006). Average number of man-days per acre required for hybrid seed production of various vegetables as follows: tomato-480; Chilli -1800; okra-180; brinjal600; cucurbits -150 to 450. India is having huge human resources availing at reasonably cheaper rates Prasad et al., 2009). This is attracting various corporate sectors of national and international origin to invest in seed business in India.

Now a day hybridis replacing the open pollinated varieties (OPV) largely due to higher yield, uniformity and their improved quality for instanceIndia is second largest user of hybrid tomato seed after USA (Hazra et al., 2006). Vegetable seed exports consist of 70% of total seed exports (Hazra et al., 2006). Vegetable seeds of either OPV or hybrids from India are having cosmic demand in foreign countries like Pakistan, Bangladesh and Saudi Arabia. The percentage share of various countries importing fruit and vegetable seeds from India.

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Development of F1 hybrids in major vegetables in India:

In India the first F1 hybrid 'Pusa Meghdoot' of bottle gourd was developed by IARI in 1971. In 1973, Indo-American Hybrid Seed Company from the private sector developed its first hybrid Karnataka in tomato and Bharat in capsicum. There are number of F1 hybrids developed by public sector organization are popular among farmers and seeds of these are multiplied by NSC at national and SSC at state level

S. No	Crop	Available Hybrids	Source
1.	Tomato	Pusa Hybrid-1, Pusa Hybrid-2, Pusa Hybrid-4, Pusa Hybrid-8, Pusa Divya (Kt-4)	IARI, Delhi
		Arka Rakshak, Arka Ananya, Arka Samrat, Arka Shreshta, Arka Vishal, Arka Vardan, Arka Abhijit	IIHR, Bengaluru
		Kashi Abhiman	IIVR, Varanasi
		Pant Hybrid-1, Pant Hybrid-2, Pant Hybrid-10, Pant Hybrid-11	GBPUT, Pantnagar
		Rajashree, Phule Hybrid-1	MKVP, Rahuri
2.	Brinjal	DBHL-20, Pusa Hybrid-5 (Long), Pusa Hybrid-6 (Round), Pusa Hybrid-9, Pusa Anupama(Kt-4)	IARI, Delhi
		Arka Navneet	IIHR, Bangaluru
3.	Chilli	CH-1, CH-3	PAU, Ludhiana
		Arka Meghana, Arka Harit, Arka Sweta	IIHR, Bangaluru
		Kashi Early, Kashi Surkh	IIVR, Varanasi
4.	Sweet pepper	Pusa Deepti, KTCPH-3	IARI
5.	Cucumber	Pusa Sanyog	IARI
6,	Bitter Gourd	Pusa Hybrid-1, Pusa Hybrid-2	IARI
7.	Bottle Gourd	Pusa Hybrid-3	IARI
		Kashi Bahar	IIVR, Varanasi
		Pant Sankar Lauki-1	GBPUAT,Pantnagar
		Narendra Sarkar-1	NDAUT, Faziabad
8.	Muskmelon	Pusa Rasraj	IARI, Delhi
		Punjab Hybrid-1	PAU, Ludhiana
9.	Pumpkin	Pusa Hybrid-1	IARI, Delhi
10.	Summer Squash	Pusa Alankar	IARI, Delhi
11.	Watermelon	Arka Jyoti	IIHR, Bengaluru
12.	Cauliflower	Pusa Kartik Sankar, Pusa Hybrid-2, Pusa Snowball Hybrid-1	IARI, Delhi
13.	Cabbage	Pusa Cabbage Hybrid-1	IARI, Delhi
14.	Carrot	Pusa Vasudha, Pusa Nayanjyoti	IARI, Delhi
15.	Onion	Arka Lalima, Arka Kritiman, Arka Bhima	IIHR, Bngaluru
16.	Okra	Kashi Bhairav	IIVR, Varanasi
17.	Ashgourd	Pusa Shreyali and Pusa Urmi	IARI, Delhi

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Limitations Of Hybrid Seeds: As with most things, hybrid seeds are not perfect – they do have their disadvantages. We certainly won't hold that against them, but we will list the disadvantages here, just for informational purposes.

Hybrid Seeds are more expensive. There is a lot of time spent on crossings that end up in the trash.Hybrid seeds can be very expensive, so it might cost quite a bit per seedling. The company needs to make up for the cost of failed experiments by charging more money for the successful ones.As a result, when you pay for hybrid seeds, you are paying for both the successful and unsuccessful experiments. There is no way around this – after all, it's called "research" for a reason.

Hybrid seeds are less nutritious and less tasty. When a hybrid seed is produced that has some desired characteristic, it often comes at the expense of another good trait. For instance, seeds that grow into plants with larger fruit may also have fruit that is less tasty.Perhaps this is because the fruit contains more water, so the plant cannot produce fruit that tastes quite as good as the smaller ones. For example, the smaller oranges often have much more intense flavor than the large ones.In addition to having more water, larger fruits may also have lower nutrient content. The reason is that the plant has been bred to produce larger fruit, without necessarily acquiring the ability to absorb more nutrients from the soil.

This means that the plant cannot provide enough nutrients to give the fruit the same nutritional value (pound for pound) as smaller fruit. The same problem could stem from increased yields: if a plant produces twice as much fruit, but takes up the same amount of nutrients, then every fruit may have half the nutrients of a normal one.Fruit from hybrid seeds may be less tasty and nutritious than fruit from heirloom seeds, since it is difficult to breed the "perfect" plant.

Hybrid seeds make it difficult and impractical to save seeds. It is true that all of the hybrid seeds from a packet will grow into similar plants.However, some of these plants will grow fruit that is seedless, meaning that there is no way to save the seeds and produce another generation. Instead, you will need to buy hybrid seeds again the next year in order to grow your garden.

If we plant hybrid seeds, and that the fruit does end up having seeds. Unfortunately, the next generation of plants grown from these new seeds is not guaranteed to be anything like the last one.In fact, the next generation of plants may be less vigorous, less productive, or more susceptible to disease than the previous generation. Even worse, the next generation might not be able to produce fruit at all! In some cases, the seeds will not germinate, and you won't get any plants at all.

Conclusion

The vegetable hybrid seed industry is expected to be active and dynamic with hybrid varieties developed indigenously for domestic markets and commercial farming and superior open pollinated varieties produced for the benefit of marginal farmers and homestead gardens. With improved hybrid seed production practices, it is hoped to bring down the price of hybrid seed to make it accessible to the majority of farmers. There is a great scope for development and expansion of the vegetable seed industry and hybrids in India.Availability of trained labour and guaranteed returns and incentives for quality has helped in setting up of several seed villages.This has also helped in improving the socio-economic scenario including overall prosperity, narrowing down of rural/urban divide and employment generation especially for village women and youth.

India has a major advantage in having a choice of latitudes and altitudes to select appropriate seed production areas. Greenhouses have also been set up for successful production of difficult to produce crops like capsicum. Availability of quality technical expertise, increased production and productivity of hybrid seeds of international standards, reduced risks and maintaining low costs have helped to make hybrid seed production a viable opportunity for foreign companies in India. New untapped areas should be explored indigenously for production of seeds of tropical as well as temperate vegetable crops. Rural folk should be encouraged and trained in seed production of vegetable varieties and hybrids. With low cost labour availability and environment suitability for quality, vigorous and bold

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seed production, all kinds of vegetable seeds can be produced in India for domestic and export markets which will not only save foreign exchange instead earn it besides empowering rural poor with skill, generate employment and income.

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REPORT ON ENTIRE RAWE-05 PROGRAMME

Submitted to,

Dr. Anindita Saha

Department of EES

Palli Siksha Bhavana

Submitted by,

Malati Murmu

Roll: BAG (Sem-VIII)-20

RAWE- 05

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ACKNOWLEDGEMENT

I, Malati Murmu, a student of B.Sc. (Ag.) Honours, Sem-VIII, feel proud to present my report on entire RAWE 05 Programme which aims to visualise the Working of KVK, SARF, Block and an Agro-based Industry.

I gratefully acknowledge my sincere thanks to our respected teacher Dr. (Mrs.) Anindita Saha for her valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to her for providing a helping hand in this regard.

I place my thanks to supporting staff of the industry whose co-ordination & co-operation helped us to complete our work successfully.

I also take this opportunity to place on record my deep gratitude to my parents for their countless blessings showered on me while doing the work and to complete it. & last but not the least I thank the almighty for whatever I have achieved till now.

Rigorous hard work has been put in this project to ensure that it proves to be the best. I hope that this project will prove to be a breeding ground for the next generation of students and will guide them in every possible way.

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Agricultural Education is an important tool in ensuring increased agricultural productivity, sustainability, environmental and ecological security, profitability, job security and equity. So, it needs to be evolved in a very rapid manner to meet the expectation of the society. Though the students of agriculture are learning substantial basic and applied issues of science and technology, but they do not have adequate confidence for field work. The World Bank (1975) stated that there was little emphasis on curricula on preparing the agricultural graduates for better career in agricultural or agribusiness or govt. jobs. With a view of giving a real-life exposure to the students, **Rural Agricultural Work Experience Programme (RAWE)** has been started by the recommendation of 'Randhawa Committee', constituted by **ICAR** in the year 1996.

What is RAWE?

The **Rural Agricultural Work Experience (RAWE) Programme** is a flagship activity for the final year B.Sc. (Ag.) students during the last semester. Building self-confidence in the agricultural graduates by honing their professional skills is the key objective of introducing RAWE at the under graduate level by ICAR. It is a compulsory course offered to students to understand the rural situations, status of Agricultural technologies adopted by farmers, prioritize the farmers problems and to develop skills and attitude of working with farm families for all-round development in rural area.

Objectives

- To make us understand the rural community life and the prevailing situation
- To familiarize with the rural socio-economic conditions
- To provide an opportunity to have practical training in crop production
- To improve communication skills among us using extension teaching methods
- To develop confidence and competence among us for handling professional problems
- To make us understand the changed role of man and women in agriculture

Palli Siksha Bhavana (Institute of Agriculture), Visva Bharati University has also introduced this programme for the students of Semester- VIII B.Sc. (Ag.) Hons for a period of six months. The programme contains five core areas:

- RAWE-01 Crop Production
- RAWE-02 Crop Protection
- RAWE-03 Rural Economics
- RAWE-04 Extension Programme
- RAWE-05 KVK/ SARF/ Block activities and attachment to the Agro-based Industries

The report on entire RAWE-05 Programme is given below.

Under RAWE-05 Programme, we went to Krishi Vigyan Kendra (KVK), Sub-divisional Adaptive Research Farm (SARF), a Block and an Agro-based Industry.

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KRISHI VIGYAN KENDRA (KVK)

A Krishi Vigyan Kendra (KVK)is an agricultural extension centre in India. The name means "farm science centre". Usually associated with a local agricultural university, these centres serve as the ultimate link between the Indian Council of Agricultural Research and farmers, and aim to apply agricultural research in a practical, localized settings. All KVKs fall under the jurisdiction of one of the 11 Agricultural Technology Application Research Institutes (ATARIs) throughout India.

As of October 2018, there were approximately 706 KVKs throughout India.

Mandate of KVK

According to Mohan Singh Mehta Committee, the basic mandate of KVK would be such that Assessment, Refinement and Dissemination of the technologies and products coming out from the National Agricultural Research System (NARS).

Modified mandate of KVK

Assessment and dissemination of technologies and products coming out from the NARS and acting as District level knowledge and information centre for the agricultural and related sectors.

Main Functions of KVK

1. Imparting various types of training programme e.g.-
   i. Information, knowledge and skill development training programme for practicing farmers and farm women.
   ii. Long duration skill and entrepreneurship development training programmes for rural use.
   iii. Refresher Training Programmes for grass root level extension functionaries like Assistant Director of Agriculture (ADA), Krishi Proyukti Sahayak (KPS), Block Technology Manager (BTM), Assistant Technology Manager (ATM)
2. Assessment of technologies coming out from the NARS through organisation of On Farm Trials (OFT) and On Station Trial (OST).
3. **FRONT LINE DEMONSTRATION**- to organise Front Line Demonstration to assess and demonstrate the products and technologies proved successful in the OFT & OST programmes.
4. To handover the successful technologies proved through OFT, OST and Front-Line Demonstrations to the line departments of the concerned State Government.
5. Providing value added services like SMS (Short Message Services) to the mobile number of registered farmers free of cost.
6. Supplying quality inputs like seeds, fish spawn, various breeds of animals and birds, various bio-inputs like vermicompost, azolla, bio-pesticides produced at the instructional and demonstration farm of the KVK.

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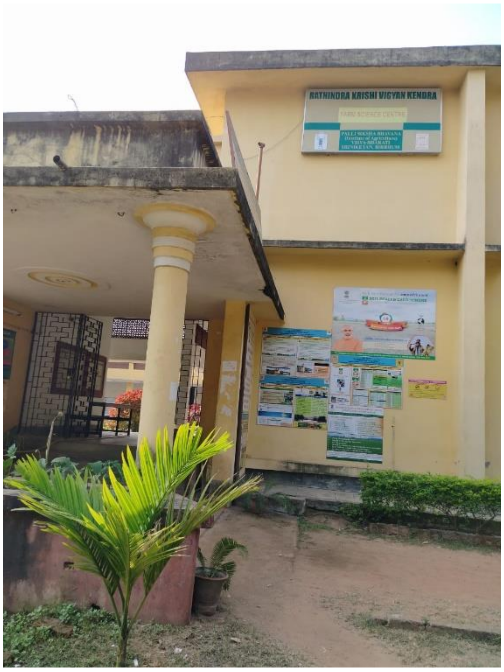
On 21st December, 2019, we went to a KVK which is situated in Sriniketan. This KVK is known as RATHINDRA KRISHI VIGYAN KENDRA. This kendra is named after Rathindranath Tagore, the eldest son of Rabindranath Tagore. Rathindranath Tagore was the 1st Indian graduate in Agricultural Science; graduated from University of Illinois at Urbana, USA in 1910. He was the first Vice-chancellor of Visva Bharati when Visva Bharati was declared as Central University in 1951 through VB Establishment Act (1951) in the Parliament of India

RATHINDRA KRISHI VIGYAN KENDRA

RKVK was established on 4th October, 1994 by Indian Council of Agricultural Research, New Delhi. This KVK was sanctioned to Visva Bharati (A Central University) for the farming community and agricultural practioners of Birbhum district of West Bengal, India. The foundation stone of Rathindra Krishi Vigyan Kendra (RKVK) was laid out by late Dr. Shankar Dayal Sharma, Former Hon'ble President of India.

To achieve the KVK Mandates, Rathindra KVK is functioning under the direct supervision of Palli Siksha Bhavana, Institute of Agriculture. Principal of Palli Siksha Bhavana is the Officer-in-charge of RKVK.



Rathindra Krishi Vigyan Kendra is Provided with 16 technical and non-technical staff headed by the Programme Co-ordinator (Associate Professor Cadre) and 6 subject matter specialists (Assistant Professors Cadre) in the discipline of Agronomy, Extension, Horticulture, Plant Protection, Fishery, Animal Science, Home Science, etc., are provided to assist and implement the mandate activities of KVK. Further, three Training Assistant Cadre- Far Manager, Programme Assistant (Computer) and One Programme Assistant in the most relevant discipline are also provided to assist the Programme Co-ordinator and his staff to carry out the functions of the KVK.

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LIST OF FAMILY MEMBERS OF RKVK

SL. N0.	*NAME*	*DESIGNATION*
01.	Dr. Subrata Mandal	Subject Matter Specialist (Agronomy)
02.	Sri. Sourav Mandal	Subject Matter Specialist (Plant Protection)
03.	Dr. Krishna Mitra	Subject Matter Specialist (Fishery)
04.	Dr. Prabuddha Ray	Subject Matter Specialist (Agricultural Extension)
05.	Dr. Madhuchhanda Khan	Subject Matter Specialist (Animal Science)
06.	Sri Suraj Kumar Bhakata	Computer Programmer
07.	Sri Palash Ankure	Programme Assistant (Farm Manager)
08.	Sri Makbul Ahmed	Jr. Steno-cum-clerk-computer Operator
09.	Sri Krishna Bansi Chatterjee	Supporting Staff
10.	Sri Bikash Chandra Ghosh	Supporting Staff
11.	Sri Chowdhury Mahiuddin Anwar	Supporting Staff
12.	Sri Naran Tudu	Supporting Staff

In RKVK, there are -

- 2 laboratories.
  Soil & Water testing lab- Dr. Subrata Mandal
  Plant Diagnostic lab- Sri Sourav Mandal
- One Departmental Library- Dr. Prabuddha Ray
- Instructional Demonstration Farm
- Progeny Orchard of Mango
- Progeny Orchard of Lemon
- Progeny Orchard of Guava
- Progeny Orchard of Water Apple
- Progeny Orchard of Ber
- Progeny Orchard of Pomegranate
- Demonstration Poultry Farm
- Demonstration Duckery Farm
- Vermicompost Unit
- Azolla Unit
- Mushroom Unit
- Portable Hatchery for Fish Cultivation
- Pond and Hatchery Unit for Fish
- 27 bedded Training Hostel

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SUB-DIVISIONAL ADAPTIVE RESEARCH FARM (SARF)

Introduction:

Birbhum district of West Bengal has 3 sub-divisions viz. Rampurhat, Suri Sadar, and Bolpur-Sriniketan. In each Sub-division there is one Sub-divisional adaptive research farm (SARF). On 9th-10th January, 2020 we went to the Sub-divisional Adaptive Research Farm of Bolpur-Sriniketan to get a clear information about the works of SARF. This is an adaptive research farm under the Department of Agriculture, Govt. of West Bengal, managed by Assistant Director of Agriculture. This Farm conducts pre-release trial tests of various new crops under the climatic extremes at tropic of Cancer i.e. under hot humid conditions during summer and cold of winters on lateritic soils of Birbhum.

FARM INFORMATION:

Topic	Relevant Information
Total Geographic area of the farm	25 Acre
Net available area of cultivation	16.63 Acre
Net cultivated area	7.757 Acre
Source of irrigation	Farm pond
No. of farm pond	1 Large and 1 Small (Not used for irrigation purpose as water retention capacity is very low)
Irrigated area	1.5 Acre
Average cropping intensity	151.9%
Area allotted to agricultural marketing and food department	5 acres+3 acres= 8 Acres

Objectives:

Our visit to Sub-divisional Adaptive Research Farm, Bolpur-Sriniketan Sub division was conducted with some specific objectives. They are as follows:

- ✓ To gather general information about SARF, Bolpur.
- ✓ To study the organizational structure of SARF, Bolpur.
- ✓ To know about different ongoing field trials of SARF, Bolpur.
- ✓ To study the various extension activities of SARF, Bolpur.

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- ✓ To study the procedure of certified seed production of SARF, Bolpur.
- ✓ To know about ongoing training program of SARF, Bolpur.
- ✓ To study in detail about the meteorological observatory located in SARF, Bolpur.
- ✓ To know about the achievements and constraints faced by SARF, Bolpur.

Methodology:

We have selected Sub-divisional Adaptive Research Farm for our study. During the study of Sub-divisional Adaptive Research Farm, we followed the following methods:

1. Formal & Informal discussion with the officials of SARF.
2. Interaction with Smt. Pushpita Roy and Sir Subir Ranjan Maity
3. Participant Observation
4. Photo documentation

Mandates

Mandate means a specific set of responsibilities to perform. The mandate of the SARF are as follows:

- ➢ the Farm has been working on identification of the problems in the locality.
- ➢ Conducting research on a priority basis.
- ➢ Fulfil the demand at the locality by solving the existing problem.

To fulfil the mandate, there are some activities adopt by the SARF. –

- Production of quality seeds of different agricultural crops.
- Conduct different research trials from the Commodity Research Station
- Demonstration of Crop Museum.
- Farmers consultancy and advisory measures renders as and when new emerging problems from farmers end reported.

Objectives of SARF:

- ➢ To avail the small and marginal farmers all kinds of good quality foundation, certified and truthfully labelled seeds of cereals, pulses and oilseeds at a lower cost.
- ➢ To disseminate among the farmers, the new technologies to increase the productivity.
- ➢ To take up breeder and foundation seeds are and multiply.
- ➢ To distribute foundation seeds among other farms, where they are multiplied to obtain certified seeds.
- ➢ To supervise the production of quality seed (mainly paddy, potato, mustard, red gram, black gram, sesame, lentil) to ensure the recommended criteria are fulfilled.
- ➢ To see if the seeds are recommended or not recommended and then sell the recommended seeds to the farmers.

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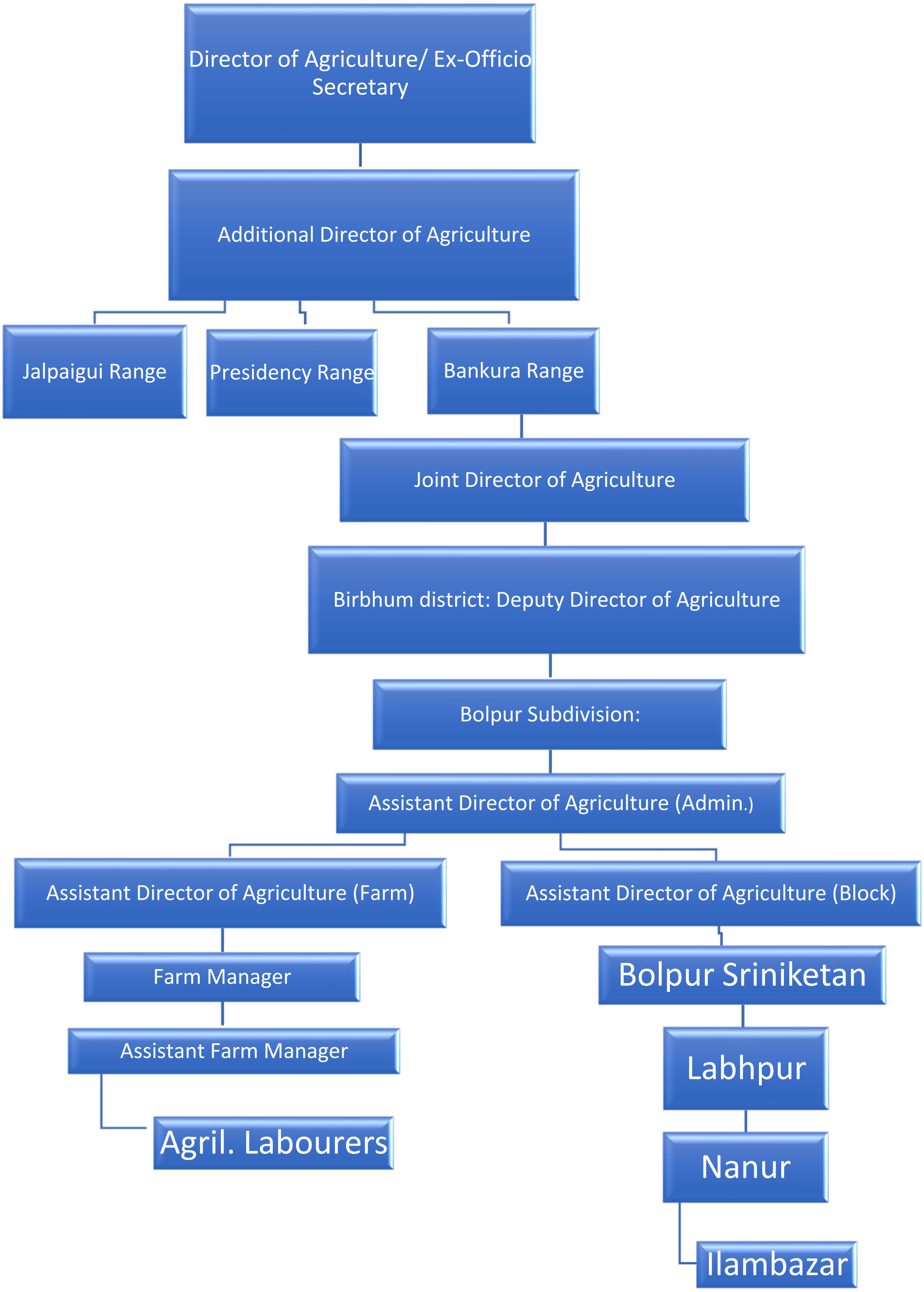
Organizational Structure of SARF, Bolpur

The Sub-divisional Adaptive Research Farm comes under the umbrella of Director of Agriculture. The head of this farm is Madam Pushpita Roy, Assistant Director of Agriculture. The detailed structure is provided below:



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AGROMETEOROLOGICAL OBSERVATORY OF SARF:

Agrometeorological observatory is a place where all the necessary instruments are maintained to observe and record different weather elements/parameters at stipulated time interval. when the observations are recorded for a sufficiently long time and analysed statistically, reliable crop-weather relations can be obtained.

The observatory site selection should meet the following basic requirements:

- The site should be representative of the surrounding data. The observatory should be at the centre of the farm.
- the observatory should be free from waterlogging during rainy season and easily accessible.
- The site should be at a distance of 10 times the height of any obstacles.

In each subdivision, there is a special observatory which measured 180/120 ft as standard. But in this SARF, this observatory is measured as 100/120ft to maintain wind speed.

The Agrometeorological Observatory of SARF is presently headed by Subir Ranjan Maity. He collect the data of mean temperature, rainfall, humidity, sunshine duration, wind speed etc.

On 9th January,2020 we visited the Agrometeorological Observatory with Meteorological officer Subir Ranjan Maity.

Instruments for measuring weather parameters:

1. ANEMOMETER

Anemometers are used for measuring wind velocity. In India, Robinson cup anemometer with four or three light Aluminium cups fixed to arm of a steel cross mounted on vertical axis is commonly used in observatories.

The cup rotates in anti-clock direction. The height from centre of anemometer cups is 10 feet above ground level. Note down two readings from anemometer at an interval of 3 minutes. Generally it is measured for 8:30am-8:30 am (next day)

In synoptic charts, wind speed is given in knots.

1 knot= 1 Nautical mile= 1.15 miles/hr= 1.85 km/hr =o.52m/sec

The highest surface wind speed ever officially recorded is 372 km/hr at the Mount Washington Observatory in US on 12 April in 1934, using a heated wire anemometer.

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2. CAMPBELL-STROKE SUNSHINE RECORDER

Duration of bright sunshine hours is measured with sunshine recorder. The instrument consists of a glass sphere of 10 cm diameter, mounted concentrically in a section of a spherical bowl, to focus the sunrays sharply on a card. It is installed on a masonry pillar of 1.52 m above ground surface.

Particulars of sunshine cards for different season

Cards	*Season*	*Period*	*Grooves*
Short curved	winter	15 October to end of February	Upper
Long curved	summer	12 April to 2 September	lower
Straight	equinoxes	3 September to 14 October and 1 March to 11 April	middle

The cards are inserted at each afternoon. Cards burn at that appropriate wavelength in which photosynthesis occurs.

3. WINDVANE

The direction of wind can be obtained with wind vane. It is essentially a broad arrow head mounted on ball-bearings to enable the arrow to move freely in the horizontal plane to indicate the direction of wind.Wind vane is installed over a wooden plank fixed on a wooden post. The height between the pointer and ground level is 3.05m (10 feet).

There are two ways of indicating wind direction.

- By Direction: N, E S, W, NE, SE, SW, NW, NNE, ENE, ESE, SSE, SSW, WSW, WNW and NNW.
- By Degrees clockwise from North: N=360°, E=90°, S=180°, W=270°.

4. STEVENSON SCREEN

Atmospheric/air temperature is measured by means of thermometers housed in a special wooden box called STEVENSON SCREEN fixed at about 1.22m above ground level. It is a wooden rectangular box of length 56 cm, width 30 cm and height 40 cm with a double roof having lower sides. The screen is set up with a door facing North to minimize the sunlight entry at the time of recording observations. Maximum and Minimum thermometers are placed in horizontal position on the upper and lower sides of wooden box, respectively and bulb end rest at an angle of 2° to horizontal plane. Dry and wet bulb thermometers are kept vertical in the wooden box on the left and right sides.

Meteorological thermometers are:

- Maximum thermometer
- Minimum thermometer
- Dry bulb thermometer
- Wet bulb thermometer

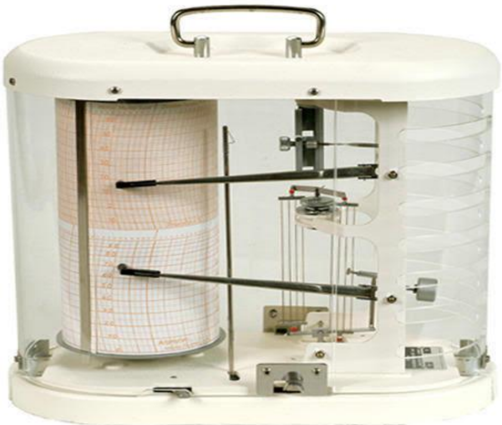
Maximum temperature: The temperature range is from -35° to +55°C. The thermometer should be set at 0700 hours(LMT).

Minimum temperature: The temperature range is from -40° to +50°C .The instrument is set at 1400 hours by tilting the bulb upwards.

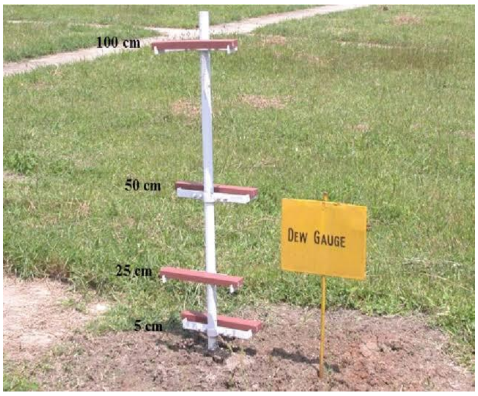
Dry bulb temperature: The temperature range is from-35° to +55°C. least count is 0.5°C. It is used for calculating humidity, vapour pressure and dew point

5. THERMOHYDROGRAPH

The Thermograph placed in Stevenson screen is an automatic self-recording instrument. The graph paper is changed every day at 8:30 hours IST.



6. DEWGAUGE



There are several dew-plates of similar sizes placed in the shelves mounted in a certain height in the vertical plane. Placing of woods are done after sunset and before sunset, it is placed out. Both the sides of dew-plate (top & bottom) get the dew.
Total dew measured is equivalent to rain.
The size of droplets are measured as: 1,2a,2b,3a,3b,4a,4b,5a,5b,6a,6b,7a,7,8a, 8b, 9

The dew measured 9 is equivalent to FOG.

Dew	Rain(mm)
1	0.02
2a,2b	0.045
3a,3b	0.075
4a,4b	0.11
5a,5b	0.16
6a,6b	0.21
7a,7b	0.27
8a, 8b	0.35
9	No observation

7. ORDINARY RAIN GAUGE

The non-recording rain gauge does not record the rain, but only collect the rainfall.
The collected rainfall can be measured as follows;
Depth of rain received(cm) = volume of rainfall collected(cm^3)/area of the aperture of the gauge(cm^2)

8. SELF RECORDING RAINGAUGE

This type of rain gauges, with mechanical arrangement for recording rainfall in a graph paper, can give us automatic record of rainfall. As the rain continues, the pen rises from the zero line of the chart and when the pen stops, it gives a straight line on the graph. Base of the gauge is cemented on the foundation so that the rim of the gauge is exactly 75 cm above the case of self-recording rain gauge. Its range is 10mm.

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Ongoing projects of SARF:

I. MUSTARD CULTIVATION
Variety-B9
Sowing Time- last week of November
Class- Foundation Seed

II. LENTIL CULTIVATION
Variety- WBL-77
Sowing Time- 15th November
Class- Foundation Seed

III. LATHYRUS CULTIVATION
Variety- Nirmal
Sowing Time- last week of October
Class- Certified Seed

IV. SUDHA PADHATI or SARP (System of Assured Rice Production)
In this process 500g paddy seeds are sown in 50 m^2 nursery against Conventional method, where 2.5-3 kg seeds are sown in same area. When the results are compared, it was found that cultivation through Sudha Padhati is more profitable than the conventional method. In this method, as single seedling are transplanted hence it avoids the competition among seedlings. Insect pest attack are less. Plant survive and gives equal yields even after 25 days.

TRIAL 01 Seedbed no.- 4 Each seedbed $50m^2$ area

Treatment	Seedbed Duration	FYM	Urea	SSP	MOP	$ZnSO_4$	Borax
01	25	125 kg	275g	1562g	210g	125g	50g
02	40	125kg	275g	3125g	210g	125g	50g
03	55	125g	275g	3125g	210g	125g	50g

Technology transfer:

- New varieties are introduced to the farmers and encourage the farmers to cultivate them. The farmers are advised not to cultivate the varieties older than 10yrs.
- Organic farming is being encouraged, soil health is being given priority.
- Sheath blight is a problem in kharif season.it is then advised to stop topdressing of urea and apply potash.
- Single seedling method is performed and recorded that the same yield is obtained as when more than one seedling is transplanted. This decreased the BPH infestation.
- Cultivation of pulse crop is encouraged as it is an important factor for organic farming.

Training:

- **ATMA** exposure visits
- Seed treatment is encouraged
- Disease acknowledgement
- Single seed transplanting
- Pulse production is encouraged

Extension activities:

- Farmers problem are reported and possible solutions are provided.
- Seed distribution to the farmers
- Farmers are referred to other departments if the problem can not be solved.

Constrains

1) Fencing: As there is no boundary wall or wire fencing, the valuable crops and trials are fully damaged by cattle grazing.
2) Scarcity of Krishi Shramiks: Scarcity of Krishi Sramik is also a major problem for production of quality seed.
3) Posting of night guard: Presently as there is no night guard posted in this farm, Krishi shramiks are engaged for watching purpose.
4) Scarcity of irrigation facility: Irrigation to the standing crop is provided only from the farm pond.
5) Open threshing floor: scarcity of open threshing floor for sun drying of seed grains and pre-threshed crops.

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AGRO-BASED INDUSTRY

Introduction:

As a part of RAWE programme study of agro based industry has a great importance to understand procedure and functioning of an agro based industry. In this regard we visited a rice mill, Maheshwari Rice and oil mill.

The main aim of this programme is to gather practical knowledge how the key performance is done by an agro based industry. This study will help us in various aspects of future career development. This small industry carries out various works on agriculture, food stocks, processing and transportation and thus taking part in economic growth of a society.

Objective:

- To study the profile of the agro industry.
- To study various practices to process basic food grain, rice and wheat.
- To study the existing agricultural scenario.
- To study stocks maintained by the organization.
- To study the present scenario of agro based rural industry.
- To study the pattern of co-ordination among various activities.
- To study the achievement of the organization.
- To identify the present constraints & overall evaluation of the industry.

Methodology:

I have collected information mainly by visiting the industry, through a structured interview schedule, formal & informal discussion with food processing officer and manager, general observation.

Formal and informal discussion with the officials.

Semi-structured interaction

Participant observation.

Photo documentation

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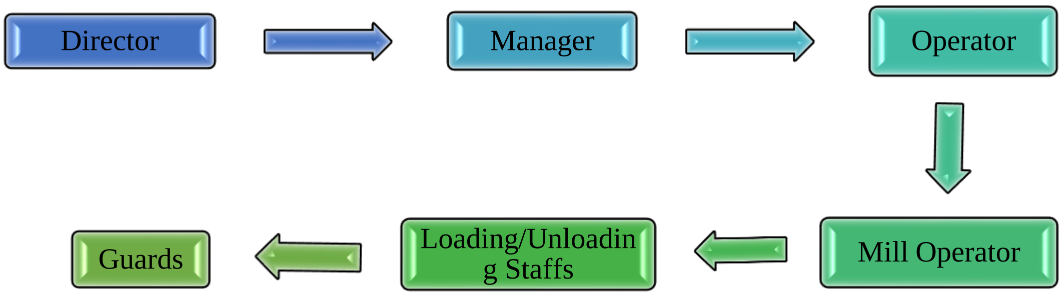
Organisational structure:



General Information

Name of the Industry: Maheshwari Rice and oil Mill

Address: Village: Trishulapatty

Post: Trishulapatty

District: Bolpur

Police Station: - Bolpur

District: - Birbhum

Pin: -731204

Year of Establishment: 1954

Products

- Rice
- Rice husk
- Rice oil

Profile of Agro-processing unit:

The rice mill was established in 1954. Initially it was named as **Maheshwari Rice and oil Mill.** They mainly collect the paddy from nearby villages from aratdar or local farmer.

Economics:

The capacity of the industry is about 1000 bags/day processed rice (50 kg/bags). They sell out loose processed rice with a worth of 1750-1800 Rs/- per quintal. Generally, sale it in 50 kg or 25 kg bags. There are 100 contract labours and 20 staff are working per day but. The wage per labour is 180 Rs/day. The wage per rice processor is 6500-7500 Rs/month. If 10

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tonnes of raw paddy are used then 6.6 tonnes of processed rice are obtained and 3.4 tonnes residues are left out.

Marketing behaviour:

They mainly use the raw rice grains as the inputs. They bring it from local areas, aratdars, local farmers. At first, they process the whole paddy grains and then they grade the products according to their quality. They are mainly maintaining 3 quality of their produce i.e. 1,2,3 grade. Local peoples, aratdar, are mainly the consumer of their produce. From aratdar, local retailers buy the product and sale to the ultimate consumer. local retailers, trader, FCI also buy the product from the mill. They also send their produce to other state, where they get fair prices and good markets.

Risk Management:

These industries are facing several problems such as stock problem when huge amount of paddy buy, Sometime lack of proper Skilled labours, Upgrading technological, Support services etc. Although some of the problems could be dealt with by the industries and also requires government intervention and the cooperation and support of international agencies. At this crucial juncture, the challenge in front of entrepreneurs of the agro based units i.e. rice mill units is to produce rice for 1.2 billion people of our country because scarcity can cause considerable distortions in any country.

Constraints:

Sometime they made the contact with traders or wholesalers, but they found that labours are not available as they were present previously. So, they find it difficult to transfer the produce within the due date. Weather is a very typical factor for them, because they have to depend on it. Sometime they go for sun drying the paddy grains and they faces problem when it does not arise. Proper care is to be taken in the parboiling step of milling Paddy. Proper maintenance is necessary for proper separation through Surtax separator. It is to be taken care that the Cooling system of the Sortex separator is functioning properly throughout the procedure.

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COMMUNITY DEVELOPMENT BLOCK

Introduction:

The Community Development Block is a rural area earmarked for administration and development in India. A community development block covers several gram panchyats, the local administrative unit at the village level. Presently there are 341 community development blocks in India.

The main aim of visit to community development block coming under RAWE programme was to study the various developmental aspects of the rural areas and how these works are carried out by the community development block. In this regard, a visit was paid in Salboni community development block which carries out rural development work, livestock upgradation, women and child development and some rural reconstruction activities.

Objective:

The general objective of the present study is to know about the organizational structure of the block. The specific objectives are-

- To study profile of the block.
- To study demographic pattern of the block.
- To study social institutions present in the block.
- To study agricultural situation of the block.
- To study animal husbandry and dairy status.
- To study cottage and rural industry of the block.
- To study different ongoing programmes under the block.
- To know the organizational structure of the block.
- To study pattern of co-ordination among various departments in the block.
- To study achievements of the block.
- To identify the present constraints & overall evaluation of the block.

Methodology:

The information were collected mainly by visiting different departments of the block through a structured interview schedule, formal and informal discussions with the officials of different departments at the block, ADA, BDO, KPS & by general observations.

A visit was made and survey was carried out in Salboni Block, Paschim Medinipur.

Salboni block is a community development block that forms an administrative division in Medinipur Sadar subdivision of Paschim Medinipur district in the Indian state of West Bengal.

It is located 28km from Medinipur, the district headquarters.

Salboni CD Block has an area of 553.39 km^2. It has 1 panchayat samity, 10gram panchayats, 134gram sansad (village councils), 528 mouzas and 409 inhabited villages. Salboni police station serves this block. Headquarters of this CD Block is at Salboni.

The Assistant Director of Agriculture of Salboni Block is Amit Biswas.

Information Gathered:

A. General:

Name of the Block:	Salboni	Year of Establishment:	1960
Sub- Division:	Medinipur Sadar	District:	Paschim Medinipur
Police Station:	Salboni	No. of Villages	409
Total Area of the Block	55445 ha	Location of the Block: (Boundaries on 4 sides)	
Nearest Railway Station:	Salboni	Nearest Highway:	NH 60
Telephone Office:		Trade Centres	

B. Demography:

Total no. of family:	22470	Total Population:	188658
Male Population:	103132	Female Population:	85526
Educated Male:	65488	Educated Female:	24458
People engaged in agricultural operations			

C. Social Institutions:

Cultural institutions			
Educational Institutions:	Total no of Primary School: 168 Total no of High School: 25 Total no of Junior High School: 24		
Religious Institutions			
• Economic Institutions:	Gramin bank: 7 Commercial Bank: 10		

Panchayati Raj:

Total No. of Anchal: 08

Total No of Gram Panchayat: 10

Youth Club:

Activities:

i) Development of games, playground
ii) Cultural programs, sports
iii) Blood donation camp

D. Agriculture:

Gross Cropped Area:	44953 ha	Net Cropped Area:	21645 ha
Cropping Pattern	Paddy- mustard -potato	New Cropping Pattern Advocated (if any)	
Principal Soil Type	Lateritic Soil (20% Alluvial Soil)	Area Under Vegetable Cultivation:	1830 ha

E. Animal Husbandry:

Existing Breeds	Cattle: Gir (Deshi), Jersey(Exotic) Goat: Black Bengal Poultry: Broiler, Desi Duck: Indian Runner	Total Population of Animals:	55440
Area under Fodder Cultivation	5ha	Total no. of AI Centers:	23
Prevailing Cattle & Poultry Diseases:	Cattle: Foot and mouth disease, Diarrhea, Worm, Mastitis, Thileria Poultry: Ranikhet, Pox		

F. Cottage and Rural Industries: i. Handicrafts- 55 ii. Furniture Making: 18 iii. Rice mill- 51

Name of Industries with no: Jindal Cement Plant

G. Development Programmes (Agriculture, Horticulture, Animal Husbandry and Rural Development):

A. Name of Programme 1. A.T.M.A(Demonstration & Training Programme) 2. FSSM and OTASFI, Custom Hiring Centre 5-50% subsidy on farm machineries. 80% satisfactory level	Target Demonstration-193, Training1040(man-days) (To implement the program successfully in the block)	Achievement Demonstration193,Training-880 (mandays),successfully going on
B. How was the present programme drawn up		i. With the help of GP and Prani & Matsa Sthayee Samiti ii. Through meeting by higher officials of the block. iii. Through Annual Action Plan

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	iv. By counting total no of population of the block, resources are distributed from district level.
C. How problems/ Felt needs determine:	i. Through community participation ii. Through farmers training iii. Exposure visit
D. What are the basis of fixing targets	i. Priorities necessary for development of the block. ii. Availability of fund and other sources. iii. Targets given by higher bodies are fulfilled. iv. Total number of population/area size.
E. What channels are usually used to inform the public about the development programmes	It is done through village level meetings, publicity through display board, poster, banner, leaflet, sound system announcement, gram panchayat, prani bandhu.
F. How are the people involved in the building up of the block programmes:	Community participations are ensured through Gram Panchayet Development Plan (GPDP) scheme. In case of animal husbandry 25% people of the block are involved.

H. Organizational Structure of Salboni Community Development Block

I. Co-ordination:

a. Efforts taken up to have perfect co-ordination within the different development departments

Block Development Officer

Joint Block Development Officer (2)

Panchayat & Rural Development Officer

Block Disaster Management Development Officer

Education Welfare Development Officer

Small Scale Industries Development Officer

Family Welfare Development Officer

Backward Class Development Officer

Self Help Group Development Officer

Labour Welfare Development Officer

Fishery Development Officer

Health & Environment Development Officer

Assistant Director of Agriculture

Food Supply Development Officer

Land Development Officer

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Live Stock Development Officer

Child Education Development Officer

Small Savings Development Officer

Mass Education Development Officer

Minority Development Officer

Monthly review meetings, seminars at block and sub-division level are held involving all the line department officials. Moreover, at the time of preparing Annual Action Plan emphasis is given for development activities through convergence mode and setting up of different monitoring committee.

b. Problems of co-ordination: No major issues are there but lack of employees, inefficient organizational structure and problem between some line departments.

J. Major Achievements of the block: • MGNREGA, PMAY, NSAP • Block declared open defecation free (ODF) under Mission Nirmal Bangla. • Activities like demonstration, training, field visit, group training and meeting, KCC distribution and all other activities under Gov. Schemes are completed in due time period. • Kanyashree, Yuvashree, Sabuj Sathi, Sabujshree, Rupashree, Sikshashree are also provided to the people by state govt. through BDO office.

K. Existing constraints of the Block: • Lack of staffs in few departments. • Shortage of permanent staffs in KPS post. • Unwillingness for adoption of new technology. • Medium literacy rate • Unavailability of canal water throughout the year, so depends on ground water.

L. Reports and Records maintained by KPS and ADA: Reports Records

KPS Crop coverage, disease pest incidence Tour diary

ADA Soil sample collection report, farm mechanization, KCC etc.

Cash book, check register, stock register, leisure

M. Evaluation: The developmental programmes are going on under the block at satisfactory level though certain areas still need to be improved.

Suggestions for Improvement:

1. Proper distribution of benefits to all concerned should be done.

2. Fodder cultivation should be promoted.

3. More SHGs should be set-up. People should be made aware about different programmes & benefits of that programmes through campaigns, meetings etc.

CONCLUSION

RAWE-05 is an exposure to the rural and agricultural development activities of KVK, SARF, Block and Agro-based Industry. It provides a clear image to the students. It improves our communication skills by using extension teaching methods in transfer of technology.

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EFFECT OF CORONA ON THE AGRICULTURE OF WEST-BENGAL

COURSE: **RAWE 01:** Crop Production (Village Attachment) (0+5)

Palli Siksha Bhavana, Institute of Agriculture
Visva Bharati
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Submitted to : Prof. B. Saren

Submitted by : Mandira Saha
Roll No : BAG (SEM-VIII)-21

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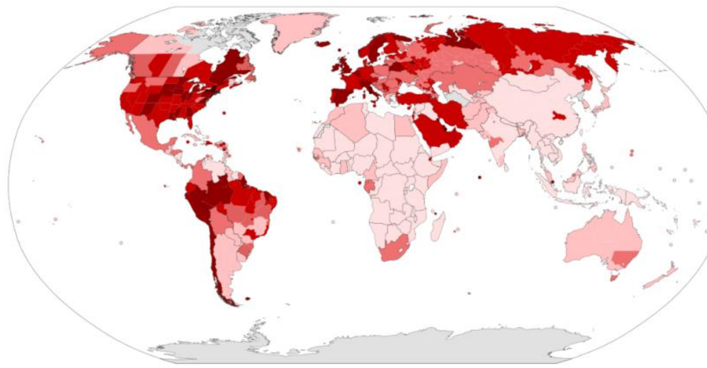
INTRODUCTION

West Bengal has a land area of 88.752 lakh hectares with 2.7 percent of the geographical area; it supports about 7.81 percent of population of the country. West Bengal is the third largest economy in India. The state is the largest producer of crops like rice, jute, vegetables and fruits in the country and offers significant opportunities for the food processing industry. Farming is an age-old means of livelihood for peoples of West-Bengal. With nearly 72% of the population living in the rural areas, agriculture is the predominant occupation in West-Bengal. The state bestowed with diverse natural resource and varied agro climatic conditions which support cultivation of a wide range of crops.

The peak farm activity happens between April and June. This is when the winter crops - wheat, boro rice, pulses and various vegetables - are harvested and sold. It is also peak season for fruits. And it also when farmers begin sowing the summer rain-fed crop, comprises paddy, pulses, cotton, and sugarcane. In this year, the agriculture sector, which suffered recently due to uneven monsoon, is facing another hit due to disruptions from the **Corona** virus. And the **Corona** virus lockdown is having an adverse effect on the agriculture sector in West-Bengal, and other states of India as well.

WHAT IS CORONA VIRUS?

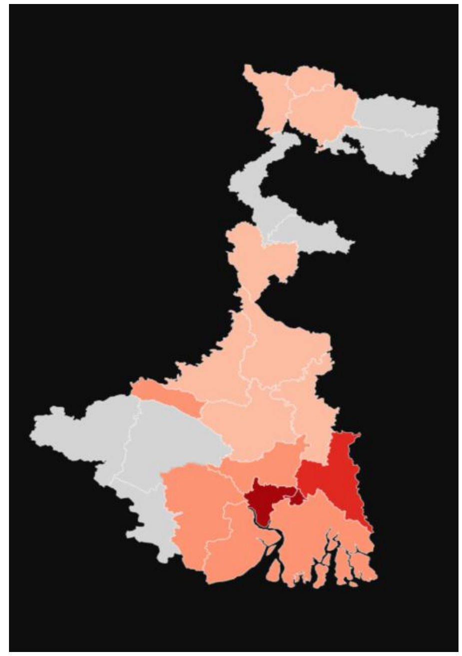


The ongoing disease **COVID -19** pandemic, also known as the **CORONA** VIRUS pandemic disease 2019 is caused by severe acute respiratory syndrome corona virus 2(SARS-CoV-2). In humans these viruses cause respiratory tract infections that can range from mild to lethal. The outbreak was first identified in Wuhan, China, in December 2019.

As of 3rd June 2020, more than 6.19million cases of **COVID-19** have been reported in more than 188 countries and territories, resulting in more than 376,000 deaths. And more than 2.65 million people have recovered from the virus.**COVID- 19** is a new disease, and many of the details of its spread are still under investigation. This occurs mainly when people are in close contact (2m or 6ft) via small droplets produced during coughing, sneezing, or talking.

The novel **Corona** virus has spread widely in India relatively compared to other countries; however, as **COVID-19** cases are increasing fast, there is great concern about the disease's potential spread and impact. Part of managing an infectious disease outbreak is trying to delay and decrease the epidemic peak; this provides more time for vaccines and treatments to be developed. To manage the outbreak include personal preventive measures such as hand hygiene, wearing face masks, and self-quarantine; and community measures aimed at Social distancing (or physical distancing) includes infection control actions intended to slow the spread of disease by minimizing close contact between individuals. Methods include such canceling mass gathering events, quarantining entire cities and imposing strict travel bans.

India has taken early action to limit the spread of **COVID-19**, ordering a 21-day nationwide lockdown for its population of 1.3 billion people starting from March 25.



After the 21-day period, the WEST-BENGAL Govt. is still maintaining the lockdown. These measures may help in limiting the health crisis, but—as in other hand—the complete shutdown of all economic activities except essential services will create an economic crisis and misery for the poor, with massive job losses and rising food security. The agricultural and economic shock will likely be much more severe for WB and all other states of India, for two reasons. First, pre-**COVID-19**, the agricultural economy was already slowing down, compounding existing problems of uneven rainfall, water scarcity, unemployment, huge pest infestation, low yield, low incomes, rural distress, malnutrition, and widespread inequality. Second, India's large informal sector is particularly vulnerable. Lacking regular salaries or incomes, agriculture farmers, migrant, and other informal workers would be hardest-hit during the lockdown period.

The Indian Council of Agricultural Research (ICAR) has issued state-wise guidelines for farmers to be followed during the lockdown period. The advisory mentions specific practices during harvest and threshing of various *rabi* (winter sown) crops as well as post-harvest, storage and marketing of the farm produce.

Even before the outbreak, West-Bengal farmers were struggling. Low crop prices had led to a massive slowdown of rural consumption. Even in normal times, farming has become unviable. Many farmers have taken their lives since 1997. Most of the suicides have been linked to poverty, debt, a sharp rise in costs and crop failures due to pest attacks. And now, the **COVID-19** lockdown and excessive restrictions on movements of farmers and farm goods have taken a heavy toll on the rural economy of WB.

EFFECT OF CORONA VIRUS ON AGRICULTURE OF WEST-BENGAL

AGRICULTURE

Non-availability of migrant labourers & Lack of transportation

West-Bengal's agricultural sector, which suffered recently due to uneven monsoon, will face another blow because of the **COVID-19** lockdown. As another harvest season approaches, farmers worry about their standing crops. Preliminary reports show that the non-availability of migrant labour, is interrupting the harvesting activities, particularly where farmers grown wheat, mustards and pulses are being harvested in the winter season, they are now facing a tough time as most of the labourers unavailable returned to their homes amid lockdown and in other hand farmers are finding

it difficult to harvest their crops owing to the absence of many machines like combined harvesters, paddy harvesters etc. which comes from different places. Farmers are managing the workload by themselves. The farmers had started harvesting wheat, but with markets not open, the storage became a problem. There are disruptions in supply chains because of transportation problems and other issues. Prices have declined for wheat, vegetables, and other crops, yet consumers are often paying more.

Difficulty in Storage

The state government has already received reports that potatoes are lying in cold storages and go-downs because of unavailability of labourers and problems that truck drivers are scared to face while transporting. Part of the potato crop is usually put into cold storage in preparation for the second marketing season. And in that storage most of the potatoes are rotting in the storage and affected by the pests. However, a shortage of labour in cold storage facilities has resulted in operational issues that are interfering with the timely sorting and storing of potatoes.

Sowing Problem

A large part of the sowing zones will remain untouched because of unavailability of labourer, inputs and so on, said one of the professor of Bidhan Chandra Krishi Viswavidyalaya. Agricultural input shops are closed, and there is no fresh supply due to the non-availability of transport. This is a concern as the period from the end of March to the first week of April is when the transplantation of Boro paddy takes place. The issue is not a lack of seed supply, since it was done last month. But a lack of access to fertilizer and pesticide will cause a crisis, especially for small farmers, who do not maintain large stock of these and often obtain them on credit in exchange for sales agreements of their produce.

Drawback of Wearing Mask

For the farmers, who were facing huge financial losses owing to untimely rain and hailstorms in January and February and even March, wearing mask due to the **Corona** virus outbreak had proved a double whammy. The future is seemingly uncertain **not only** for those whose rabi crop is standing ready in the fields for harvesting **but also** many of jute growers (as WB is the largest producer of **JUTE** in India), prepared their fields for sowing which is being undertaken using family labours as hired labour is unavailable at present and jute must be harvested before the rainy season so that it can be soaked in the canal to prepare it for retting. So, the farmers are managing this condition, as they are supporting lockdown and it should be. But the inputs (fertilizer, herbicides, pesticides etc) are unavailable and except this, one of the **major** problems is, it is too hot in the field while working, so not possible for them to wear masks while working. But they cannot go against the government norms. They have been following social distancing norms. But all were clueless about their fields as

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wearing mask was imposed movement because of the pandemic and all were facing the acute dearth of agricultural sector.

Transport Issues

The farmers were anticipating a good profit this year, but the lockdown has crippled their livelihoods. Farmers who cultivate tomato, onion, banana, pineapple, watermelon and other cash crops were worst hit while the paddy farmers have slightly escaped from the lockdown impact. The worst affected as of now remain the vegetable and fruit growers who are neither getting farm labourers nor suitable means of transport on time. Banana and watermelon farmers suffered huge losses as the nature of their produce requires timely sales, as all of their ripened fruits and vegetables are rotting in front of their eyes. Banana is a yearly crop. At many places, banana plantains have reached the harvesting stage now. But the farmers left the banana bunches to ripen in trees because of transport restrictions. With a bumper yield of vegetables, fruits and cash crops farmers are desperately looking for government help to sell their produce at least in the local markets at whatever prices.

Less consumer and Low price of agricultural products

Agricultural produce rates have drastically fallen. Farmers had no option but to dump their produce. We have seen many viral videos of pineapples growing; watermelon growing and vegetable growing farmers are dumping their product. Even, if the government lifts the lockdown, there is little hope for farmers. The government should reserve Rs 1 lakh crore - Rs 1.5 lakh crore and buy the produce at government declared prices. It should give crop loans to every farmer without looking at their past records.

Fear of Flower growers

With places of worship closed and ban on all cultural, traditional or religious ceremonies over **COVID19**, there are no takers for flowers. With government procurement centres shut, transportation becoming a challenge and heavy restrictions imposed on sale of flowers, fruits, vegetables, grains, pulses have all taken a hit landing farmers in heavy losses running into crores. With unseasonal rains already beginning, procurement of seeds and fertilisers in time for sowing is a new challenge.

Challenges for Paddy Growers in the upcoming Kharif Season

The lockdown has come as a major blow for Bengal farmers engaged in paddy cultivation and farming of perishable goods. 70% of the state's farm output is rice during the Kharif season. The crop production will be affected due to the **Corona** virus lockdown. Though initially, they found it hard, later the state government started procuring vegetables and paddy, in addition to a few of market intervention measures. However, the huge mismatch between procurement and production has severely affected the farmers.

Trouble in the Tea Gardens of North-Bengal

In the sectors and regions which are already reeling under poverty, the **Corona** virus and subsequent lockdowns on work and mobility have become an added curse. One such sector in India is the **Tea gardens** of West Bengal. But the tea estate owners were terribly worried because this is the season of

skiffing and plucking of the first flush tea leaves, which yields the most precious leaves particularly for the Darjeeling variety of tea. The West Bengal government also declared on 9 April that 15% workforce can be used for skiffing and plucking the first flush leaves and again on 11 April, in a fresh notice; they directed employing 25% of the labour force for all activities of the garden, with necessary precautions. It was decided that the workforce will be employed rotationally. For the workers of the tea gardens which had closed down, the difficulties are even greater. This is the situation of all tea garden workers across Dooars. Fear of starvation is a phantom that has relentlessly haunted them throughout their lives. The new fear of infection has added teeth to their insecurity, which now constantly gnaws at them. The present crisis is draining their lives bit by bit as their meagre savings deplete with every meal. The outbreak of a viral epidemic in these places can therefore result in a human catastrophe.

Lockdown Impact on the Agriculture Sector

Over several weeks of lockdown in West-Bengal have left not only the farmers in a deep crisis, but also the sale of dairy products, fish, poultry, etc. has also been hit during this period as the uptake by the organized industry players has been affected due to shortage of workforce and transport issues. Clouds come floating into the life of many progressive farmer of in West-Bengal. Also the farmers are themselves apprehensive of visiting these markets fearing **Corona** infection. Lack of storage and availability of pesticides at some places has further raised complications. The State Government has initiated some steps to help the farmers. The lockdown concerns about stopping farm activity will not only end up hurting farmers and labourers but also affect food security.

Here, I would focus on not only the **COVID-19** impacts on agriculture, but also food and nutrition security and livelihoods.

FOOD & NUTRITION SECURITY

Government warehouses are overflowing with 71 million tons of rice and wheat. In order to avoid exclusion errors, it is better to offer universal coverage of distribution in the next few months. Nutrition programs like Integrated Child Development Services (ICDS), mid-day meals, and Angan wadis (rural child care centers) should continue to work as essential services and provide rations and meals to recipients at home. Eggs can be added to improve nutrition for children and women. West-Bengal state governments have started innovative programs to help informal workers and the poor. For example, government is providing meals with diversified diets at the doorsteps of households.

CASH TRANSFER

Unemployed informal workers, famers need cash income support. The government has provided Rs. 500 ($6.60) per month to the bank accounts of 200 million women via the **Jan Dhan** financial inclusion program. But this too is insufficient. We need to have a minimum of Rs.3000 ($40) per month in cash transfers for the next three months.

MIGRANT WORKERS

Many male inhabitants 60-70% of West-Bengal about work as daily wage construction workers in other districts and states. In recent days, global media have broadcast images of hundreds of thousands of migrant workers from several states trudging for miles and miles on highways; some walked more than 1000 kilometers to return to their home villages. They should be given both cash transfers and nutritious food.

HERE ARE SOME MEASURES ARE REQUIRED TO KEEP THE AGRICULTURAL SECTOR AND SUPPLY CHAINS WORKING SMOOTHLY:

1. The government has correctly issued lockdown guidelines that exempt farm operations and supply chains. But implementation problems leading to labour shortages and falling prices should be rectified.

2. Keeping supply chains functioning well is crucial to food security. It should be noted that 2 to 3 million deaths in the Bengal famine of 1943 were due to food supply disruptions—not a lack of food availability.

3. Farm populations must be protected from the **Corona** virus to the extent possible by testing and practicing social distancing.

4. Farmers must have continued access to markets. This can be a mix of private markets and government procurement.

5. Small poultry and dairy farmers need more targeted help, as their pandemic-related input supply and market-access problems are urgent.

6. Farmers and agricultural workers should be included in the government's assistance package and any social protection programs addressing the crisis.

7. As lockdown measures have increased, demand has risen for home delivery of groceries and E-commerce. This trend should be encouraged and promoted.

8. The government should promote trade by avoiding export bans and import restrictions.

BELOW ARE SOME ADDITIONAL MEASURES ADDED BY THE BOTH CENTRAL AND STATE GOVERNMENT

Immediately after the nation-wide lockdown was announced, the Indian Finance Minister declared an INR 1.7 trillion package, mostly to protect the vulnerable sections (including farmers) from any adverse impacts of the **Corona** pandemic. The announcement, among a few of benefits, contained advance release of INR 2000 to bank accounts of farmers as income support under **PM-KISAN** scheme. The Government also raised the wage rate for workers engaged under the MGNREGS, world's largest wage guarantee scheme. Under the special scheme to take care of the vulnerable population, **Pradhan Mantri Garib Kalyan Yojana** (Prime Minister's scheme for welfare of the poor), has been announced. Additional grain allotments to registered beneficiaries were also announced for the next three months. Cash and food assistance to persons engaged in the informal sector, mostly migrant laborers, have also been announced for which a separate **PM-CARES** (Prime Minister Citizen Assistance and Relief in Emergency Situations) fund has been created.

Bengal chief minister Mamata Banerjee asked the police not to stop farmers from taking part in agricultural activities, saying farming cannot stop during the lockdown to contain the Covid-19 outbreak. Agriculture cannot stop. Farmers work alone in the fields, keeping a long distance from each other. The administration should only ensure that they do not gather in one place. Farmers are quite conscious. Tea gardens should also be open. She also announced that farmers, old people and others who get social pension from the state will be given their dues for March and April together. The chief minister also made a fund raising pitch to fight the pandemic that has infected over 208K people in the country. Bengal has 5,772 cases of infection and 325 casualties.

She appealed to NRIs, corporate houses and PSUs to donate and also read out details of the bank account of the state relief fund. The Chief Minister said community block development officers and local police stations in the districts have to ensure that people do not starve if they are stranded and fair price shops have been asked to give a month's ration to people. Also mid-day meals will be sent to the homes of children by Anganwadi workers.

The Indian Council of Agricultural Research (ICAR) has issued state-wise guidelines for farmers to be followed during the lockdown period. The advisory mentions specific practices during harvest and threshing of various rabi (winter sown) crops as well as post-harvest, storage and marketing of the farm produce.

The Reserve Bank of India (RBI) has also announced specific measures that address the "burden of debt servicing" due to **COVID19** pandemic. Agricultural term and crop loans have been granted a moratorium of three months (till May 31) by banking institutions with 3 percent concession on the interest rate of crop loans up to INR 300,000 for borrowers with good repayment behavior.

C.M. of West-Bengal giving ration to the poor people, farmers in the lockdown

EVALUATION

The impact of **COVID-19** on the economy is no doubt devastating. No sector has escaped from its impact. Its impact on agriculture is complex and varied across diverse segments that form the agricultural value chain. Even among the different segments, its impact varies widely among different regions and among producers and agricultural wage labourers. This impact will reverberate across the larger economy and will stay longer than a few months. The problems in agriculture at the moment are primarily related to **(a)** labour availability and, **(b)** inability to access markets for produce due to issues in transportation as well operation of markets.

The end of the lockdown will not end the problems. On the contrary, they are likely to be compounded at the onset of the new agricultural sowing season. The most important issue that farmers have to surmount is the problem of repaying their crop loans at least for those who have borrowed from the formal banking sector. Crop loans are repaid between April and May and a fresh loan is granted at the onset of a new season. Recent price collapse means that farmers are staring at huge losses and most of them are already highly indebted and hence unlikely to have the means to repay their loans.

Any failure to do so will mean that they will be forced to borrow money from the informal sector at high rates of interest for the new season. Hence, the government will be well advised to think of a rescheduling of loans wherein existing loans are converted to long-term loans payable over a three year period. There is also a greater need for government support in the form of support for other agricultural inputs. Lack of any relief will only make the agricultural crisis worse.

The non-availability of labour has hurt operations in many parts. Some parts of agriculture that have the luxury of deploying technology for harvesting, like Paddy and Wheat, are relatively more insulated since they often do not have to depend on large numbers of manual labour. The increasing use of mechanical harvesters for paddy has helped in the present circumstances, though their inter-state movement has been severely curtailed. However, commercial crops are drastically hit as they tend to be more dependent on migrant labour. Consequently, the shortage of migrant labour has resulted in a sharp increase in daily wages for harvesting crops. In many areas, the rise is as high as 50 percent, making it unremunerative for producers since prices have collapsed due to either lack of market access including the stoppage of

transportation and closure of borders. This is in contrast to areas where migrant labourers have returned home from urban areas and this has led to a sharp decline in agricultural wages.

Agricultural producers are particularly hard hit with returns on produce varying from one-third the usual or a complete loss. In a number of districts, inter-state trade in commercial crops or proximity to urban areas provides market access and better prices. These are often due to initiatives of individual farmers rather than direct state support. This is often the case of crops like onions, cotton, mango, inland fisheries, flowers and vegetables. But in most of the cases, the rise in labour costs and lack of access means that farmers are staring at huge losses and hence allowing crops to rot in the fields, a better 'stop-loss' mechanism. Farmers have no other options but to dump their produce.

COVID-19 is an unprecedented challenge for West-Bengal as well as all other states of India; its large population and the economy's dependence on agriculture, farmer and informal labour make lockdowns and other social distancing measures hugely disruptive. The central and state governments have recognized the challenge and responded aggressively—but this response should be just the beginning. West-Bengal as well as all other states must be prepared to scale it up as events unfold, easing the economic impacts through even greater public program support and policies that keep markets functioning.

SUGGESTION

An immediate consequence of this should make the government weary and alert to a possible sharp spike in the price of vegetables and other commercial crops due to large scale changes in cropping patterns. Large buffer stocks in paddy and wheat mean that food grains shortage due to poor harvest is unlikely, at least this year. The case of commercial crops and vegetables is more complex. The decision to plant these is largely dependent on realization price in the preceding season. A collapse in returns means that farmers are likely to shift to another crop thereby substantially altering supply dynamics and with it prices. This, in turn, may have a bearing on food inflation.

To sustain the demand for agricultural commodities, investments in key logistics must be enhanced. Moreover, e-commerce and delivery companies and start-ups need to be encouraged with suitable policies and incentives. The small and medium enterprises, running with raw materials from the agriculture and allied sector or otherwise, also need special attention so that the rural economy doesn't collapse.

In spite of above challenges, Agriculture has been the way life and continues to be the single most important livelihood of the rural masses in WB.

So, the Agriculture Department, Govt. of West-Bengal is working in a mission mode for development of agriculture and allied sector in holistic manner with the vision of doubling farmer's income by 2020 by ensuring farmers access to skill, technologies, markets and financial inclusion.

CONCLUSION

In the sectors and regions which are already reeling under poverty, the **Corona** virus and subsequent lockdowns on work and mobility have become an added curse. One such sector is the agriculture sector.

Over all, the global outbreak of the deadly Novel **Corona** virus has made everyone suddenly realize the need for investments in a better healthcare over all other expenditures, which now seem useless. And behind these scenes, a more frightening situation of starvation and hunger is sharply escalating. The pandemic of hunger specially for the farmers might end up claiming more lives than the pandemic caused by the virus.

In the mean time, in one hand **Cyclone Amphan** has ravaged the farming sector in at least 14 of the 23 districts in West Bengal and the loss incurred had created an all-time record, especially in the coastal areas of WB. The farmers had hoped that after the lockdown is lifted, they will be able to sell their produce and compensate for their losses. But they have no mercy due to this **Cyclone Amphan**.

In fact, Not only that, in other hand, the upcoming **locusts attack** a midst **Corona** virus crisis, is creating another trouble for farmers and it will have an adverse effect on the agriculture sector. Experts have warned of huge crop losses if the locusts are not stopped by June-July when the monsoons will lead to a new season of sowing rice, sugarcane, cotton and other crops.

How much it could be worse this year for West-Bengal because of a chain of climate events (**Amphan**), administrative laxity in several dist. of West-Bengal and then the difficult circumstances brought on by the **Corona virus**. The **COVID-19 pandemic**, has led to West-Bengal agriculture sector in a severe global, social and economic disruption including an economic recession. And the end of the lockdown will not end the problems. On the contrary, they are likely to be compounded at the onset of the new agricultural sowing season.

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I gratefully acknowledge my sincere thanks to our respected teacher Prof. Binoy Saren for his remarkable, valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard. Lastly, I would like to thank my family and friends who have helped immensely in making this project presentable.

Thanking you,

Mandira Saha

BAG (SEM-VIII)-21

ASSIGNMENT ON PHYSIOLOGICAL BASIS OF YIELD VARIATION IN CEREALS

SUBMITTED BY:

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SEM- VIII

ROLL NO. 23

SUBJECT CODE: RAWE-01

SUBMITTED TO:

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PHYSIOLOGICAL BASIS OF YIELD VARIATION IN CEREALS

Introduction:

Cereal grains are the major food of mankind. In many of the developed countries of the world, cereals provide two third of dietary calories. Rice in Asia, maize in South America, sorghum in Africa& wheat in middle east are recognized as the staple food on whose yield, famine or feast depends. A high grain yield of any crop can be achieved only with a proper combination of variety, environment and agronomic practices.

Analysis of cause and effect relationship in crop grain yield is extremely complex. Improved agronomy has contributed greatly to the recent increase in cereal yield , and has better control of disease & pests whether by genetic or chemical means. Plant breeding has played major role in two ways, by selection of disease & pest resistance varieties & by selecting cultivars with greater yield potential which can response to higher inputs.

Physiological aspects of photosynthesis and respiration to demonstrate how much remains to be accomplished in sorting out the regulation and function of various components. If there are inefficiencies in these systems and if causes can be identified, they would represent legitimate targets for genetic manipulation. Properties of rubisco, alternative oxidase, and photorespiration process already loom as opportunities for genetic manipulation. Those factors evolved and have survived during millions of years, however, indicating utilities of which we are as yet uncertain. Serious reinvestigation of foliage canopies offers promise for important gains in photosynthetic productivity of crops. First cycle of such research, begun over 50 yr ago, demonstrated importance of strong advantages of erect leaves in dense canopies and minimum interception by emergent reproductive structures. Those properties are now credited with contributing to yield progress in maize.

Just as impact of Green Revolution can be attributed mostly to improved partitioning of products of photosynthesis to grain yield, progress in yield is strongly associated with improved HI. Morphological traits associated with increased yield potential include grain number and HI Even if HI could be raised to 60% from its current maximum value (50%),it implies that yields could only be increased by a further20% using HI as a selection criterion, unless total crop biomass is also raised. Furthermore, improved partitioning by greater reduction in plant height is unlikely since research suggests that optimal plant heights have already been achieved. Some studies have shown increased biomass to be associated with yield increases.

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Physiological Parameters Affecting Grain Yield in Cereals

Crop yield comprises only a portion of biomass that accumulates over a crop cycle. The physiological factors have been studied experimentally & theoretically using mathematical models. The useful part of the major cereal crops are composed almost entirely of carbohydrates & water. Effective root and canopy systems (including stem structure for foliage display), for example, generally must be established before onset of reproductive effort. The physiological factors limiting yield are those that determine how efficiently crops convert the limited resources of carbon dioxide & light into carbohydrates & how much of these carbohydrates moves into storage organs that form useful part of the crop The main physiological factors affecting the grain yield are –

- Photosynthesis
- Water use efficiency
- Nutrient Use Efficiency
- Assimilate Partitioning
- CO_2 Assimilation
- Harvest Index (HI)
- Respiratory Efficiency
- Source and Sink Capacity
- Leaf area
- Leaf Components
- Leaf Angle
- Stem Reserves and Green Leaf Area Duration
- Radiation Use Efficiency

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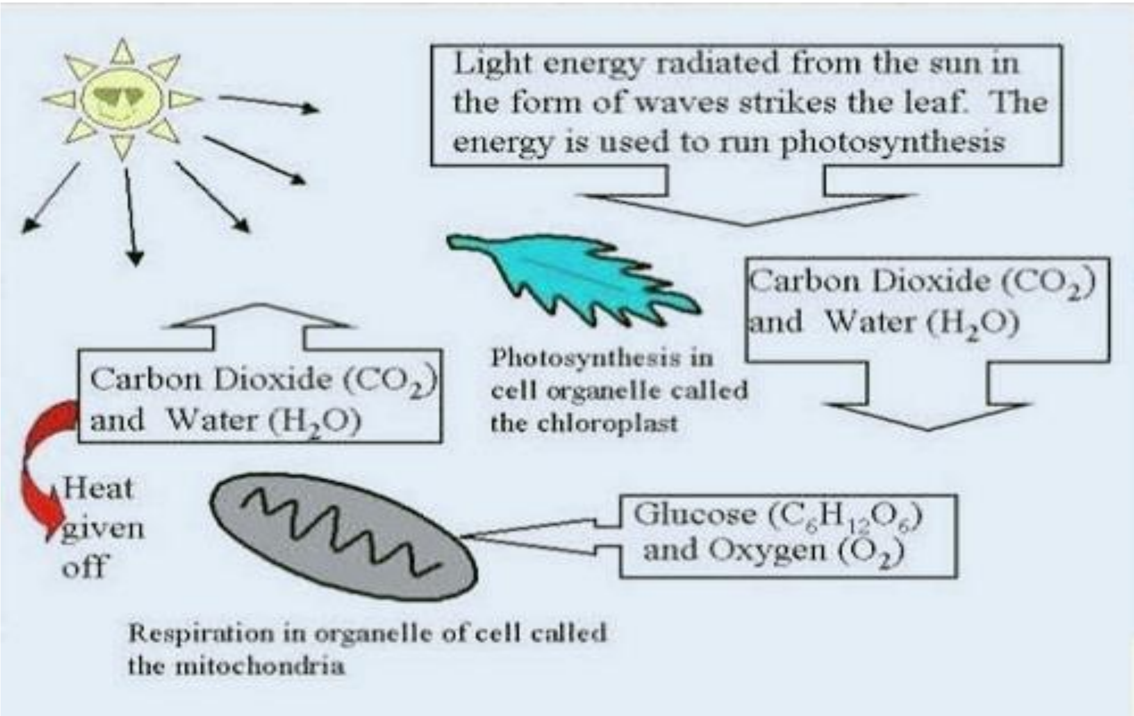
PHOTOSYNTHESIS AND RELATED TRAITS :

Plant production is driven by photosynthesis. Key elements in the system are

a) the interception of photosynthetically active radiation(PAR, 400-700 nm spectral band),
b) use of that energy in the reduction of CO and other substrates (photosynthesis),
c) incorporation of assimilates into new plant structures(biosynthesis and growth), and
d) maintenance of plant as living unit.



Achieving high yield is conceptually maximize the extent and duration of radiation interception; use captured energy in efficient photosynthesis; partition new assimilates in ways that provide optimal proportions of leaf, stem, root, and reproductive structures; and maintain those at minimum cost.

By definition, improved yield cannot be attributed to better overall radiation use efficiency (RUE) in cases where total biomass has not been improved. (RUE in a crop context represents ratio of total energy present in crop's biomass to that of solar energy incident on crop across its growth cycle; mass is not, is perhaps explained by lower pre anthesis vegetative growth rates observed for more modern cultivars in this study. Expression of higher photosynthetic rate in absence of significant changes in biomass could be a pleiotropic effect of improved partitioning to yield driven by high

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demand for assimilates during grain filling. Canopy temperature depression is a direct function of evapotranspiration rate, which itself is determined largely by stomatal conductance. These traits could also be pleiotropic effects of genetic variability among lines for a number of physiological and metabolic processes including sink strength, photosynthetic rate, vascular capacity, and hormonal signals.

In cereals, grain filling is largely dependent on photosynthesis and environmental conditions after flowering, but the capacity for storage is determined by conditions before flowering have dominant influence on yield. In wheat, varieties in which the photosynthetic rate of flag leaves under controlled environmental conditions falls substantially during the period between end of stem growth and beginning of grain growth, but rises again as export of assimilate to the grain increases.

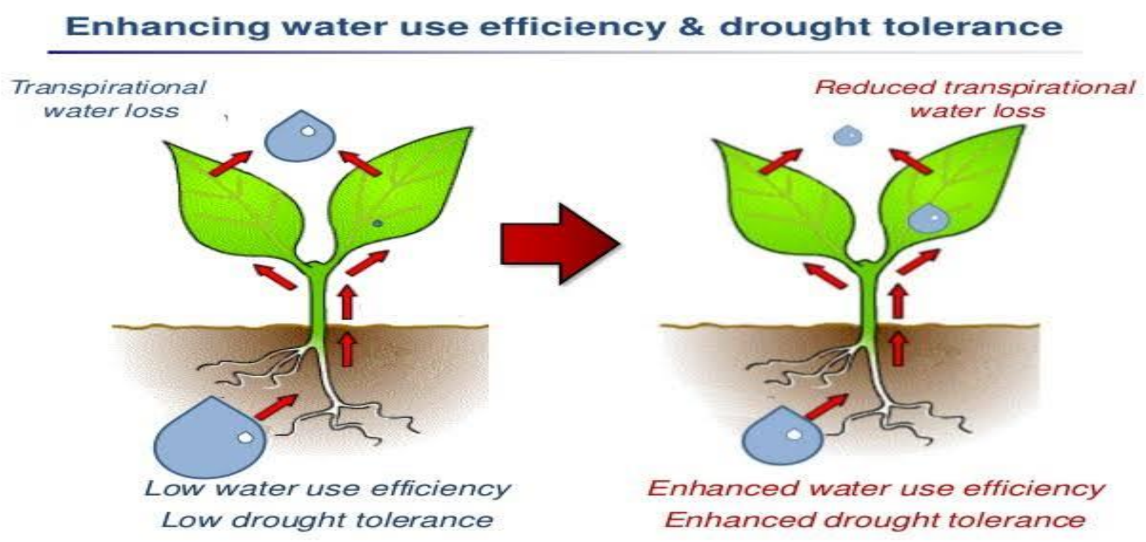
In crop production point of view solar energy is to be conserved for future use via its fixation is biomass by the process of photosynthesis. In this process, CO_2 from the air is converted into carbohydrates.

WATER USE EFFICIENCY :

Water use efficiency (WUE) is the measure of a cropping system's capacity to convert water into plant biomass or grain. Crop water use efficiency: the efficiency with which an individual crop converts water transpired (or used) to grain.

Crop WUE (kg/ha/mm) = grain yield (kg/ha) per crop water supply depth (mm)

WUE can affect the yield potential of the crop. WUE is a measure of crop's ability to extract stored moisture from the soil. This is a physiological property as WUE is also a measure of plants ability to convert biomass into grain i.e. assimilate partitioning.



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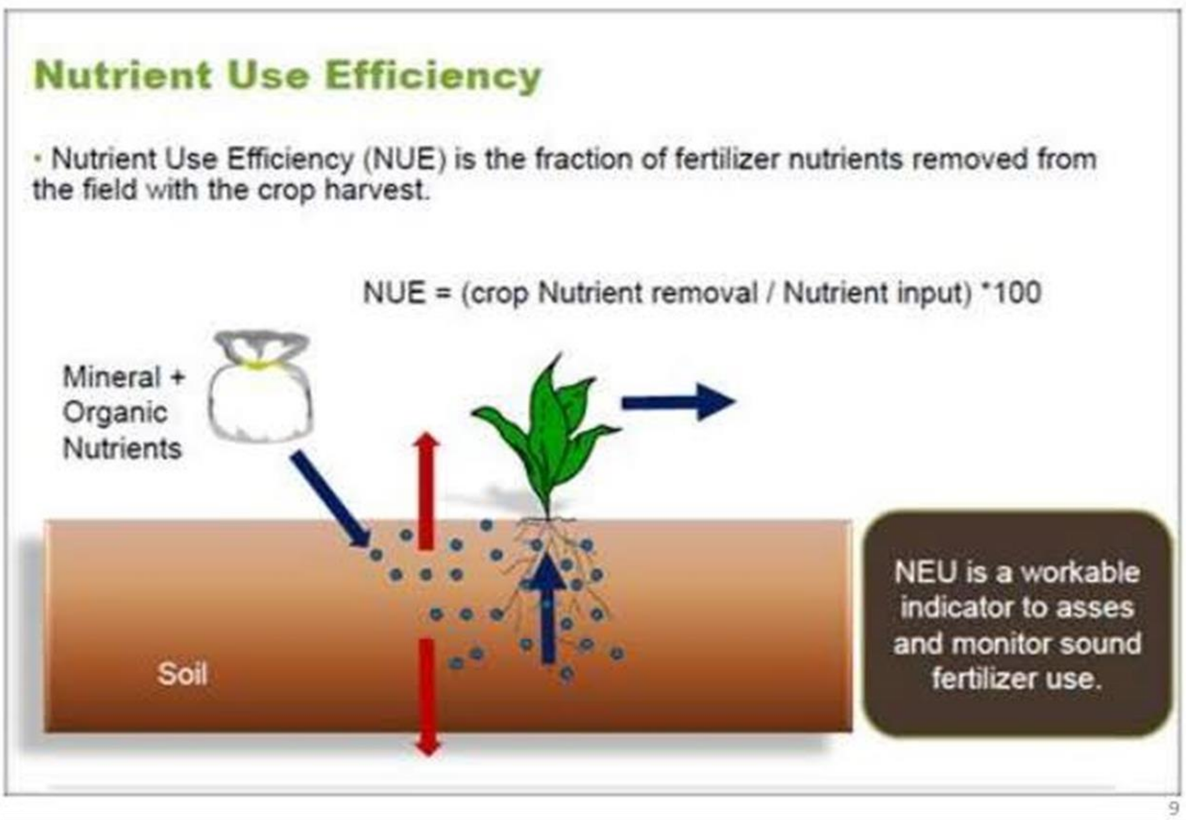
NUTRIENT USE EFFICIENCY:

Physiologically it is defined as the yield increase in relation to the increase in crop uptake of the nutrient in above-ground parts of the plant. It is the ability of the plant to transform nutrients acquired from the source applied into economic yield. It is the ratio of total change in yield upon application of nutrient and the total amount of nutrient added.



Partial factor productivity (PFP) is a simple production efficiency expression which is a long term indicator of overall cropping systems ability to transform the biomass into a more economic form i.e. grain. PFP can be calculated for large areas and comes under fertilizer policy issues as well.

Genetic gains in N use efficiency (NUE), defined as grain yield per unit of N available to plant. While NUE almost doubled with introduction of height reduction (*Rht*) genes in early 1960s, progress since Green Revolution has continued at a lower rate in parallel with more modest improvements in partitioning to yield. Improvement in NUE has been associated with improvements in both total N uptake, as well as efficiency of utilization in terms of grain yield. This study also revealed interesting and controversial fact that Green Revolution varieties demonstrated genetic gains in yield even under severely N-limited conditions, that is 2to 2.5 t ha yield levels. This trend has continued since 1966with varieties of mid 1980s yielding more than 3 t ha under same conditions. Research has demonstrated improvement in both N and P use efficiency in modern varieties of wheat.

ASSIMILATE PARTITIONING :

It refers to distribution of assimilates i.e. photosynthetic products to various plants parts or more technically the sinks. There may be many sinks in a plant and many a times an organ may behave as a source and as a sink at various times of plant growth. Biological and economic yield of "crops" can be influenced by interactions of source and sink. Sink demand for assimilate (i.e., sink strength) influences the photosynthetic rate of source leaves. Sink strength is a product of sink size and sink activity. Highest yield will be obtained when there is a balance between source and sink.

Increasing light intensity and photosynthesis, increases demand for assimilates and can lead to increase in rate of assimilate export from leaves . In rice grain filling is slow during low temperatures because of slow rate of translocation. Higher rates of mass transfer per unit phloem area is studied in Soybean petioles in leaves of C4 , grasses and wheat roots.

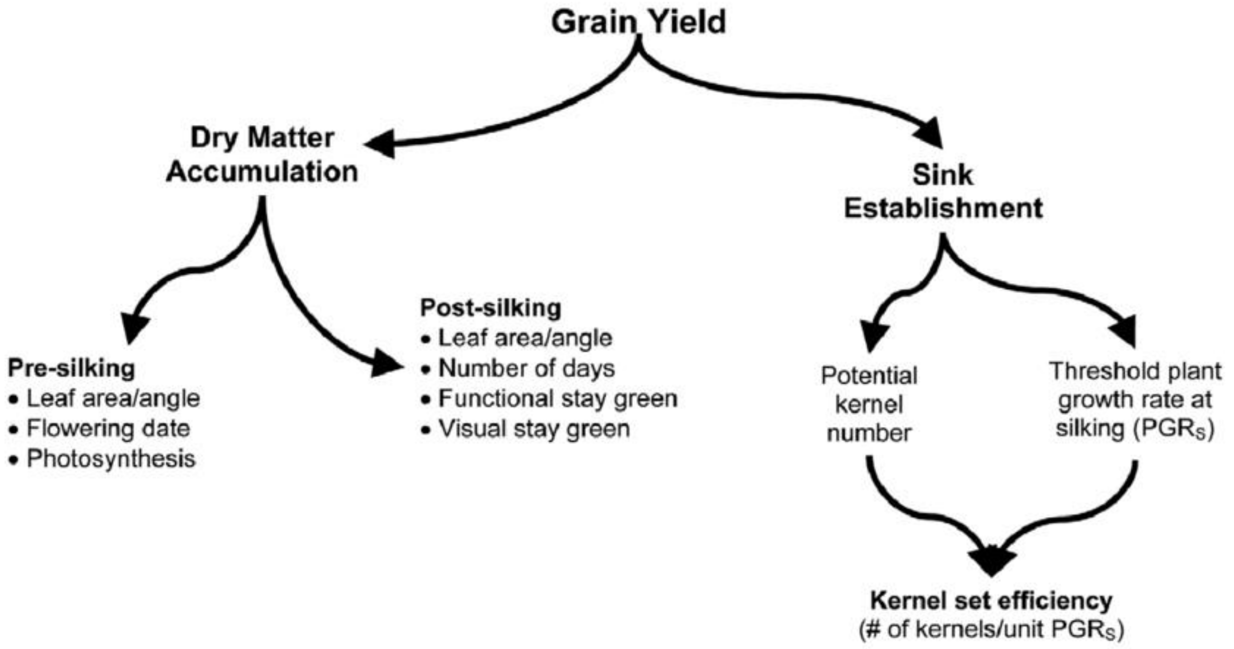


Fig: Dissection of yield formation in maize into physiological component processes at the whole-crop level

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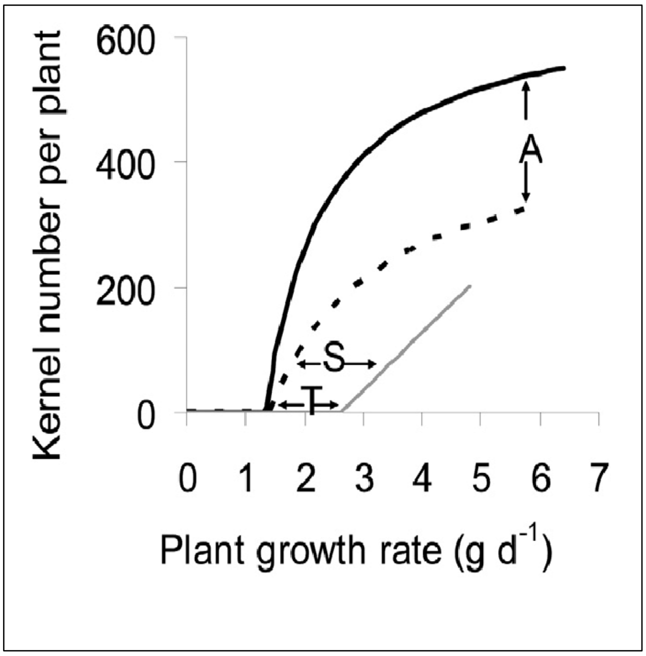
Pattern of assimilate distribution determined by rate of photosynthesis, strength and proximities of various sink environmental conditions.

- In sugarbeet, for eg., a limiting supply of photosynthates to leaves and more to roots instead under water stress.
- Rice – flag leaf and penultimate leaves are main suppliers to ear.
- Pea, soybean, auxillary inflorescence supported by subtending leaf.
- Cotton boll - younger leaf is responsible for yield.
- Root crops- uppermost leaves responsible.
- Older tobacco leaves preferentially support younger ones 3, 5, 8 nodes above them.

In the first phase major part of assimilates are invested in the leaf growth. This growth in leaf area is accompanied by a proportional increase in energy interception because neighbouring plants are so small that mutual shading hardly place a role. Individual plant weight increases by constant proportion per day thus leading to exponential growth . After a closed surface has been formed more leaf growth does not lead more light interception, hence the CGR remains constant and total plant increase linearly. In the last phase leaf senescence leads to decrease in the CGR.



Major part of total dry matter accumulation is achieved during the second phase. Total dry matter production of crop has largely determined by magnitude of CGR during linear phase and duration of the phase. The duration of period of linear growth is superior and cultivar specific and more over is influenced by environmental conditions.

Like solar radiation and temperature , supply of nutrients and water, occurance of weeds, pests and diseases , with an optimum supply of water and nutrients in absence of weeds, pests and diseases, the growth rate is determined by solar radiation and temperature and this is referred to as Potential Growth Rate.

Photosynthetic advantage of C4 compared with plants at levels of carboxylation is attenuated at the whole leaf by combination of stomatal and mesophyll resistances and still more so at the level of crop photosynthesis by shading, periods of low light and respiration with the result that no consistent advantage of C4 pathway is evident in maximum crop growth rates and yields . The real value of C4 pathway probably lies elsewhere in its better adoption to high temperature & high insolation condition provided the nights are not cold, just as C3 plants perform better under cool conditions with only moderate insolation.

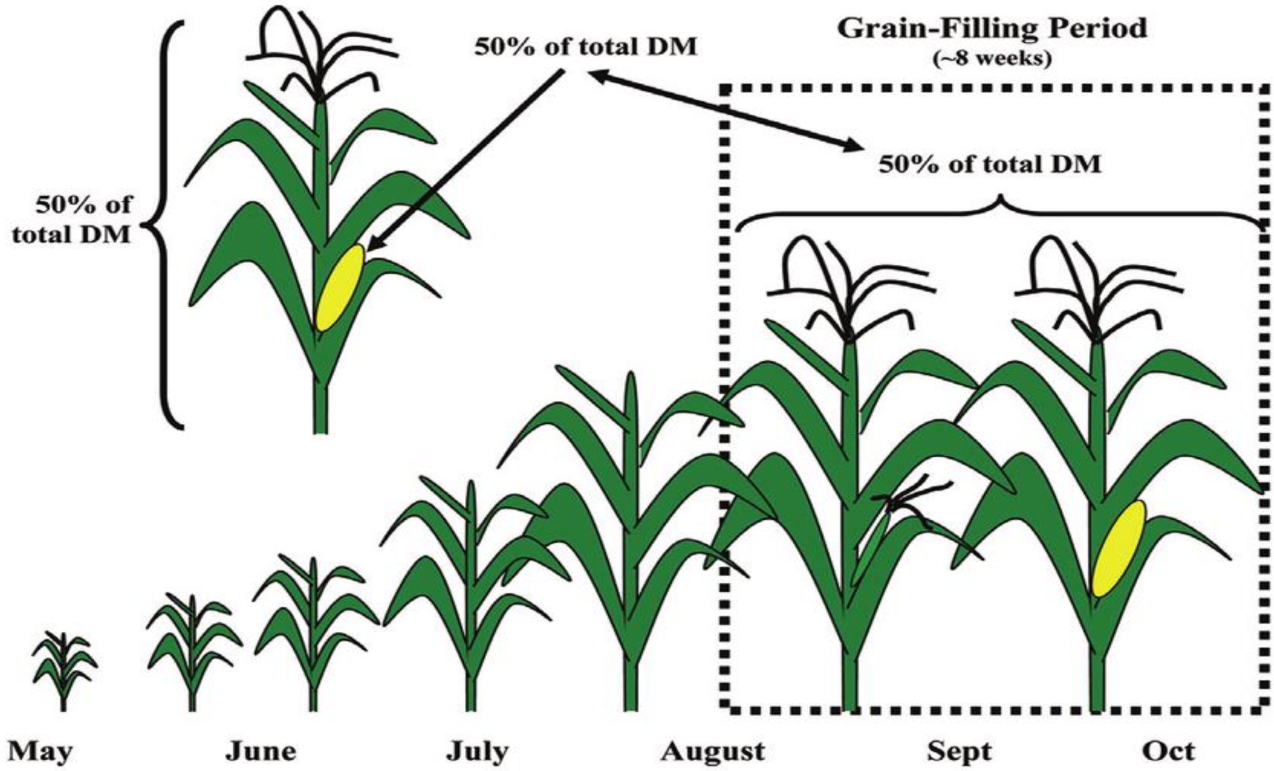


Fig: Pattern of dry matter accumulation throughout of growing season and distribution within a mature maize plant

CO_2 ASSIMILATION :

In crop production point of view solar energy is to be conserved for future use via its fixation is biomass by the process of photosynthesis. In this process, CO2 from the air is converted into carbohydrates. This Process is called CO2 assimilation.

For crop photosynthesis, relative advantage of C4 over C3 plants is less than at the level of single leaf due shading of lower leaves and to increasing importance of aerodynamic compared with the leaf resistance to CO2 exchange. Highest rates of photosynthesis measured on wheat crops by aerodynamic methods are only slightly less than those for maize. If the crop is of C3 type LAI of 1, CO_2 assimilation rate is of 25 kg /ha /hr. For an LAI of 4, CO2 assimilation rate is about 39 kg/ ha /hr.

Maximum rate of net CO_2 assimilation at high light intensity -

- C4- plants – 30-90 kg / ha /hr
- C3-plants- 15-50 kg / ha /hr

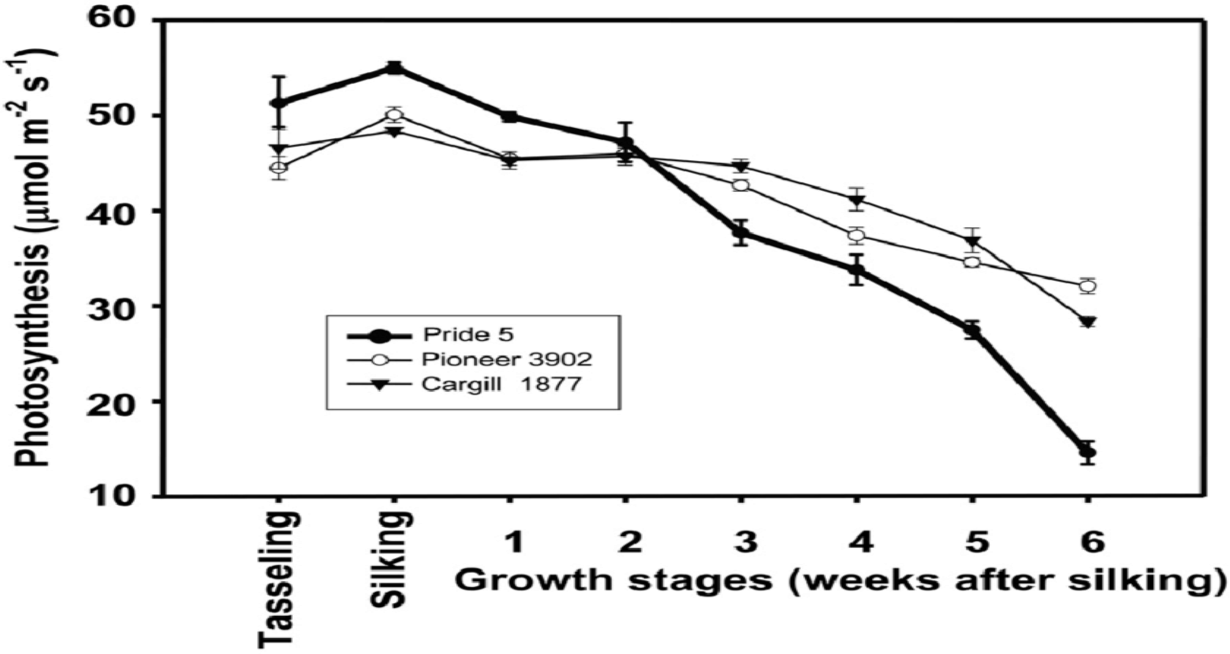


Fig: Leaf CO 2 exchange rate (CER) of maize hybrids

Growth rate of respiration is the sum of net rate and the concurrent dark respiration. The dark respiration is at normal temperatures roughly 1/9th of the maximum net assimilation rate . Maximum net assimilation rate and dark respiration are much more effected by temperature than the initial light use efficiency. Under field conditions , where plants are subjected to fluctuating temperature conditions, there appears to be adoption of the photosynthetic apparatus.

HARVEST INDEX (HI):

Harvest index is the proportion of the aboveground dry matter at physiological maturity that is allocated to the economic product (e.g., grain in maize or wheat). It is the ratio of Economic yield to the Biological yield.

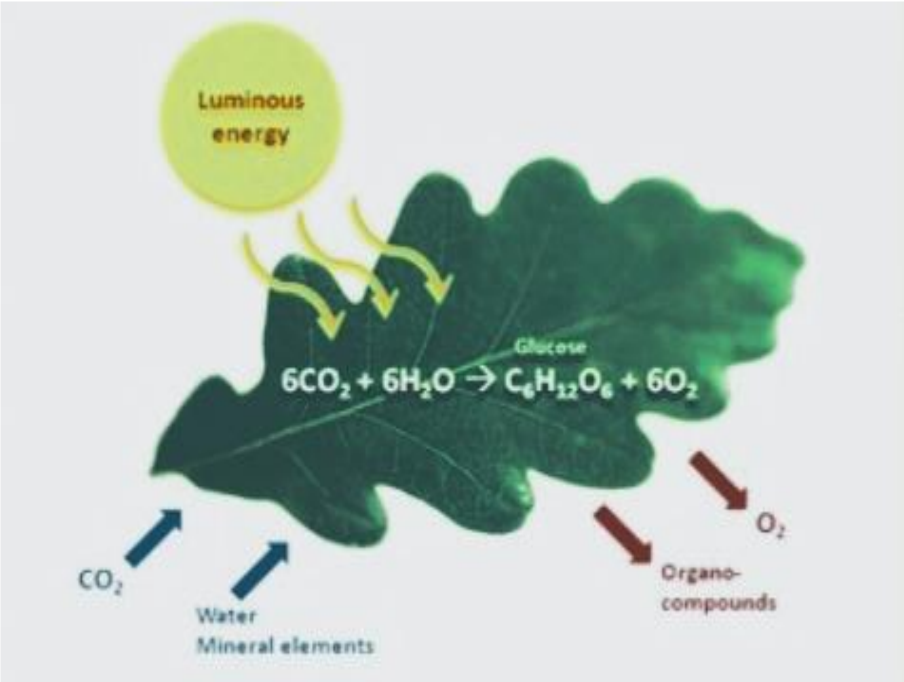
HARVEST INDEX (HI) = ECONOMIC YIELD / BIOLOGICAL YIELD

Maximum harvest index varies among crop species (e.g., 55% for maize hybrids vs. 20% for canola varieties), among genotypes within a crop species (e.g., 55% for North American maize hybrids, 40% for tropical maize cultivars, and 35% for maize inbred lines), and among ‘environments’ in which it is measured (e.g., harvest index is usually negatively affected by biotic and abiotic stresses) It provides an indication of a crop's ability to convert plant biomass into grain yield.

Improving harvest index has been critical to advancing the yield potential of some important cereal crops. Harvest index in grain crops is the result of partitioning of dry matter to the grain during the grain filling period, either from net canopy photosynthesis during the grain filling period or from remobilization of pre anthesis dry matter accumulation.

RESPIRATORY EFFICIENCY:

Part of the carbohydrates produced is used as building material for structural plant dry matter as cellulose proteins lignin and fats and a part of this as photosynthates used as a source of energy for plant process. The release of energy from carbohydrates produced during assimilation process is described by the following equation. This process is called respiration.



$$C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O + energy$$

A significant amount of the CO2 fixed by photosynthesis is respired to produce the energy needed for production of new organs and maintenance of old ones. This is often termed a "cost". Costs associated with growth and maintenance of crops can be represented as biomass equivalents. About 40% of weight of carbohydrates formed during assimilation process is lost by Respiration. Substraction of the rate respiration from the assimilation rates gives the rates of increase in plant dry weight. One of the physiological interventions is to reduce the respiratory losses i.e. to increase the efficiency of respiration for better yield. Respiration in higher plants is commonly viewed as a sequence of enzymic steps. With hexose as a generic substrate, flow of carbon can be traced through glycolytic pathway (found in cytosol and plastids) to tricarboxylic acid (TCA) cycle in matrix solution of mitochondria.

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Products of glycolysis (pyruvate and malate) can be completely oxidized in TCA cycle with production of ATP and reduced nucleotides. The great bulk of ATP production then occurs through oxidation of nucleotides by protein complexes located in mitochondrial inner membranes. If all reducing agents produced by glycolysis and TCA cycle are employed in ATP production, a total of about 30 mol ATP mol glucose can be produced. About half of free energy of hexose is captured in ATP when a hexose molecule is completely oxidized in respiration; rest is lost as heat. Most of "retained" energy is also lost as heat when ATP is subsequently used (hydrolyzed).

The respiration consists of:

- Growth Respiration
- Maintenance Respiration

GROWTH RESPIRATION :

Represents metabolic cost of converting the translocated products of photosynthesis to structure, cytoplasmic storage. The conversion of primary photosynthesis into structural plant material as cellulase, proteins , lignin and fats requires and energy for synthesis of end product , the transport of sugars and the uptake of nitrogen and minerals.

Therefore, part of the sugars assimilated is respired to provide energy for the synthesis of new plant components. At higher temperature, rate of conversion of primary photosynthates into structural plant material changes but the conversion efficiency remains constant, because the biochemical pathway is not affected by temperature.

MAINTIANANCE RESPIRATION:

Maintenance respiration of crops towards end of their life cycle, but it would be satisfactorily to base its estimation as accordingly of non-storage protein and membrane components which turns over for more rapidly than all wall constituents and storage polysaccharides, proteins and oils. Proteins in the plant , especially in the leaves consist mainly of enzymes which have only a limited life span .

Temperature is the most important environmental factor affecting maintenance respiration. The metabolic costs of the repair of injury from stress (biotic/abiotic) also considered as part of maintenance respiration. Essential for biological health and growth of plants, sustain living tissues.

29. Maintenance versus growth respiration: Growth respiration can be distinguished from maintenance respiration by relating variation in respiration rate to variation in RGR over short time intervals . This approach assumes a model for respiration where:

Total respiration = Maintenance respiration + Specific costs of growth *RGR

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SOURCE AND SINK CAPACITY :

Mostly cereals are sink limited crop. That's why in cereals, grain filling is largely dependent on photosynthesis and environmental conditions after flowering, but the capacity for storage is determined by conditions before flowering. It is widely believed that yield gains are most likely to be achieved by simultaneously increasing both source (photosynthetic rate) and sink (partitioning to grain) strengths.

While most experiments indicate that yield is primarily limited by growth factors prior to anthesis, source capacity may have become more limited in modern cultivars. For example, experiments on a historic series of spring wheats from Russia indicated that, while sink capacity has been improved in post–Green Revolution period, improvement has also resulted in modern lines that are now more source limited than those in previous eras.

From a practical point of view, breeders have tried to modify sink capacity of wheat by modifying spike morphology. A good example of this approach was reported by Dencic (1994) who crossed genotypes using single, back, and top crossing, and desirable lines selected using a pedigree approach. with branched tetrastichon (two spikelets per node of rachis) with high-yielding lines that contain other desirable traits such as high yield, disease resistance, and quality. After 10 yr of breeding and selection, 229 lines with desirable characteristics were yield tested, of which yield superior to the standard checks of the four lines was 13% (i.e., 1t ha) higher than standards and following morphological traits were improved over standards:
spike length (16%), spikelets per spike (10%), grains per spikelet(9%), grains per square meter (18%). This progress in yield was achieved in spite of fact that tetrastichon donor lines had problems of empty florets or shriveled grain with very low kernel weight.

LEAF AREA & OTHER LEAF COMPONENTS :

Leaf area is frequently correlated with growth & yield. Leaf Area Index simply the ratio of leaf area to ground area.

LEAF AREA INDEX (LAI) = LEAF AREA / GROUND AREA

The relevant measure of leaf area in relation to the final yield of total dry matter of most crops is the integral of leaf area index over the whole growth period. LAD(leaf area duration) will increase if LAI increases faster at the beginning of growth period, or if LAI declines more slowly at the end of the growth period .

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Increasing leaf area early in the growth would be best except that cereals with longer survival of leaves should be available. Yield is likely to increase with maximum LAI above 10 for cereals. Higher grain yields are possible only when maximum leaf area index and net assimilation rate occurs by flowering stage.

When LAI is large , crops with upright leaves should photosynthesize faster per unit of leaf area than crops with horizontally disposed leaves. Species without photorespiration grow and photosynthesize faster at higher temperature and light intensities than those with photorespiration. Increasing yield potential by increasing photosynthesis efficiency & sink size are the most popular approaches.

Solar-energy-capturing apparatus of higher plants is located in thylakoid membranes of chloroplasts. It consists of light-harvesting antennae complexes composed of carotenoids and chlorophylls a and b connected to Photosystem(PS) I and II reaction centres, a cytochrome *b f* complex, and ATP synthase. The *b f* complex transfers electrons from PSII ,the water-oxidizing center, to PSI leading to NADP reduction. The proton gradient that develops across thylakoid between an interior lumen and the exterior stroma is employed by ATP synthase (coupling factor complex, CF -CF) to produce ATP from ADP.

Photosynthetic reductive pentose phosphate cycle ("dark reactions" involving CO assimilation) is found in stromal solution. Key enzyme, rubisco, catalyzes both oxygenation and carboxylation of ribulose-1,5-bisphosphate(RuBP). Rubisco's activity as an oxygenase, initial step in process of photorespiration, increases as ratio [O]/[CO] at enzyme and/or temperature increase. Also in stroma are enzyme systems that manufacture and repair chloroplast constituents, reduce nitrite and sulphite, and synthesize starch. Q of reductive cycle is 2 and low temperature limits CO_2 reduction unless the capacity is increased through increases in enzyme concentrations.

LEAF ANGLE:

The erectophile leaf canopy has been proposed as a trait that could increase crop yield potential by improving light use efficiency in high radiation environments. A number of studies support the hypothesis. It has been associated with a 4% yield advantage in wheat isolines. More erect leaf posture was associated with higher grain number and higher stomatal conductance. In barley two varieties contrasting in leaf angle were compared for photosynthetic rate at different depths of canopy. The erect leaf variety showed a more even distribution of photosynthetic rate throughout the canopy, as well as higher rates of stem photosynthesis.

STEM RESERVES AND LEAF AREA DURATION:

There are a number of additional physiological traits that have implications for yield potential and are related to increasing assimilate availability (i.e., source). One is ability to reach full ground cover as early as possible after emergence to maximize interception of radiation. Another is remobilization of soluble carbohydrates (stem reserves)during grain filling. A third is ability to maintain green leaf area duration ("stay green") throughout grain filling. Direct evidence for contribution of these traits to high yield potential is lacking. Stem reserves apparently make a greater contribution to performance in relatively low-yielding lines where contrasting lines have been examined. It is been suggested that use of stem reserves and stay-green may be mutually exclusive, since loss of chlorophyll and stem reserve mobilization seem to be consequences of plant senescence. A greater understanding of genetics of these traits is called for to establish potential for breaking such linkage. As yield potential is raised by improving reproductive sinks, extra assimilates gained by increasing early groundcover could contribute to increased stem reserves and be tapped at later reproductive stages to enhance potential kernel number and size.

RADIATION-USE EFFICIENCY(RUE):

Crop growth rate and yield are functions of canopy photosynthesis and they generally correlate poorly if at all with maximum photosynthesis rates of individual leaves. Given the oblique display and mutual shading of leaves within canopies, few leaves exposed to sunlight are sufficient to achieve maximum yield. Other reasons for discrepancy can be found in acclimation to radiation level, temperature and stress, and amount of standing crop (and thus amount of maintenance respiration). As a result, crop physiologists have sought other measures that would relate yield and canopy photosynthesis. Light-conversion efficiency (radiation-use efficiency, RUE) has received most attention. RUE is measured and reported in various units, e.g., g new biomass produced MJ radiation intercepted or absorbed by leaves. A useful feature of RUE is that experimental values can be compared with estimates of potential rates of dry matter production that might be possible by a canopy of well-acclimated leaves. Potential RUE would be attained with all leaves exposed to only moderate PFD (little or no light saturation and, thus, minimum *qr*). If that crop at same time intercepted most of incoming radiation, its rate of biomass production per unit land area would also be maximized. We recently re-examined potential RUE for C plants in light of modern understanding of quantum requirements and C losses in respiration.

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Ways to improve grain yield:

This may contribute to improvements in crop productivity by the following 2 factors:-

1. Increasing total biomass production: Yield was positively and highly correlated with total biomass, harvest index and grain straw ratio and was concluded that the yield was directly dependent upon the total biomass production.
2. Favouring assimilate transfer to the harvestable portion of the crop.

The realization of potential capacity of the crop to partition assimilates efficiently to harvest organs is determined by the environment. The environmental determinants are as follows-

- Light
- Water stress (rainfall)
- Wind velocity
- Relative humidity etc.

Management programmes based on an understanding of assimilate partitioning responses to various environmental factors can lead to improvements in crop productivity.

Physiological Limitations in Cereals:

Each crop has its own growth and yield characteristics & hence its own physiological limitations.

- In varieties having low drought tolerance , grain weight was more dependent upon the availability of the post- anthesis dry matter per grain.
- Spikelet sterility is a major constraint is rice production as it influences grain yield by determining the number of filled grains per unit area.
- Sinha (1977) enumerated several possible factors which may be influencing sink realization due to flower bud or fruit drop:
  - Limitation of photosynthesis.
  - Reduced plant intensity in plant canopies.
  - Canopy temperature.
  - Humidity in crop canopies.
  - Soil and water factor.

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Conclusion:

To achieve next breakthrough in productivity like the one of semi dwarf types over the traditional indigenous types, there are very limited possibilities in the near future. The breeders will have to concerned with marginal increases in productivity through systematic & judicious combination of components of yield. Further avenues may be opened by fundamental researches in the field of genetics & physiology of crop plant.

Water use efficiency should be improved by decreasing mesophyll resistance and by achieving a better understanding of control of mechanism of stomata. In cereals the borderline for a further increase in the harvest index may be reached in near future.

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An Assignment on:

2020

Problems and Prospects of Aerobic Rice Culture

SUBMITTED TO: PROF. B. K. SAREN

DEPT. OF AGRONOMY

SUBMITTED BY: NILESH CHATTERJEE

SEM- VIII ; ROLL NO. 24

SUBJECT CODE: RAWE-01

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6/6/2020

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Problems and Prospects of Aerobic Rice Culture

Introduction:

Aerobic rice is a production system in which especially developed "aerobic rice" varieties are grown in well-drained, non-puddled, and non-saturated soils. With a good management, the system aims for yields of at least 4-6 tons per hectare.

A fundamentally different approach to reduce water outflows from rice fields is to grow the crop like an upland crop, such as wheat or maize. Unlike lowland rice, upland crops are grown in non-puddled, non-saturated (i.e., "aerobic") soil without standing water. When rainfall is insufficient, irrigation is applied to bring the soil water content in the root zone up to field capacity after it has reached a certain lower threshold level, such as halfway between field capacity and wilting point (Doorenbos and Pruit 1984). The amount of irrigation water should match evaporation from the soil and transpiration by the crop (plus any application inefficiency losses). The potential water reductions at the field level when rice can be grown as an upland crop are large, especially on soils with high seepage and percolationrates (Bouman 2001). Besides seepage and percolation losses declining, evaporation decreases since there is no ponded water layer, and the large amount of water used for wet land preparation is eliminated altogether.

Origin and History:

International Rice Research Institute (IRRI) developed the ―aerobic rice technology‖ to address the water crisis in tropical agriculture. In aerobic rice systems, wherein the crop is established in non-puddled, non-flooded fields and rice is grown like an upland crop (unsaturated condition) with adequate inputs and supplementary irrigation when rainfall is insufficient. The new concept of aerobic rice may be an alternate strategy, which combines the characteristics of rice varieties adopted in upland with less water requirement and irrigated varieties with high response to

inputs. In China, the water use for aerobic rice production was 55–56% lower than

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the flooded rice with 1.6–1.9 times higher water productivity. It indicates that aerobic rice may be a viable option where the shortage of water does not allow the growing of lowland rice.

In Asia, "upland rice" is already grown aerobically with minimal inputs in the upland environment, but mostly as a low-yielding subsistence crop to give stable yields under the adverse environmental conditions of the uplands (Lafitte et al 2002). Upland rice varieties are drought tolerant, but have a low yield potential and tend to lodge under high levels of external inputs such as fertilizer and supplemental irrigation. Alternatively, high-yieldinglowland rice varieties grown under aerobic soil conditions, but with supplemental irrigation, have been shown to save water, but at a severe yield penalty (Blackwell et al 1985, Westcott and Vines 1986, McCauley 1990). Achieving high yields under irrigated but aerobic soil conditions requires new varieties of "aerobic rice" that combine the drought-tolerant characteristics of upland varieties with the high-yielding characteristics of lowlandvarieties (Lafitte et al 2002, Atlin et al 2006).

Development of aerobic rice:

The development of ***temperateaerobic rice*** started in the mid-eighties in northern China andBrazil. In China, breeders have produced aerobic rice varieties with an estimated yield potential of 6-7 t ha– 1 (Wang Huaqi et al 2002). It is estimated that aerobic rice systems are currently being pioneered by farmers on some 80,000 ha in northern China using supplementary irrigation (Wang Huaqi et al 2002). Bouman et al (2007) reported yields of aerobic rice obtained by farmers around Kaifeng of up to 5.5 t ha−1 with sometimes as little as 566 mm of total water input, with only one or two supplementary irrigation applications compares the performance indicators of aerobic rice, lowland rice, and maize obtained by farmers in the same area. Simulation model predictions even suggested that no irrigation would be needed for high yields with some 400−600 mm of rainfall and groundwater tables of 2 m deep and less. In Brazil, a breeding program to improve upland rice has resulted in aerobic varieties with a yield potential of up to 6 t ha–1

(Piñheiro et al 2006).Farmers grow these varieties in rotation with cropssuch as soybean and fodder on large commercial farms with supplemental sprinkler irrigation on an estimated 250,000 ha of flat lands in the Cerrado region, realizing yields of 3−4 t ha−1.

The development of ***tropical aerobic rice***is of relatively recent origin. De Datta et al (1973) grew lowland variety IR20 in aerobic soil under furrow irrigation at IRRI in the Philippines. Water savings were 55% compared with flooded conditions, but yield fell from about 8 t ha−1 under flooded conditions to 3.4 t ha−1 under aerobic conditions. Using improved upland rice varieties, George et al (2002) reported aerobic rice yields of 1.5−7.4 t ha−1 in uplands with 2,500 to 4,500 mm of annual rainfall in the Philippines. Yields of 6 t ha−1 and more, however, were realized only incidentally in the first years of cultivation, and most yields were in the 2−3 t ha−1 range. Bouman et al (2005) and Peng et al (2006) quantified yield and water use of the recently released tropical aerobic rice variety Apo under irrigated aerobic and flooded conditions. In the dry season, yields under aerobicconditions were 4−5.7 t ha−1 and in the wet season they were 3.5−4.2 t ha−1. These yields were obtained in relatively wet soil with seasonal-average soil moisture tensions in the root zone of 10−12 kPa and with maximum values of around 40 kPa. On average, the mean yield of all varieties was 32% lower under aerobic conditions than under flooded conditions in the dry season and 22% lower in the wet season. Total water input was 1,240−1,880 mm in flooded fields and 790−1,430 mm in aerobic fields. On average, aerobic fields used 190 mm less water in land preparation and had 250−300 mm less seepage and percolation, 80 mm less evaporation,and 25 mm less transpiration than flooded fields.

Target area for aerobic rice:

Aerobic rice can be found, or can be a suitable technology, in the following areas:

1. "Favorable uplands": these are areas where the land is flat, and where rainfall with or without supplemental irrigation is sufficient to frequently bring the soil water content close to field capacity, and where farmers have access to external inputs such as fertilizers.
2. Fields on upper slopes or terraces in undulating, rainfed lowlands: quite often, soils in these areas are relatively coarse-textured and well-drained, so that ponding of water occurs only briefly or not at all during the growing season.
3. Water-short irrigated lowlands: these are areas where farmers do not have access to sufficient water anymore to keep rice fields flooded for a substantial period of time.

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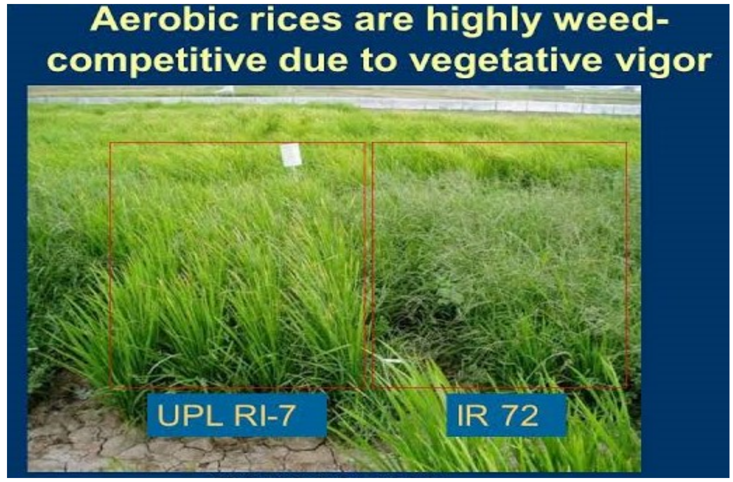
Management for aerobic rice:

1. The usual establishment method is dry direct seeding. Aerobic rice also allows practices of conservation agriculture as used in upland crops, such as mulching and minimum tillage.



2. Aerobic rice can be rainfed or irrigated. Irrigation can be applied through flash-flooding, furrow irrigation (or raised beds), or sprinklers.
3. Unlike flooded rice, irrigation—when applied—is not used to flood the soil but to just bring the soil water content in the root zone up to field capacity.
4. Site-specific nutrient management (SSNM; http://irri.org/ssnm/) can be used to determine the optimal management of fertilizers. In the absence of knowledge on SSNM, 70−90 kg N/ha could be a useful starting point to obtain a yield of 4−6 t/ha. The first split can best be given 10−12 days after emergence, the second at active tillering, and the third at panicle initiation. The application of Phosphorus fertilizer can be more critical to aerobic rice than to flooded rice.
5. Rice fields that are not permanently flooded tend to experience high growth and more species of weed. Appropriate herbicide use and additional manual or mechanical weeding in the early phase of crop growth, are therefore needed to control weeds.
6. Soil-borne pests and diseases such as nematodes, root aphids, and fungi are known to occur more in aerobic rice than in flooded rice, especially in the tropics. It is recommended to grow aerobic rice in rotation with upland crops suitable in the area.

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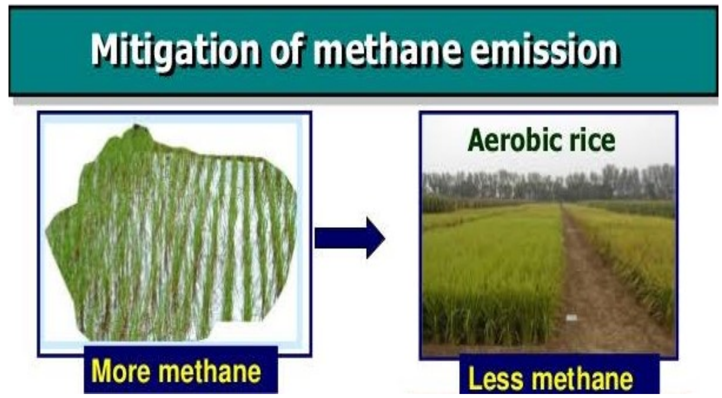
Problems of ARS:



1. There is a huge yield gap between aerobic and flooded rice. Researchers found that the yield difference between aerobic and flooded rice ranged from 8 to 69% depending on the number of seasons that aerobic rice has been continuously grown.
2. Researchers also found that there is relatively low uptake of nitrogen under aerobic conditions as compared to flooded conditions which was reflected by the relatively low fertilizer-N recovery under aerobic conditions.
3. There is a prediction of decline in soil organic matter under aerobic system as compared with permanent flooding or the rotational flooded rice-aerobic rice.
4. Nutrient uptake and supply to plants may be reduced because of lower delivery rates to roots through mass flow and diffusion as both of these processes are influenced by the reduced soil water content.

5. Soil-borne pests and diseases find different living conditions in aerobic soils and especially root knot nematodes (RKN) have been reported to become problematic when the production system becomes partially or fully aerobic.
6. The aerobic rice production system has been reported to be less sustainable than irrigated rice systems operated under predominantly flooded soil conditions, especially when aerobic rice is grown in sequence for several years.

Prospects of ARS:

1. Aerobic rice production system eliminates continuous seepage and percolation losses, greatly reduces evaporation as no standing water is present at any time during the cropping season, and effectively uses the rainfall and thus helps in enhancing water productivity, concomitant loss of soil sediments, silt and fertility from the soil.

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2. Researchers found almost double weed density and biomass in aerobic rice field than those of conventional transplanted rice at 35 and 75 days after sowing /transplanting.
3. The probability of crop failure is much lower in case of draught or scarcity of rainfall.
4. In this system the production of crops are much more sustainable than other systems.
5. Very much suitable in dryland agriculture.
6. Soil as well as nutrient loss is much more less than irrigated system.

Conclusion

Over the centuries, lowland rice has proven to be a remarkably sustainable system for rice production mostly because of its luxurious water availability. But the present day water crisis threatens the sustainability of lowland rice production and necessitates the adoption of water saving irrigation technologies. Technologies like saturated soil culture and alternate wetting and drying are receiving renewed attention by researchers. These technologies reduce water inputs only at the expense of yield. Aerobic rice is a new concept to decrease water requirements in rice production and is highly suitable for irrigated lowland rice with insufficient rainfall and favourable uplands with access to Experiments on aerobic rice have shown that water requirement in aerobic rice were more than 50 per cent lower (only 470-650 mm) and water productivities were 64-88 per cent higher than the lowland rice.

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I, Nilesh Chatterjee, a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my project in RAWE-01 Programme on the topic "Problems and prospects of aerobic rice culture" which aims to visualize the whole concept of aerobic rice system.

I gratefully acknowledge my sincere thanks to our respected teacher Prof. B.K.Sarenfor his remarkable, valuable guidance andsupervisionthroughoutthe assignment work. It wouldbe my utmost pleasure to express my sincere thanks to his for providing a helping hand in this regard.

Yours Sincerely,

Nilesh Chatterjee

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PROSPECTS AND PROBLEMS OF CULTIVATION OF MEDICINAL AND AROMATIC CROPS AT FARMERS' LEVEL IN INDIA

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ACKNOWLEDGEMENT

I, Prakriti Rakshit, a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my assignment on the topic
"Prospects and Problems of cultivation of medicinal and aromatic crops at farmers' level in India"
which aims to visualize the Working of the industry.
I gratefully acknowledge my sincere thanks to our respected teacher Dr. Joydip Mandal for his remarkable, valuable guidance and supervision throughout the course. It would be my utmost pleasure to express my sincere thanks to him for providing a helping hand in this regard.

Thanking You.

Yours Sincerely,
Prakriti Rakshit.

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Introduction

Cultivation of medicinal and aromatic plants (MAP) today is not only a promising alternative and counterpoint to wild collection, enabling preservation of natural genetic variability and survival of rare, endemic, vulnerable and endangered species, but also represents a powerful economy branch providing the high class quality raw material for pharmaceutical, cosmetic and the food industry. Domestication and cultivation of most of medicinal plants, usually conceived as a minor crops, face with many challenges on small, medium and large scale production, relating both cultivation technologies and market and prices fluctuations. Cultivated MAP material is increasingly preferred by the herbal industry, because it is easier to predict plant yield, quality and drug composition, especially when compared with wild harvested raw materials. In case of cultivated MAP material, the possibility of plant misidentification and adulteration is excluded. The profitability of cultivation of medicinal plants compete with profit achievable for standard field crops for which already exist a specialized machinery and a standard procedure for application of fertilizers and agrochemicals to control weeds, pests and diseases. For successful large scale cultivation of MAP, the high quality raw material should be produced using low input cultivation methods to be competitive at the international market and with plants collected from the wild. The most common issues with which the producers of medicinal plants encountered are the market, abundance and accessibility of wild populations, agro-environmental conditions, labor availability and costs, investments in machinery, post-harvest processing, and profitability of production. Superior genotypes are very important for profitable production of the high quality medicinal plants' row material. Out of all cultivated medicinal plant species, only a small percentage is clearly genetically defined and represented on the seed market in term of variety. Similarly to the other crops, traditional breeding methods, as well as biotechnological procedures and selection assisted by molecular markers are applied in development of new varieties and cultivars of MAP, aiming at improvement of their desirable characteristics. This refers to increased drug yield and the content of required secondary metabolites. Mapping of genes and specific DNA sequences involved in biosynthesis of particular metabolite classes seems to be a future challenge in MAP breeding programs. In the next section the problems and prospects of cultivation of MAP are elaborated.

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Problems And Prospects

1. **Market**:

Forecasting the market trends for herbs is always difficult, due to very large variability in reports and information concerning amount of material in natural populations and plantations. Annual fluctuations in the amount of plants that are normally placed on the market are usually affected by climatic factors, depression due to irrational collection, number of available collectors and profitability of farming. It often happens that a new medicinal plant species reach the sudden popularity in the world of herbal pharmacy, followed by dramatic increase in demand for its raw material, resulting in rise in prices on the market. The high price cause greater collection of natural populations. Since the amount of raw material that can be collected from the wild is limited and heterogeneous in quality, experimental cultivation gets more chances. Otherwise over-exploitation of plant population in nature inevitably leads to their depletion, and consequently to reduced offer.

2. Abundance and Accessibility of Wild Populations:

When choosing plant species for introduction into the cultivation, beside consideration of market issues, farmers usually have to take into account the abundance and accessibility of plant populations in the nature. If a plant species is widespread in the wild, then the interest of the farmer becomes questionable. The collector of wild plants has much lower production costs compared to investments that farmer has. In contrast to the cultivation of medicinal plants, a collector does not have to rent/farm the land and to perform necessary agricultural practices like: obtaining of good quality seeds, seedlings production, deep plowing, fertilizing, soil preparation, planting, watering, hoeing, etc.

In case of highly abundant natural populations, cultivation may be favored only by special requirements of the market, mainly related to strict request of a drug quality, i.e. relatively limited range of the content of particular secondary metabolite. When significant quantities of raw material are gathered from the wild, such material is mixture of populations differing in the content and composition of bioactive substances. In general, for the most traded species, cultivation is always an option. This is especially worthwhile for plants whose distribution in nature is linked to specific habitats, climate and/or geographic regions, as well as species whose medium- and long term collection could cause risks of endangerment (plants in which underground organs are collected, i.e. roots, tubers, and rhizomes). In case

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of collecting the underground plant organs, the whole plant is usually pulling out, whereas parts containing buds are not returned back into the soil, to ensure the further reproduction of the plant.

3. Agro-Environmental Condition

Regional characteristics for growing a certain crop, depending on the climatic characteristics and soil type, might be treated as an additional key factor in selecting of medicinal plant species for cultivation. It is obvious that some alpine plants cannot tolerate long period of summer temperatures over 20°C, and thus their cultivation is limited to higher altitudes which is especially true for southeast and southern EU countries, and other with a similar climate (yellow gentian, rhodiola, arnica). In some cases herbal industry seeks for a high level of active substances, which accumulate as a result of secondary metabolism, which is closely related to the strategy of survival under stress conditions induced by increased UV radiation

i.e. rutin in buckwheat leaf. Such plants should be grown at higher altitudes to achieve desired quality of the drug. As a general rule should be stressed that plant varieties which can be grown in the regions of a lower altitudes have a longer vegetation and higher yields than plants grown at higher altitudes, but, on the other hand the latter could have increased accumulation of secondary metabolites per unit mass of herbal drugs. It has been assumed that biosynthesis of most of secondary metabolites is induced by extra-optimal influence of various abiotic and biotic factors. Therefore, in optimal environ- mental conditions, a plant would tend to increase biomass of the photosynthetic organs and to invest into its reproduction, rather than to synthesize secondary metabolites usually needed to cope with stresses.

4. Labor Availability and Cost

Unlike conventional farming, cultivation of medicinal plants is carried out on smaller areas. For this reason, the interest of the agro-chemical industry to develop specific programs to protect these crops is small or nil. In the absence of selective agents to combat the weed flora plantation maintenance is usually performed by inter-row cultivation and manual hoeing. Weed pressure on the plot could be significantly reduced by combining agriculturally intensive field crops in the crop-rotation system with herbs and applying glyphosate based herbicide prior to plantation establishment. Regarding weed reduction, wheat is the best preceding crop in crop-rotation, since it has range of beneficial effects suitable for the next crop. Wheat has short vegetation, where after the harvest and the shallow plowing many weeds are brought in a good position for growth, which afterwards can be effectively treated with total herbicides. Despite the integral measures against weeds, producer of medicinal plants still must account for hiring of additional seasonal labor for this purpose. In addition, in most herbs some of the process of planting, harvesting and post-harvest processing is not fully automated and therefore this must be taken into account for the required number of seasonal workers. Considering that it has been estimated that seasonal labor in the total sum of production costs relates significant part, right after the cost of energy for drying, proper planning of the number of seasonal workers and the amount of their allowances can be crucial for success of production. The problem of availability and motivation of labor for growing of alternative crops is usually the limiting factor in production of medicinal plants in hilly-mountain rural areas, due to general depopulation. Unstable situation in terms of availability and costs of labor for field farming should be taken into account when producer is choosing the plots for cultivation of medicinal plants. Since the problem of labor costs may limit even the best planned plant production, in organization of farm work starting from a seed towards the raw material, producer should strive to increase level of automation of the overall production process.

5. Investments in Machinery

Some processes in cultivation of medicinal plants can be facilitated by inclusion of specialized machinery. For some processes, it is possible to use the machinery of major crops production in unmodified form, or with some minor modifications. Thus, for seed processing the existing sieves and cyclones for air-selection could be used; for direct sowing cereal or pneumatic drills are appropriate; for seedling production the soil block machinery and plastic containers from vegetable production could be recommended; for planting - planters could be used; harvesting could be done with harvesters or mowers, and for digging of roots potato diggers and ploughs could be a good option. For harvest of some herbs specialized harvesters are used, which could be operational with minor modifications for harvesting of some other medicinal plants. For example, the harvester specialized for chamomile flowers picking, could be used for harvesting of peppermint, lemon balm, and ribwort plantain. Among all herbs, the automation of the production process in case of chamomile has reached the furthest point. Since investments in machinery, as well as in facilities for drying of the raw material, significantly raise production costs, these additional funds must be justified by the final price

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of raw materials. Therefore, it is evident that a large cultivation area more quickly justifies resources invested in automation, *i.e.* machinery.

6. Post-Harvest Processing

There is a wide range of machinery for postharvest processing of fresh and dry medicinal plants raw material. In case of fresh plant material processing, the most common steps are lines of washing, chopping, and the separation by size, while the processing equipment for dry plant material are mainly used for the separation of the leaf from the stem, machine for flowering stalk cutting (e.g., chamomile), and vibrational or air separators. Some of the postharvest practices are necessary and their absence would cause an irreversible quality loss of raw material. Thus, for example, insufficiently washed roots can dry out in optimal conditions, but the soil residuum on root increases the critical quality parameter - the share of ash (%) and makes raw material useless for further industrial processing. Use of additional facilities, such as choppers and size separators enable more rational use of energy during further drying of raw material. Drying of medicinal and aromatic plants is crucial process in maintaining high quality of herbal drugs. Drying is one of the oldest ways of preserving and processing of food, and also the most important part of primary processing of MAP.

Modern production of high-quality raw medicinal herb, flower and root is inconceivable without the use of industrial dryers. Investing in the packaging does not usually significantly increases the cost of the production, but it is certainly the cost of which the producer should be aware. Warehouses are usually an essential element of infrastructure for the production of medicinal herbs, so when planning the production of large quantities of herbs their construction should be considered.

Conclusion

It was summarized that from the perspective of the market, domestication and cultivation of MAP provide a number of advantages over wild harvest for production of plant-based medicines, as following:

(a) Cultivation provides reliable botanical identification

(b) Cultivation guarantees a steady source of raw material and yield planning

(c) Wholesalers and pharmaceutical companies can agree on volumes and prices over time with the grower

(d) Cultivation allows controlled post-harvest handling

(e) Quality control can be assured and product standards can be adjusted to regulations and consumer preferences

(f) Cultivated material can be easily certified, including organic or biodynamic

(g) Selection and breeding with commercially desirable traits from the wild or managed populations may offer opportunities for the economic development of the medicinal plant species as a crop.

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Potato Cultivation and its Impact on Livelihood Condition

RAWE-01

Visva Bharti

Palli Siksha Bhavana

Submitted to ;

Prof. B .K Saren

Submitted by;
Rajlakshmi

Sem VIII,Roll-26

Potato Cultivation and its Impact on Livelihood Condition

Introduction ;

Potatoes are a favorite regular on the Indian dinner table. Most families cook potatoes for their food. They are as regular as wheat or rice. Therefore, cultivating potatoes is a good, viable business. The word 'potato' actually refers to the tuber which is the edible part of potato plant.

The global annual potato production is more than that of all vegetables. Owing to this high demand of potatoes, farmers look upon it as a profitable business. In addition, it serves as a good point to break the crop rotation from grass.

Botanically called ***Solanum tuberosum*** potatoes fall under family ***Solanaceae.***

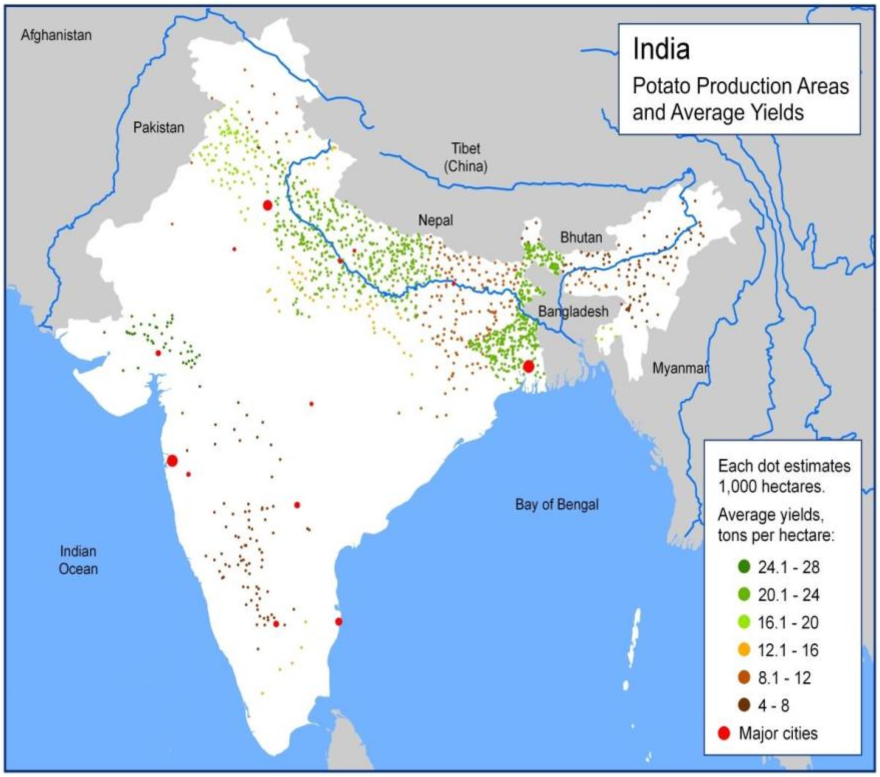
The potato plants are annuals attaining a height of maximum 2 feet. They propagate through underground tubers. The buds on the tubers develop into leaves and stems. The flowers maybe pink, red, white, purple or blue flowers bearing yellow stamens. The fruits borne by the plant after flowering are small and green in color.

The Potato, a **native of South America** .

Area and Distribution :

Area – Uttar Pradesh > West Bangal > Bihar

Production –Uttar Pradesh > West Bangal > Bihar



VARIETIES :

Kufri Sinduri:

Medium maturing ($3^1/_2$ to $4^1/_2$ months) with round, light red medium-sized tubers. It is suitable for cultivation as a main crop variety in plains as a replacement to Kufri Red and other later varieties.

Kufri Chandramukhi:

Early maturing (mature 10 days earlier than upto-date), with attractive, oval, white tubers. It degenerates so slowly and keeps well

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in storage. It gives high yields and cooks easily and does not degenerate rapidly in the plains.

Kufri Khasi-Garo:

An early maturing variety, possessing a good degree of field resistance to late blight and moderate resistance to early blight and viruses, fit for growing in the hilly regions of Assam.

Kufri Chamatkar:

An early bulking variety with uniform-sized, shining and smoothed tubers.

Kufri Shectorn:

A front-resistant variety, suitable especially for the Punjab, Rajasthan, Haryana and U.P. It can be planted late in the northern plains due to its high degree of resistance frost.

Kufri Jyoti:

A widely adaptable, fertilizer-resistant variety possessing a high degree of field resistance to late blight disease in the foliage and also a good degree of tuber resistance to the same disease. This variety is also resistant to the wary disease and moderately resistant to cercospora leaf blotch.

Kufri Alankar:

A very early-tubering photo insensitive variety capable of giving high yields, suitable for cultivation in the plains of Northern India.

Kufri Jeewan:

A late-maturing high-yielding variety, possessing a high degree of field resistance to late blight, resistance to the wart and Cercospora diseases.

Kufri Chipsona-1 , Kufri Chipsona -2 ;

It is suitable for making chips and for processing .

Climate and Soil ;

- ✓ Potato can be grown well in fertile and well-drained soil.
- ✓ Potato grows well in soil having pH 4.8-5.4.
- ✓ Heavy soil should be avoided. The short day conditions are highly favourable for economic yield of potato crops.
- ✓ To secure good for potato a day length of 12-13 hours is needed and night temperature 20^0 C increase tuberization.

Planting habit and Botany ;

- ✓ The potato belongs to family Solanaceae.
- ✓ It is a harbaceos annual and propagated by tubers, the thick underground stems which are called stolons.
- ✓ The stolon are slender, arising from buds, length and diameter varies with varieties.
- ✓ Eyes on the potato are buds and one or more develops into stem and leaves.
- ✓ Stem may be green, purple or light violet. Leaves are compound with opposite leaflets. Stems and leaves prostrate or erect.
- ✓ Height of plant one to two feet depending on variety. Roots are shallow and superficial, extend upto two feet.
- ✓ Flowers are about an inch in diameter, corolla white to purple or violet. Fruit is a berry but commonly not developed, spherical, half to one inch in diameter, purple or black.

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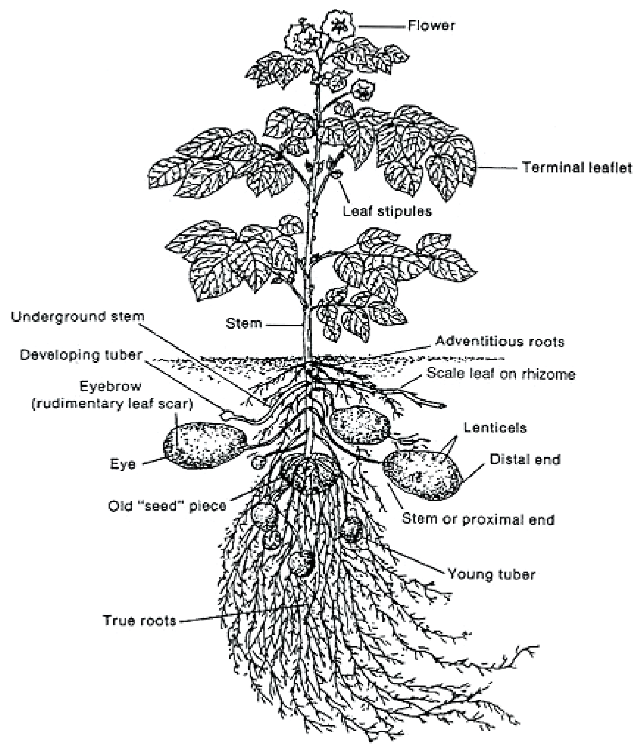
- Seeds are about the size of mustard, hetrozygous, not use for propagation except for breeding purpose
- . The size, shape, colour of skin of tubers varies with variety. The flush colour may be white, light yellow, pink or light blue.
- C_3 , Short day plant from tuberization point of view while flowering point of view long day plant .
- Fruit type is Berry and potato requires temperature for satisfied tuber growth is 17-19 °C .
- Ph requirement about 5.0 -6.5 , as acidic condition reduces scab disease incidence .



Planting ;

- Potato is grown in rabi season during October to December.
- Use seed rate of 8-10 qtl/acre for small size tuber, 10-12 qtl/acre for medium size and 12-18qtl/acre for large size tubers. Use whole seeds for disease free quality seed production.

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- ✓ The planting distance for potato crop is 50 X 20 and 60 X 25 cm.

Seed Sowing ;

- ✓ 25 g cut (piece) of tuber with 3-5 buds/eyes @ 15-20 q/ha.
- ✓ As getting high yield @ 20-25q/ha for 15g/seed .
- ✓ Spacing – 45-60 x 15-20 cm .

Nutrient Management ;

- ✓ Nitrogen is most important nutrient element for potato crop. The peak period of nitrogen uptake varies from 40-70 days.
- ✓ Potato varieties differ among themselves in their fertilizer need.
- ✓ Nitrogen is applied in split doses.
  - ➢ For western part of India, farmers are advised to apply N 100 kg (urea 217 kg), P 60 kg (single super phosphate 375 kg) and K 120 kg (muriate of potash 200 kg) per hectare just before planting and 50 kg N (urea 109 kg) one month after planting (at earthing up) as a split application .
  - ➢ For North region, farmers are advised to apply 25-30 t/ ha well decomposed organic manure and one ton caster cake at land preparation. In addition of organic

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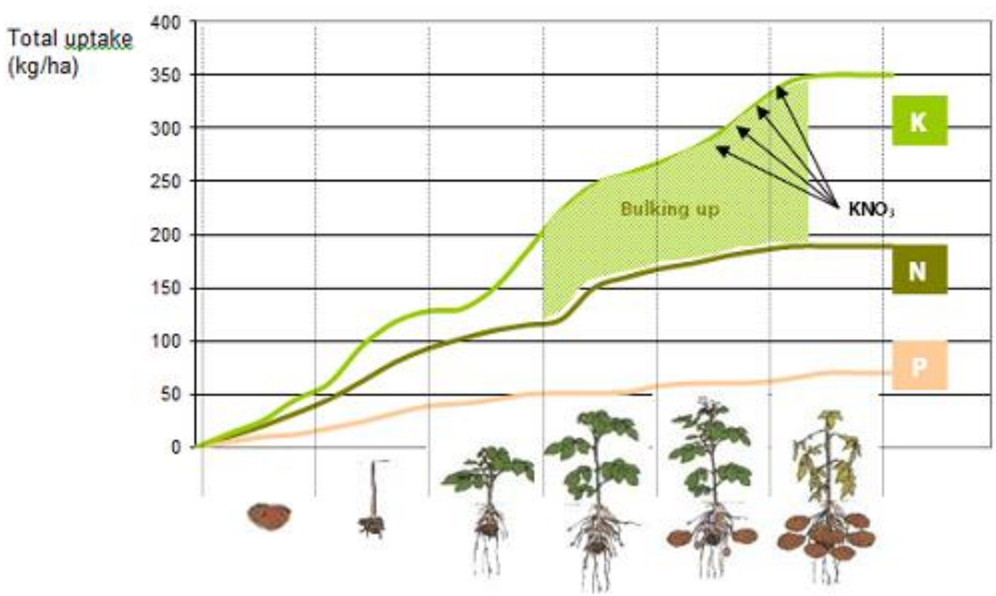
manure, apply nitrogen 275 kg/ ha, phosphorus 138 kg/ ha and potash 275 kg/ ha.

- ✓ All dose of P, K and half dose of N to be applied as basal dose and half dose of N (in the form of ammonium sulphate) to be applied 35-40 days after planting as a split application.
- ✓ Wherein, farmers are advised to adopt fertigation for potato farming to obtain higher yield over conventional method of fertilizer application.
- ✓ All dose of P should be applied as basal application and N and K should be applied into nine splits equally of seven days intervals as fertigation.
- ✓ First application of N and K to be given 9th days after potato planting (Potato Research Station, Deesa, SDAU, S.K. Nagar, Gujarat).



Water Management ;

- ✓ Adequate and regular water supply is needed for sustainable potato crop growth. The quantity of water used for irrigation is an important factor.

- Water with high concentration of dissolved salts is undesirable for potato.
- Water requirement of potato varies from 350 to 550 mm depending on crop duration , atmoshpheric condition , soil type and variety under development.
- 8-12 Irrigation are necessary at an interval of 10 days .
- Furrow irrigation is most common irrigation in potato for obtaining higher yield .
- The farmers are advised to adopt drip irrigation to obtain higher yield than conventional method of irrigation. Dripper discharge to be adjusted @ 4 L/ hr at lateral spacing 2 ft.

Earthing up in potato ;

- Proper development of tuber depends upon aeration , moisture availability and proper soil temperature.
- Earthing up is done when the plants are 15 to 22 cm high .
- Generally earthing up is done at the time of top dressing of nitrogen fertilizers .

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- ✓ The ridges should be broad, loose and high enough to cover up the tubers .
- ✓ If necessary the second earthing up may be done after two weeks of the first one .
- ✓ A mould board plough or a ridger may be used for earthing up in a large area .

Weed management ;

- ✓ Weed control in potato crop normally done by the manually labour.
- ✓ In the case of perennial weeds like 'motha' or 'doob' grass Gramaxone may be sprayed @ 2.5 litres in 1000 litres of water per hectare .
- ✓ Spraying should be done at the stage when potato plants are emerging to the extent of 5-10 % and weeds have germinated on the ridges.

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- ✓ Alchalor(Lasso) may also be used @ 4 litres per hectares as pre emergence spray .
- ✓ Metribuzin(Sencor) is effective against annual grasses and broad leave weeds . It should be sprayed before the emergence of weeds @ 1.0 kg/ha in 800 litres of water .

Disorders ;

1. **Black heart** – Due to lack of O_2 in stored potato the internal tissue break down and become black .
   Avoid storage temperature above 35 °C and poor ventilation .
2. **Hollow heart** –Due to excessive use of N-fertilizers , an irregular cavity in the centre of tuber develops .
3. **Chilling injury** – Due to prolonged storage of tubers at a temperature of about 0°C .

PESTS;

1. Cut worms – Spray Dursban 20 EC or apply Phorate in soil.
2. Caterpillar – Spray Thiodan or BHC (10%)
3. Aphid -- Spray Rogor or Nuvacron or Malathion
4. Jassids -- Spray Metasystox (0.1%)

Diseases

5. Nematodes -- Fumigate soil with D-D
6. Early Blight – Spray Dithane M-45 (0.2%)
7. Late blight -- Spray Dithane M-45 or Dithane Z-78 or Difolatan or Zineb.
8. Scab --Disinfect tubers with Agallol-6 or Mercuric fungicides.

9. Virus disease – Use certified seeds. Spray Metasystox (0.1%) or apply Timet or Furadon in furrow before planting.

Impact of Potato cultivation on livelihood ;

- ✓ Potato has significant share in overall agricultural production in the country .
- ✓ India is the second largest producer of potato in the world after china and both countries put together nearly one-third of global potato production .
- ✓ As we know cultivation of potato requires intensive labour so the family size is one of the most important factors for cultivation of potato .
- ✓ Growing of potato is essentially a profitable economic activity . However farmers often fail to realize profitable price primarily due to inadequate formal marketing strategy and lack of collateral credit available from the formal sources .
- ✓ The long supply chain which accommodate large number of middle men in both the markets is prohibiting farmers from otherwise profitable prices .
- ✓ These markets are highly unorganized and dominated by large numbers of small players .
- ✓ Moreover the markets are characterized by price seasonality and price instability .
- ✓ In most time in contract farming of potato no government functionaries are involved in the contract farming arrangement and the aggrement were largely verbal .
- ✓ On the supply side, potato markets have no information about the expected supply during the season .

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- ✓ Average expenditure of potato crop is Rs 82484.20 per ha , average gross income is Rs 142740.00 per ha and average net income is Rs 60255.00 per ha.

- ✓ The probable region for higher expenditure on cultivation of potato crops is due to higher cost of potato seeds , FYM and expensive labour .

- ✓ The net income from the crop may be increased if they get remunerative prices of their produce and this is possible only if they get higher share in market price of their produce .

- ✓ Study indicates that average area under potato cultivation is only 1.02 ha which is less than the average total land holdings of the farmers . This is because they cultivate other vegetables also for generation more income .

- ✓ Majority of the farmers reported that low productivity of potato crop; less sale price and higher cost of cultivation were the main reasons for not growing the crop on whole of land area.

- ✓ It could be concluded from the findings that poor shelf life , inadequate supply of storage material, lack of marketing facilities, less support price and price fluctuation were the main constraints encounterd by the potato growers in the adoption of recommended crop production technologies .

- ✓ Therefore , more emphasis should be given to some of major serious constraints , such as inadequate supply of storage material , lack of marketing facilities and less support price

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and though the distribution of pertinent literature in simple language on the potato cultivation among the potato growers.

- ✓ Necessary action should be taken to strengthen the supply services at villages to make available inputs like seeds , fertilizers , insecticides , pesticides , agricultural implements .

- ✓ The credit facilities to growers at right time may facilitate to adopt more technology by potato growers .

References ;

- www.indiaagronet.com
- Vikaspedia.in

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Acknowledgement ;

I feel very proud to present my RAWE-01 Assignment on "Potato cultivation and its effect on livelihood" which aims to visualize to develop our entire idea and the experience gained by us to present in concise form .

I gratefully acknowledge my sincere thanks to our respected professor B. K Saren for his remarkable , valuable guidance. It would be my utmost pleasure to express my sincere thanks to him for providing helping hand in this regards .

I place my thanks to my friends , whose co-ordination & co-operation helped me to complete my work successfully .

Raj Lakshmi

Sem VIII

Roll no.-26

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Different Equipment Used of Rice Production

PALLI SIKSHA BHAVANA INSTITUTE OF AGRICULTURE

VISV-BHARATI , SRINIKETAN

COURSE – RAWE 01 (Crop Production)

SUBMITTED TO →

DR .K.C.Swain

SUBMITTED BY →

RAZIA SULTANA

ROLL -28

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Acknowledgement

I, RAZIA SULTANA a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my project in RAWE Programme on the topic "Different Equipment Used of Rice Production". This piece of work would remain incomplete without expressing my gratitude toward the people associated with it.

I gratefully acknowledge my sincere thanks to our respected teacher Dr. K.C.Swain for her remarkable, valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to her for providing a helping hand in this regard.

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Thanking you,

RAZIA SULTANA

BAG (SEM-VIII)-28

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INTRODUCTION

The technological improvements in Indian agriculture since mid sixties have brought about revolutionary increase in agricultural production. Interestingly, the growth rate of food grains production particularly in case of wheat and rice was much higher than the growth rate of population. The country was facing acute food shortages till eighties has now become not only self-sufficient but also a net exporter of food grains. This has been made possible due to evolution of high yielding crop varieties, increased use of chemical fertilisers, development of irrigation facilities and plant protection measures accompanied by effective price support programmes of farm products. The increased use of purchased inputs in agriculture necessitated to raise their use efficiencies through mechanisation. The increase in the use of human and bullock labour and rising wage rates and cost of up-keep of bullock further made the case of farm mechanisation still stronger. In the context of increasing commercialisation of agriculture, mechanisation is very important. There has been increase in the use of farm machinery in Indian agriculture as it contributed to the increase in output due to timeliness of operations and increasing precision in input application. Most of the mechanical inputs have displaced human and bullock labour which is socially unjustified. Farm mechanisation has been helpful to bring about a significant improvement in agricultural productivity. Thus, there is strong need for mechanisation of agricultural operations. The factors that justify the strengthening of farm mechanisation in the country can be numerous. The timeliness of operations has assumed greater significant in obtaining optimal yields from different crops, which has been possible by way of mechanisation. Higher productivity of land and labour is another factor, which clearly justifies farm mechanisation. The various operations such as land leveling, irrigation, sowing and planting, use of fertilisers, plant protection, harvesting and threshing need a high degree of precision to increase the efficiency of the inputs and reduce the losses. 113 It is quite inevitable to use such mechanical equipments which have higher output capacity and cut down the number of operations to be performed so as to ensure timeliness of various operations. This has helped in increasing area under cultivation and increase in cropping intensity. Due to scientific and research advancements, many agricultural machineries especially for paddy have been invented in recent years. Farmers are also well aware of this fact and started to use those machineries in their paddy field to do their farm operations. Scarcity of labour is the crucial factor which forces the farmers to adopt mechanisation in agricultural activities. Most of the farmers do not own the farm machineries as the cost is higher and they use it on hired basis. Due to heavy hire charges, non-availability of machineries at right time and labour availability some farmers still hesitate to mechanise their paddy farms. Transplanting, weeding and harvesting operations consume most of the labour requirements in paddy cultivation and hence thrust should be given for mechanising these operations in order to reduce the labour requirement in paddy cultivation. High labour demand during peak periods adversely affects timeliness of operation, thereby reducing the crop yield. The steady drift of agricultural labour to industrial sector is adding more to the woes of the paddy farmer. To offset these problems stress on mechanisation is the need of the hour. Keeping the above perspectives in view, an attempt has been made in this chapter to analyse the farm mechanisation pattern, reasons for preferring mechanisation, farm mechanisation adoption behaviour of the paddy farmers and the constraints faced by the farmers in adopting mechanisation in paddy cultivation in the study area using the statistical tools such as Percentage analysis, Mean, Mean score ranking analysis, Logistic regression analysis and Scaling the ranking analysis respectively.

Implements

Improved Direct Paddy Seeder

Function	:	For uniform seed distribution with respect to time and for maintaining uniform plant population per metre square
Specification	:	
Power requirement	:	Manually operated
Overall dimensions	:	2000 x 1500 x 640 mm
Weight	:	10 kg
Coverage, ha per day	:	1.1

General Information :

The unit consists of a seed drum, main shaft, ground wheel, floats, furrow openers and handle. The seed drum is hyperboloid shape (truncated cone) with 200 mm diameter having 12 mm flat spikes of 25 mm length kept parallel to the axis of rotation. The slopes of the cone facilitate the free flow of seeds towards the metering holes. Nine numbers of seed metering hole of 10 mm diameter were provided along the circumference of the drum at both the ends at a row-to-row spacing of 200 mm. Two floats were provided on either side to restrict the sinkage and to facilitate easy pulling of the unit.

Cost of the unit (approx)	:	Rs. 4800/-
Salient features	:	Uniformity in seed sowing and plant population. Reduction in seed rate and the cost of thinning is reduced. Hill dropping of seeds is achieved and continuous drilling is eliminated.

Improved direct paddy seeder

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Rice Cum Daincha Seeder

Function	**:**	**It sows paddy in 3 rows and green manure in 3 rows simultaneously.**
Specification	:	
Power requirement	:	Manually operated
Overall dimensions	:	1650 x 1600 x 690 mm
Weight	:	15 kg
Coverage, ha per day	:	0.8 ha per day
General Information : **The seeder has two drum hoppers , two skids, a ground wheel and a handle. Paddy seed rate can be adjusted from 72 – 75 kg per ha. The seeder simultaneously sows pre germinated paddy seeds and daincha seeds in alternate rows and puddled soil. The advantage of this seeder is avoidance of separate cultivation of green manure crop.**		
Cost of the unit (approx)	:	Rs. 6000/-
Salient features	:	Uniformity in seed sowing and plant population. Reduction in seed rate and the cost of thinning is reduced Hill dropping of seeds is achieved and continuous drilling is eliminated. Growth of competitive weeds is checked due to green manure crop.

Rice Cum Daincha Seeder

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Rice Transplanter

Function	**:**	**For transplanting mat type paddy seedlings. Suitable for all transplanted type paddy varieties.**
Specification	:	
Type	:	Manually operated
Power requirement	:	One operator and one labour to transport mat seedlings
Overall dimensions	:	1230 x 1250 x 835 mm
Weight	:	17 kg
Capacity	:	0.25 ha / day
General Information : **The machine consists of a seedling tray, forks, handle and skids. By pressing the handle, the forks pick-up the seedlings and plant them in 6 rows. For every stroke of the handle the seedling tray moves side wards for uniform picking of seedlings by the forks. The operator has to pull the machine while punching the handle at the desired spacing. The Row to row spacing is 200 mm.**		
Cost of the unit	:	Rs. 7500/-
Salient features	:	Planting can be done in 6 rows at a time.

Rice Transplanter

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Seed cum Fertilizer Drill for Paddy

Function	**:**	**For direct sowing of paddy and simultaneous application of fertilizer**
Specification	:	
Type	:	Mounted implement
Power requirement	:	35 – 45 hp tractor
Capacity	:	3 ha/day
General Information	:	
Cost of the unit (Approx)	:	Rs.45000/-

Salient features :

The seed rate and fertilizer rate can be adjusted

Can be operated by a 35 HP tractor

By applying the required quantity of fertilizer at root zone, better crop growth and more yields is obtained.

Saving in cost:65%

Saving in labour:84%

Cost of operation: Rs.800 / ha

Seed cum fertilizer Drill

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Cono Weeder

Function	:	For weeding between rows of paddy crop
Type	:	Manually operated
Number of rotors	:	Two
Number of operators	:	One
Overall dimensions	:	37 cm x 1.4 m
Weight	:	5 to 6 kg

General Information :

The cono weeder has two conical rotors mounted in tandem with opposite orientation. Smooth and serrated blades mounted alternately on the rotor uproot and burry weeds because the rotors create a back and forth movement in the top 3 cm of soil, the cono weeder can satisfactorily weed in a single forward pass without a push pull movement.

Cost of the unit (approx)	:	Rs. 1500/-
Salient features	:	Easy to operate by a single operator The weeder does not sink in puddled soil Field capacity 0.18 ha/day

Cono Weeder

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Two Row Finger Type Paddy Rotary Weeder

Function	**:**	**For weeding in paddy row crops**
Type	:	Manual operated
Power requirement	:	-
Capacity	:	0.35 ha / day
General Information	:	
Cost of the unit (Approx)	:	Rs.900/-

Salient features

Row spacing can be adjusted for 20cm and 25 cm

One man can easily operate the unit continuously

By push pull action the weeds are buried and soil aerated.

Saving in cost :80%

Saving in labour : 60%

Cost of operation: Rs.250 / ha

Two row finger rotary weeder

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Battery Operated Portable Wetland Weeder

Function	:	For weeding in SRI field
Specification	:	
Type	:	Manual operated
Power requirement	:	
Capacity	:	0.2 – 0.3 ha/day
General Information	:	
Cost of the unit (Approximate)	:	Rs.8000/-
Salient features	:	Easy to operate compared to cono weeder Operated without experiencing any drudgery Weeding efficiency: 95% Cost of operation: Rs.625/ha

Battery operated portable wetland weeder

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Self Propelled Vertical Conveyor Reaper

Function	:	For harvesting paddy
Overall dimensions (L x W x H), mm	:	2200 x 950 x 1100
Type	:	Self propelled engine
Power requirement	:	3.0hp
Capacity	:	0.125 ha h-1
General Information **Vertical conveyor reaper (0.75 m) of TNAU is light in weight and hence shifting the reaper from one field to another is easy. Operating the reaper is fatigue free. The total cost of the machine is well within the purchasing power of the small farmers. It is highly cost economical when compared to other paddy harvesters and combine and manual harvesting.**		
Cost of the unit (Approx)	:	Rs.60,000

Self Propelled Vertical Conveyor Reaper

Paddy Reaper Harvester

Function	:	**For harvesting and windrowing non-lodging paddy varieties. It is a self propelled unit and width of coverage is 0.75 m.**
Specification	:	
Type	:	Self propelled
Power requirement	:	3 hp kerosene engine, 1 operator and 2 women labourers to collect and bundle the cut crop
Overall dimensions	:	2200 x 850 x 1170 mm
Capacity	:	1 ha / day
General Information **The machine consists of gear box, ground wheels, handle, cutter bar assembly, star wheels and gathering header assembly. The crop should be manually harvested along the four sides of the field for a width of 0.5m and cleared from the field for providing space to the machine. At one corner an area of 2 x 1.5m should be manually harvested to place the machine initially in the field. Since the harvested crop is discharged at the right side of the reaper the harvested should be turned always to the left side.**		
Cost of the unit (approx)	:	Rs.1,00,000/-
Salient features	:	Fuel consumption - 1 litre/ha Height of cut - 50 mm Labour - 1 operator and 2 women laboure (to collect and bundle the cut crop)


Paddy Reaper Harvester

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Mini Combine Harvester for Paddy

Function	:	For combined operations of Harvesting, threshing and winnowing
Specification	:	
Type	:	Self propelled
Capacity	:	1 ha / day
Cost of the unit (approx)	:	Rs.3,00,000/-
Cost of operation	:	Rs.1300 / ha
Special features	:	Suitable for small and marginal farmers Can be easily transported to inaccessible fields Saving in cost: 80% Saving in labour: 91%

Mini Combine Harvester

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Manually Operated Fertilizer Broadcaster

Function	**:**	**For broadcasting granular fertilizers like urea, DAP etc in the field uniformly.**
Type	:	Manually operated
Power source		One person
Hopper bottom shaped	:	Cone
Length (mm)	:	280
Width (mm)	:	410 -415
Height (mm)	:	441 -450
Hopper capacity (kg)	:	12-15
Shape of metering hole	:	circular
Spreading disc spinner diameter, (mm)	:	225 -273
Vertical clearance from hopper bottom(mm)	:	24 -44
No of fins	:	8
Weight (kg)	:	3.8 -10

General Information

It consists of a hopper with tapered bottom, with a side slope of about 46 degrees. A circular disc having X sections is fitted on a vertical shaft below the fertilizer hopper and is rotated by a handle through gear arrangement. The gear ratio between the handle and the spreading disc is 1:8.4. A metered quantity of the fertilizer through adjustable opening falls on the disc, which spreads uniformly due to centrifugal force. Machine is mounted on the shoulders and is operated at a forward speed of about 2.0 km/h.

Fertilizer Broadcaster

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Paddy Winnower

Function Specifications	:	Cleaning of paddy by winnowing
Type	:	Power operated, continuous
Overall dimensions	:	1,210 mm x 960 mm x 1,430 mm
Test Results		
Suitability for crops	:	Paddy
Capacity	:	7.5 q/h
Power requirement	:	1 ha electric motor
Labour requirement	:	Two
Winnowing efficiency	:	97%
Cost of equipment	:	Rs. 7,000

Salient Features

The machine winnows paddy already threshed by the paddy thresher or by other means. It has a feeding hopper at the top to receive the threshed paddy, chaff and straw bits. A blower provided at the bottom sends a stream of air which separates the straw, chaff and other impurities. The dust, chaff and straw come out through an opening and cleaned paddy is taken out through another spout.


Paddy Winnower

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Household Paddy Parboiling Unit

Function	**:**	**To parboil paddy uniformly**
Specification		
Overall dimension (D x H) mm	:	650 x 900
Capacity	:	125 kg/batch
Power required	:	5 kg of firewood/batch
General Information The parboiling drum is made of galvanized iron sheet of 20 gauge thickness with a lid. The drum is divided into three equal portions. The top two-third portion retains paddy for parboiling and bottom one-third portion holds water to produce steam for parboiling. A perforated slanting sheet with perforated pipes separates the steam chamber from parboiling chamber. The lateral perforated pipes attached to the main steam pipe divides the entire parboiling chamber into a number of small compartments and helps for uniform and simultaneous parboiling of paddy. Perforated sloping floor helps for natural unloading of parboiled paddy. The water in the drum can be heated by burning firewood or any agricultural waste. After the completion of parboiling, the remaining hot water can be used for next batch.		
Cost of the unit (approx)	:	Rs.4,500/-
Cost of operation	:	Rs.7/h
Salient features	:	Uniform parboiling and increased head rice recovery is possible. Times 45 minutes for parboiling the first batch of soaked paddy and 25 minutes for the subsequent batches. It can also be used as a storage bin, when not used for parboiling.

Household paddy parboiling unit

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TNAU Insect Trap

Function Specifications	:	To utilize cir pith for the production of particle board
overall dimensions (L x B x H)	:	27 mm diameter and 150 mm long
Capacity	:	Suitable for a bin holding upto 25-50 kg
Power requirement	:	1 ha electric motor
Labour requirement	:	Two
Winnowing efficiency	:	97%
Cost of equipment	:	Rs. 7,000

General Information

The basic characteristics of the stored product insects, viz., affinity towards air, tendency to move towards aerated region, wander in the grain and active during dusk and dawn have been exploited in the development of the trap. The stored grain insects, like red flour beetle, saw toothed beetle, rice weevil, paddy moth, turmeric beetle, drug beetle, pulse beetle, groundnut bruchid, dermestid beetles, flat grain beetles, etc with the behaviour of wandering in the bulk grain, reach the insect trap. These insects will enter the trap through the perforations and reach the stem of the trap. In the stem, as the insects cannot move upward and escape, they move towards the bottom and reach the pit fall placed at the bottom.

Cost of the unit (approx)	:	Rs.75/-
Salient features	:	Suited only for bin storage. 2 or 3 traps can be placed at 15 to 20 cm depth in a bin of 30 to 45 cm diameter and 25 kg capacity for maximum benefit. No insecticide is used in this trapping technique. Easy to handle and maintenance free.

TNAU Insect Trap

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Conclusion

There are many drawing conclusions of the problem that are left unanswered to us the consumers. In the immediate future, the main challenges for rice production may include increasing demand for rice from population growth, the limited possibility for expanding harvested area, declining rice yield growth, and low returns from rice production. Along with other factors such as lack of financing, lack of equipment/machinery, lack of technology, lack of variety of seeds, delayed payment for farmers, unavailability of land, scarcity in water resources, the frequency of natural disasters such as drought and flooding has increased partially because of global climate change, labor shortage, a demand for high quality rice.

We believe that scientific and technological innovation will continue to play an important role in increasing rice yield despite changes in socioeconomic and physical environments and problems related to rice production. To meet and sustain the needs of the growing population, the rice production has to be enhanced with good management practices with shrinking availability of land and water resources condition.

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RESILIENCE OFINTEGRATED FARMING SYSTEM

Submitted By:

RISHI PAL

Roll No:29

Submitted To: Prof Binoy K. Saren

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I, Rishi Pal, a student of B.Sc. (Ag.) Hons., Sem-VIII, feel proud to present my assignment in RAWE01 programme on the topic 'Resilience of integrated farming system'. This assignment would remain incomplete without expressing my gratitude toward the people associated with it.

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Thanking you.

Yours sincerely,

Rishi Pal

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Resilience of integrated farming system

Introduction-

Now a days, the farmers concentrate mainly on crop production which is subjected to a high degree of uncertainty in income and employment to the farmers because various type ofunavoidable situation like drought, flood, low market price etc. In this situation they have to follow suitable strategy for obtainingaassured income from the farm household to sustain their livelihood.If farmer fall in a adverse condition then a good farming system can resilience the situation.

Integration of various agricultural enterprises viz., cropping, animal husbandry, fishery, forestry etc. have great potentialities in theincome stability,economic stability and employment generationas well as nutritional fulfilment of the farm household.

- The integrated farming system approach introduces a change in the farming techniques to obtain maximum production in the cropping pattern and takes care of optimal utilization of resources.
- Farm wastes are better recycled for productive purposes in the integrated system.
- judicious mix of agricultural enterprises like dairy, poultry, piggery, fishery, sericulture etc. suited to the given agro-climatic conditions and socio-economic status of the farmers would bring a new way of farming.

Various components can be used in a good farming system-

There are various type of component can be use in a farm household and it depends on various type of factors like condition of the land, type of soil, available technology, agro ecosystem, marketing facility, marketing need etc. A farmer should choose the component based

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on their capability and the above mentioned factors. Some important components are-

- Crops, livestock, birds and trees are the major components of any IFS.
  Crop also can be cultivated in various system like monocrop, mixed/intercrop, multi-tier crops of cereals, legumes (pulses), oilseeds, forage etc.
- Livestock components may be milch cow,drought animal, goat, sheep, poultry, bees.
- Tree components may include timer, fuel, fodder and fruit trees,
- Aquaculture it involve fish production tortoise culture azolla productions etc
- Biogas it involve utilisation of the waste product from the livestock component andpartially meet up the fuel requirement of the farm household.
- Mushroom production- nowadays it is a highlighted sector of farming it can meet the nutritional requirement of the farm household.
- Horticultural crops it involves fruit, vegetable,flowers, ornamentals, medicinal and aromatics spices and condiments etc.

Productivity concern-

Nowadays productivity of most of the crop is declining day by day. During the release of the rice variety swarna MTU 7029was gavenear about 5-6 tonnes/ha yield but nowadays it declines to 3-4 tonnes/ha. Not only rice but every crops variety which gave a good yield earlier is declining day by day because of various uncertainty and fertility problem.In this situation a good integrated farming system can help.

- If we go for crop rotation intercropping and other techniques instead of mono-cropping can resilience the fertility of the soil as well as minimise the risk of crop failureloss.
- If we maintain live stock, it can give organic manure to apply in the crop field and accordingly maintain the fertility status of the field.
- If we maintain a pond it produce required fish besides it can help to irrigate the crop land in the extreme drought condition by providing life saving irrigation as well as supply azolla type of bio fertilizer.

Profitability or income concern-

Farmer always try to obtain optimum income or profit to sustain his/her livelihood. But the uncertainty makes it uncertain. If a farmer fully depend on a single cropping system like cropping/livestock production/fisheries etc. Uncertain condition like flood, draught, crop failure, market price fluctuationmake the farmers livelihood uncertain by obtaining huge losses.

- A good well secured farming system involve recycling of output and by product fromone enterprise to an another enterprise likemanure gets from the animal husbandry can apply in the copying enterprise and the by-product or waste material from the cropping enterprise like waste food grain, straw can be used in animal husbandry or fishing enterprise as a food material. If the fish production is more or the price in the market is not good then the farmer can dry the fish and use as a manure which can avoid the expected loss.

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- A good full proof farming system can provide round the year income to the farmer. If a farmer has a orchardor flower garden then he can obtain the income round the year by selling the food of flower. Simultaneously if he has a fish production unit then it can also support the income round the year. The farmer can also sale the timber or fuel wood in the crisis of moneyfrom the farm forestry sector.

Environmental safety concern-

As a good integrated farming system support the human livelihood besides it alsosupport the environmental system, improve the producer consumer relationship of the environment.

- Silviculture system can behave as a safe house of various type of birds,
- aquatic system can support various type of aquatic insect aquatic plant aquatic bird like *pan kauris* ,ducks etc.
- A well rotate copying system with legume or crop with other families can improve microorganism variability in the soil. Like rhizobium bacteria can grow in the rhizosphere of leguminous plant, azolla can grow in the upper surface of the leaf of anabaena, a algae. Frankia,a actinomycetes can grow in the root of casuarinaor jhaw.
- In the recent time*AMPHAN* a super cyclone has destroy a lot in the Southern district of West Bengal, the agriculture system of this area get partiallydestroy, a good integrated farming systemcan also act as a protective means from his type of natural calamities. In the super cyclone the field crop and big tree orchard mostlyaffectedsomewhere flooding also happened, farmer acquired loss in the field crop and in tree and fruit orchard, but the farmer who had the animal husbandry system along with other system had support the income in the crisis condition because the animal husbandry

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has not totally destroy the domestic animal somewhere survive.

Nutritional safety concern -

- If a farmer has a pond and a small well furnished orchard with fruits along with cropping field can support the nutritional requirement of the farm household. He get the rice oil and pulses from the field which support the protein and carbohydrate for his daily requirement, and the fish get from the aquatic system can support the nutrition requirement and besides the fruits from the from the orchard and vegetable from the horticulture garden can fulfill the nutritional requirement of the household.
- A good integrated farming system can boost the immune system of a man which is earnestly required in the present devastating ***COVID-19*** situation. If a man has a good immune system,get positive with the covid-19 then he/she can fight with the virus bravely, symptom of covid-19 may be appear butin 5 to 6 days he /she can recover. Scientist says boosting of immune system is a only therapy to fight against covid-19 till any vaccine came in the market.

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Socio economic safety concern-

- A good integrated farming system can generate employment opportunity to the people in the village like poultry farm required 2-3 labourer everyday as well as one person should stay in the farm at night also, in the fishing unit lot of Well skilled labourerrequired. As a well integrated farming system furnished by various agricultural system can give the income generating opportunity besides it also make the farmer wellskilled in various agricultural system like fish production, mushroom production, flower production etc.

- If the farmer in a large area follow the same agricultural production system like cultivation of sugarcane, production of tomato, production of potato with suitable variety for preparation of chips can initiate some agro industry in this area. Like huge production of sugarcane can create a sugar mill, huge production of tomato can initiate ketchup or sauce factory. As like as the jute mill situated along the side of Bhagirathi river because of suitable condition for production of jute& rating of jute in the surrounding area.

- Nowadays agricultural scientist are stand with diversified agriculture rather than intensified agriculture. They are talking to bring the diversification in the agriculture sector rather than mono-cropping or monoculture.

Mitigation of crisis concern-

Our country India is suffering from various agricultural produce like there is no sufficient fodder for animal husbandry, as the forest is declining day by day the timber and fuel wood also getting limited, earlier the pulse production also not sufficiennow it becomes sufficientt.

In this circumstances good integrated farming system can mitigate all of the crisis.

- If a farmer kept 1 Katha of land for fodder crop along the other agriculture system for his own animal husbandry can reduce the demand and supply disparity day by day.
- If a farmer grow treesfor timber purpose like sishoo, sal,segun,sonajhuri in the boundary of his area can meet his own requirement of timber as well as fuel. Besides the extra timber can be sale at higher price which can support the income to.

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STUDY ON COMMUNITY DEVELOPMENT BLOCK

Submitted by,

Sagarika Hasda

Roll: BAG (Sem VIII)-32

RAWE-05

Submitted to,

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Department of Aril. extension

Palli Siksha Bhavana

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ACKNOWLEDGEMENT

I feel proud to present my report under RAWE05 programmer on the topic "Study on Community Development Block".

I gratefully acknowledge my sincere thanks to our respected teacher Dr. Anindita Saha, Dept. of Agricultural extension, Palli Siksha Bhavana on her valuable guidance and supervision throughout the programme.

Sagarika Hasda

B.Sc. (Ag) Hons, Semester-VIII

Roll No.-BAG(Sem-VIII)-32

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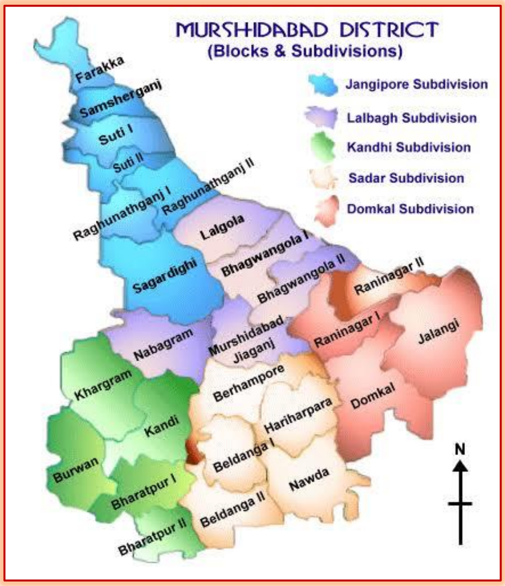
MY VISIT TO BLOCK OFFICE

LOCATION



The Murshidabad Jiaganj community development block is present in Murshidabad district of West Bengal. Jiaganj is located at 24°14′N 88°16′E.

Murshidabad-Jiaganj CD Block lies in the Ganges-Bhagirathi Basin, which is a long and narrow river valley.

Murshidabad-Jiaganj CD Block is bounded by **Bhagawangola I** and **Bhagawangola II** CD Blocks in the north, **Raninagar I** CD Block in the east, **Berhampore** CD Block in the south and **Nabagram** and **Sagardighi** CD Block in the west.

The information was collected mainly by visiting different departments of the block through a structured interview schedule, formal and informal discussions with the officials of different departments at the block, BDO, ADA, BLDO, KPS, Block Informatic Officer & by general observations.

A. General

- Name of the Block: Murshidabad Jiaganj
- Year of Establishment: 1951
- Sub- Division: Lalbagh
- District: Murshidabad
- Police Station: Murshidabad

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- No. of villages: 132
- Total Area of the Block: 203.72 sq. km
- Location of the Block: North - Bhagawangola I and Bhagawangola II Block

  (Boundaries on 4 sides) South - Berhampore Block

  East – Raninagar I Block

  West – Nabagram and Sagardighi Block
- Nearest Railway Station: Murshidabad (0.5 km)
- Nearest Highway: Lalbagh-Berhampore Road
- Telephone Office: Sub-office of BSNL, Lalbagh branch

B. Demography

- Total no. of family: 64073
- Total Population: 231718
- Male Population: 119018
- Female Population: 112698
- Educated Male: 77200
- Educated Female: 65556

C. Social Institutions

- **Educational Institutions:**
  i. Primary School: 109
  ii. Upper Primary School: 04
  iii. Higher Secondary School: 14
  iv. High School and High Madrasa: 15
  v. SSK: 65
  vi. MSK: 04
  vii. Madrasa Siksha Kendra: 01
  viii. B. Ed. Colleges: 01
  ix. Library: 02

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- **Religious Institutions:**
    i. Temple: 187
    ii. Mosque: 223
- **Economic Institutions:**
    i. Gramin bank: 1
    ii. Commercial Bank: 15
    iii. Co-operative societies: 1
    iv. Post Office: 12
- **Panchayati Raj:**
    v. Total No. of Anchal: 08
    vi. Total No of Gram Panchayat: 08
    vii. Names of Anchal:
        - ✓ Bahadurpur
        - ✓ Dahapara
        - ✓ Dangapara
        - ✓ Kapasdanga
        - ✓ Mukundobagh
        - ✓ Nutongram
        - ✓ Prasadpur
        - ✓ Tentulia
- **Youth Club:** Total No: 106

Activities: i) Development of games, playground

ii) Cultural programs, sports

iii) Blood donation camps

iv) Health camps

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D. Agriculture

- Gross Cropped Area: 16000 ha
- Net Cropped Area: 14503 ha
- Area Under Vegetable Cultivation: 1200 ha
- Cropping Pattern: 1. Aman paddy-Mustard-Sesame
  2. Aman paddy-Mustard-boro rice
- Principle Soil Type: Sandy loam

E. Animal Husbandry

- Existing Breeds of cattle, buffalo, poultry-Not Available
- Total Population of Animals

i. Cattle- 39829

ii. Buffalo- 2127

iii. Goat- 47010

iv. Sheep- 54

v. Pig- 234

vi. Poultry- 69015

vii. Duck- 78060

- Area under fodder cultivation: 22 ha
- Total no. of AI Centers: 06
- Prevailing Cattle & Poultry Diseases:

i. Cattle: Most of the diseases have been eradicated. However, some percent of animals suffer from mineral deficiency.

ii. Poultry: Metabolic diseases

F. Cottage and Rural Industries

i. Handicrafts- 1400 SHG

ii. Food (papad, jelly, chips)-615 SHG

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Development Programmes (Agriculture, Horticulture, Animal Husbandry and Rural Development)

Sl No.	Name of programme	Target	Achievement
I	BAY (Banglar Aabas Yojona)	1754 family in 2018-19 and 4607 family in 2019-20	Completed
II	BSBY (Bangla Sashya Bima Yojona)	100% of non-loanee farmers	Ongoing project
III	BGREI (Bringing Green Revolution to Eastern India)	Increase in cereal production mainly rice in 200 ha through cluster demonstration	Completed
IV	NFSM (An area enhancement innovative)	In 600 ha	Completed
V	ACP (Alternate Crop Plan)	4000 ha area	Completed
VI	RKVY (Awareness programme regarding seed treatment)	5000 ha area	Completed
VII	NMSA (Soil health card distribution)	35000 in number	26000 in number
VIII	Krishak Bandhu Assured Income)	100% of recorded farmers	60% (12662)
IX	Krishak Bandhu Net Benefit	After 01/01/19 within 18-60 age, if a farmer dies then 2 lakh Rs to his family	———

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The present programmes drawn up as-

1. Through meetings by higher officials of the block.
2. Through annual action plan.
3. Through beneficiary list.

The problems/felt needs determined through-

1. Through community participation.
2. Through farmers training.

The basis of fixing targets-

1. Priorities necessary for development of block.
2. Targets given by higher bodies are fulfilled.
3. Availability of funds and other sources.

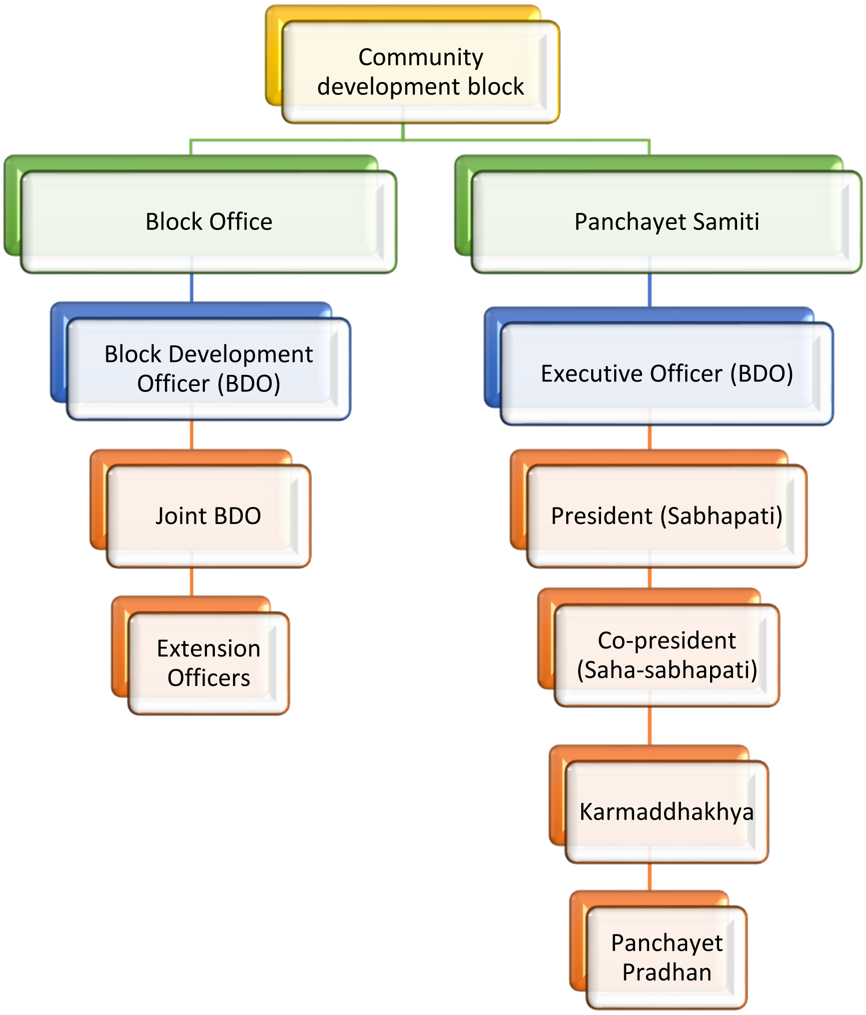
The channels used to inform the public about the development programmes-

1. It is done through village level meetings, publicity through display board, poster, banner, leaflet, sound system announcement, gram panchayat.

The people involved in the building up of the block programmes by-

1. Community participation are ensured through meeting with people, conducted by the block.

H. Organisational structure of the block



I. Coordination

Efforts taken up to have perfect coordination within the different development departments

- Monthly review meetings.
- Report returns.
- Through problem solving.
- Seminars at block and sub-division level.

Problems of coordination

- The only problem is delay in field work completion.

J. Major achievements of the block

- MGNREGS work (last year got first position in the district)
- Kanyashree (third position)
- Sabujsathi prakalpa

K. Existing constraints of the block

- Very short and limited time period to complete the works.
- Problems in interaction with the common people.

L. Records and reports maintained by KPS and ADA

- Accounts (cash book, bill vouchers, leisure)
- Stock book register
- Crop cutting experiment register
- DC register
- Stationary register
- Dead stock register
- Stuff attendance
- Schematic files

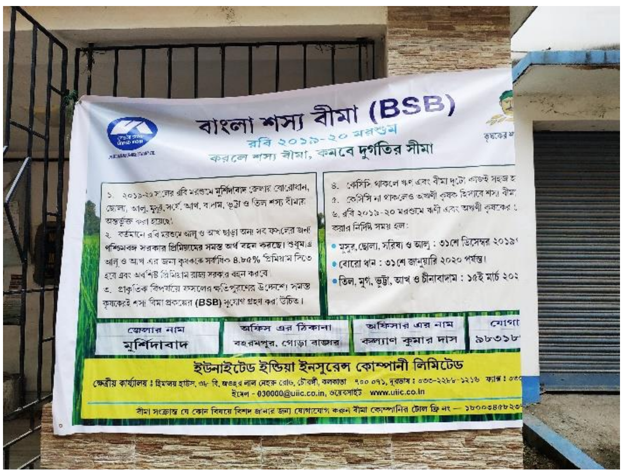
M. Evaluation

The developmental programmes in the block are being conducted satisfactorily, though certain areas are needed to be improved for betterment of the block.

With the BI (Block Informatic) of MJ Block

With the ADA of MJ block

The Block Office of MJ Block, Murshidabad



Different ongoing schemes of govt. in MJ Block

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THANK YOU

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ASSIGNMENT ON POSTHARVEST TREATMENTS TO INCREASE STORAGE OF HORTICULTURE PRODUCE

(RAWE-01)

PALLI SIKSHA BHAVANA (INSTITUTE OF AGRICULTURE)

VISVA- BHARATI

SUBMITTED TO-

DR. JOYDIP MANDAL

SUBMITTED BY- SANTANU KUNDU

SEM- VIII; ROLL NO- 33

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I would like to express my sincere gratitude to DR. Joydip Mandal for his guidance, facilitating roles & instructions towards completing the assignment.

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ASSIGNMENT ON POSTHARVEST TREATMENTS TO INCREASE STORAGE OF HORTICULTURE PRODUCE

INTRODUCTION:

Fresh fruit and vegetables are a major source of essential vitamins and minerals, such as vitamin A, vitamin C and potassium, needed for human wellbeing. They are, however, perishable living products that require coordinated activity by growers, storage operators, processors and retailers to maintain quality and reduce food loss and waste. The extent of coordination can vary greatly from loose in the case of local food supplies to complex for global supply chains. The Food and Agriculture Organization estimated that 32% (weight basis) of all food produced in the world was lost or wasted in 2009. When converted into calories, global losses represent approximately 24% of all food produced. Reducing the loss and waste of FRESH FRUITS AND VEGETABLEs is important because these foods provide essential nutrients and represent sources of domestic and international revenue

Many post-harvest treatments are applied to horticultural crops, either to maintain the quality (taste, colour, flavour, texture) or improve the visual appeal. Most important of these treatments are temperature management including the cold chain where the temperature of the crop is reduced rapidly and stabilize temperature after harvesting. Exposing the crop to high or low temperature and application of chemicals after harvest helps in managing/prevent pest and diseases and sprouting occurrence respectively.

Harvested produce must be handled with care at every stage to avoid the mechanical damage and subsequent fungal/bacterial infection. Adopting appropriate post-harvest handling operation will minimize the all ill effects of post-harvest.

Basic conditions for postharvest treatments are

- Only fresh produce can be preserved
- Produce should be free from defects
- A basic principle in shelf life enhancement process is to control or minimize the respiration rate and spoilage.

Following are post-harvest treatments to increase storage of horticultural commodities

1. Pre-cooling (Low temperature)
2. Cleaning, washing, dressing, water spray
3. Sorting, grading and sizing
4. High temperature – Curing / Drying / Hot water treatments / Vapour heat treatment /Degreening
5. Chemical treatment – antimicrobial agent/ Sprout suppressants/Mineral application/ethylene inhibitors(1-MCP, waxing, edible coating, regulation of ripening
6.Low temperature storage
7. Irradiation
8.Treatment with gas O_3
9. Control atmosphere storage
10. Modified atmosphere storage
11. Packaging
12. control atmosphere storage

1. Pre-cooling:

Pre-cooling refers to removal of field heat (quick cooling) after harvest; if not, its deterioration is faster at higher temperature of 1 hour at 320C = 1day at 100C or 1 week 00C. The entire products must be pre-cooled as early as possible to the recommended storage temperature and relative humidity. Pre-cooling is done just above chilling and freezing temperature.

Advantages of pre-cooling:

- It removes the field heat
- Reduces the rate of respiration and ripening
- Reduces the loss of moisture
- Reduce bruise damage during transits
- Reduces the production of ethylene
- Reduces /inhibits the growth of spoilage organisms
- Eases the load on the cooling system (refrigeration) of transport or storage chamber
- Above factor helps in extends the product shelf life

Pre cooling depends on the following factors

- Air temperature during harvesting (during summer pre-cooling time is more)
- Time between harvest and precooling
- Nature of the crop (High perishable crop require immediate pre-cooling)
- Difference in temperature between the crop and cooling medium
- Nature/Velocity of the cooling medium
- Rate of transfer of heat from the crop to the cooling medium.
- Type of package material used – Use of water proof ventilated boxes for good air circulation in the room is helpful. Plastic boxes/ fiber board cartons which have been treated with wax will render them water proof.

Choice of pre-cooling method depends:

- On the nature of the produce
- Economics of the process

Mechanism of pre-cooling –

Conduction and convection are the two main heat-transfer mechanisms used for cooling of produce. With conduction, the heat is transferred within a produce to its coldest surface. This is direct movement of heat from one object to another by direct methods (from fresh produce to water or warmer to cooler).With convection, the heat is transferred away from the surface of the produce via a cooling medium such as moving water or air.

Potatoes/ apples/cauliflower/orange and other fruits (bigger mass and lesser surface area) and vegetables require more time to pre-cool than produce which is having smaller mass and large surface area like lettuce/green onion/ carrot tops/peas/corn/brussel sprouts. This is because of the heat from the inside of the crop has to move to the surface before it is transferred in bigger produce.

The rate of cooling depends on individual volume and the exposed surface of product. The difference in temperature between product and the refrigerating medium also needs to be taken into account.
For example: large exposed surfaces, leafy vegetables cool almost 5 times faster than large fruit such as melons (more volume, less surface).

Types of pre-cooling methods

A. Cold air – i. Room cooling ii. Forced air cooling (presser cooling)

B. Cold water / Hydro cooling

C. Top icing – direct contact with ice

D. Evaporation of water from produce – i. Evaporative cooling ii. Vacuum cooling

E. Hydrovac cooling – combination of hydro and vacuum cooling

2. Washing, dressing, water spray, sorting & grading

washing

Washing of fruits and vegetables is done to remove adhering dirt, stains, insects, molds and sometimes spray residues.

Washing not only help in cleaning and making the vegetables/fruits fresh and also improves appearance, it also helps in extending the shelf life of the produce.

Washing is done manually under tap water or in a wash tank using soft muslin cloth.

Produce should be thoroughly washed with clean water (preferably with 100 – 150 ppm hypochlorite/chlorine) or soap or calcium hydroxide. Most efficient detergent used is sodium meta bisulphate.

After washing they are then wiped with dry muslin cloth or air-dried to remove excess surface moisture.

Under automated systems, the produce passes under a spray washer on a moving conveyor rollers.

Thumb rule is to use 1 to 2 ml of chlorine bleach per liter of water gives 100-150 ppm of Cl. pH of the water must be around 6.5 to 7.5.

Sanitation is essential, both to control the spread of disease from one item to another, and to limit spore buildup in wash water or in the packinghouse air. Fungicide may be used as post harvest dip to control diseases and disorder.

Excess water should be removed from the produce to avoid rotting.

In crops where water dipping is possible, differential floatation could be used to separate rejects.

Root and tuber vegetables are often washed to remove adhering soil.

The choice of brushing and/or washing will depends on the type of commodity and contamination.

Dry cleaning

In some cases cleaning is done by dry brushing instead of washing.

Eg. Removal of white cottony mealy bugs attached in between the surface holes of custard apple fruits.

Some fruits and vegetables are just wiped with clean dry cloth.

Fruits and vegetables which are not suitable for washing are: onion, garlic, okra, grapes, strawberry, mushrooms, etc.

Dressing

Removal, trimming and cutting of all undesirable leaves/ stem/ stalks/ roots/ other non edible or unmarketable parts is called dressing. Dressing makes vegetables attractive and marketable.

Trimming is done especially in vegetables and flowers to remove unwanted, discoloured, rotting and insect damaged parts (e.g., cabbage, cauliflower, spinach, lettuce, rose, chyrysanthemum, gladiolus, tuberose etc.) or parts that may favour deterioration or damage during later handling. In case of grapes, trimming of bunches is done to remove the undersize, immature, dried, split and damaged berries. Trimming and removal of decaying parts are preferably done prior to washing. Trimming enhances visual quality, minimizes water loss and other deteriorative processes. Trimming reduces the likelihood of diseases or their spread, facilitates packaging and handling, and reduces damage for other produce.

Water spray

Produce starts loosing water as soon it is detached from the plant. Water spray helps in compensating that water loss and maintaining the quality for longer period. Produce can also be covered with gunny sack soaked in cold water, if it has to store for longer period before sale.

Example: Green leafy vegetables

3. Sorting, sizing and grading

Sorting

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Sorting is done by hand to remove the fruits and vegetables which are unsuitable to market or storage due to damage by mechanical injuries, insects, diseases, immature, over-mature, misshapen etc. This is usually carried out manually and done before washing. By removing damaged produce from the healthy ones, it reduces losses by preventing secondary contamination. Sorting is done either at farm level or in the pack-houses. In sorting, only sensory quality parameters are taken into consideration.

4. High temperature treatment

Curing

When roots and tubers are to be stored for long periods, curing is necessary to extend the shelf life. It is an effective operation to reduce the water loss during storage from hardy root and tuber vegetables such as potato, sweet potato, yam and other tropical vegetables where cuticle are poorly developed. They are relatively susceptible to mechanical wounding during harvesting and handling. These problems can be minimized by the process of 'curing' at intermediate to high temperature and high relative humidity (RH). During curing it develops periderm over cut, broken or skinned surfaces and helps in wound restoration.

'Curing is accomplished by holding the produce at high temperature and RH for several days, while harvesting wounds heals and new protective layers of cell forms around wound'.

Advantages

It helps in wound healing of harvest and handling injuries through skin hardening
Reduce water losses
Prevent infection from pathogen

How curing happens?

Curing is normally undertaken in the field, but in some case curing structure are employed.

Produce can be cured in the field by piling them in a partially shaded area. Cut grass or straw can serve as insulating material, while, covering the pile with canvas, burlap, or woven grass matting. This covering will provide sufficient heat to reach high temperatures and high relative humidity. The stack can be left in this state for up to four days.

Curing in potato starts with deposition of suberin in parenchymatous cell just below the damaged area of the tuber.

Suberin (a waxy waterproof substance found in the cell walls of many plants, especially corky in nature) is a group of fatty acids which provides initial protection to the tuber against water loss and infection.

Subsequently, below the suberized cells a meristematic layer of cells is formed which is the periderm, also called as cork cambium (Fig.19). This produces new cells which seal off the damaged area. But these processes are temperature and humidity dependent.

Eg. Curing of potato takes place in 1 days at 210C ;2 days at 150C ;3 days at 100C;5-8 days 50C.

Drying

Drying is carried out to preserve the fruits and vegetables by reducing the water activities below that which support the growth of microorganisms and action of enzymes. This irreversibly changes the nature of the produce.

Eg.: Onion and garlic dying in the field

Dying in onion and garlic does not involve the uniform and low moisture content as in case of dehydration but drying only the outer layer.

Objective is to provide a surface barrier to water loss and microbial infection.

Some times this process is referred to as curing, but since no cell regeneration or wound healing occur it is clear to refer to it as drying.

Drying of onion has been carried out in the field and called ‘windrowing’. This involves the pulling the bulb from the ground and laying them in ground in small heaps for 1-2 weeks. When ground is wet they can cured in pack house for 7-10 days with condition of 300C and 70% RH.
Curing is judged to be complete when necks of bulbs have dried out and tight and the skin rustles when held in the hand.

Hot Water Treatments is done?

Dipping of fruits in hot water of specific temperature for specified periods for the purpose of disease control, insect disinfestations or uniform ripening’ is known as hot water treatment.
Hot water was originally used for fungal control, but has been extended to disinfestations of insects. Hot water treatment is an approved quarantine treatment for export of many fruits and vegetables against pests. However, for insect disinfestations a longer treatment is necessary than for fungal control. The times of immersion can be 1 hour or more and temperatures are below 50°C. It also adds other additional advantages such as – removal of surface residues, removal of sap fallen on the fruit surface during harvesting and facilitates washing.

Many post harvest diseases can be controlled by immersing the fruits in hot water before storage or marketing. Hot water treatment along with fungicides is more effective at 51-550C for 5-30 min. depending upon the size of the fruit.

Vapour Heat Treatment

Vapor heat treatment is a method of heating fruit with air saturated with water vapor (humidified by injection of steam) at temperatures of 40–50°C to kill insect eggs and larvae as a quarantine treatment before fresh market shipment. Vapor heat was developed specifically for insect control. The temperature and exposure time are adjusted to kill all stages of fruit fly infected produce(mango). The treatment consists of a period of warming (approach time) which can be faster or slower depending on a commodity’s sensitivity to high temperatures. Then there is a holding period when the interior temperature of the produce reaches the desired temperature for the length of time required to kill the insect. The last part is the cooling down period which can be air cooling (slow) or hydrocooling (fast).
Eg.: Treatment of citrus, mango, papaya and pineapples at 430C in saturated air for 8 hr and then holding the temperature for a further 6 hr.
For control of papaya fruit fly, fruit should be exposed to 430C and 40% RH for 11hr., followed by 430C and 100% for 8 hr.

Problems –
Hot water and vapour heat treatment may causes both internal and external damage to produce if not properly done -Injury to fruit such as increased weight loss
Acceleration of colour development

- External damage - includes peel browning, pitting, or yellowing of green vegetables. Tissue damage caused by heat will also result in increased decay development.
- Internal damage - causes poor pulp color development, abnormal softening, the lack of starch breakdown and the development of internal cavities as in case of mango and papaya. In addition, the fruit can soften quickly or show abnormal softening where some areas of the flesh remain hard while others soften.

Degreening

Post harvest treatment of citrus fruits with ethylene under controlled conditions hastens the loss of chlorophyll, a process known as ‘degreening’. Degreening consists of chlorophyll degradation to allow the expression of natural pigments masked by the green colour. Eg. Yellowing of citrus fruits. Degreening process can be hastened by applying ethylene and done mainly in non-climacteric fruits like citrus. On a small scale dip treatment in ethrel solution also bring about degreening . The concentration of ethylene required and time of exposure is significantly high in case of degreening when compared to ripening.

The main causes for greening are climatic conditions before harvest. For example, citrus often reaches commercial maturity with traces of green colour on the epidermis (flavedo). Although not different from fruits with colour, consumers sense that they are not ripe enough and have not reached their full flavor. Exposure to low temperature during maturation is necessary for an orange-coloured peel to develop. Hence fruit grown in low altitude tropics fail to degreen completely.

Degreening is done by 2 methods

1. Exposing to ethylene - Degreening is done at 25-300C and 85-95% RH with ethylene gas trickled into room to achieve 20-30 PPM or 10 µL L-1 for 24-72 hr. with regular ventilation of the chamber to prevent CO2 build up and injury. In batch process it is at 20-200 µL ethylene L-1. Trickle process is faster than batch process; since degreening condition accelerate deterioration and decay of citrus fruits. This is most popular methods
Citrus fruits are exposed from 1-3 days (depending on degree of greening) to an atmosphere containing ethylene (5-10 ppm) under controlled ventilation, 20-260C and 90-95% RH. Conditions for degreening are specific to the production area.

2. Artificial colouring - When weather is not conducive for the development for colour in orange; legally permitted dye can be used to colour the peel of the fruits like orange, with Citrus Red No.2 (1-2(2,5-dimethoxy phenylazo)2-napththol) this process is called as 'Colour Add'. It is used on mature fruit which are not intended to processing. Dye is applied to fruit by dip at 490C for 4 min. for oranges. Rinsed enough to prevent bleeding and residue tolerance is 2ppm / 2 mg kg-1 of fruit.

5. Chemical treatment

Methods of sprout suppression

A. Physicals method

Refrigeration and controlled atmosphere reduces sprouting and rooting rates but because of their costs, chemical inhibition is preferred.
Sprouting of potatoes is suppressed at and below 50C and enhanced at higher temperature storage, and in yam no sprouting was observed during 5 month storage at 130C, but tubers sprouted during that period at 150C.

B. Chemicals methods

Sprouting can be suppressed by application of growth regulators on the crop. In bulbs, such as onion, this is not possible because the meristamatic region where sprouting occurs is deep inside the bulb and difficult to treat with post harvest chemicals. Therefore, chemicals like Maleic Hydrazide (MH) is applied to the leaves of the crop at least 2 weeks before harvesting, so that chemical can be translocated deep into the middle of the bulb in the meristamatic tissue where sprouting is initiated.
Potatoes - commercially CIPC (3-chloro –iso-propyl-N phenylcarbamate is also called chloropropham) is applied prior to storage as dust, immersion, vapor or other forms of application as sprout suppressant. CIPC inhibits sprout development by interfering with spindle formation during cell division. However, cell division is extremely important during wound healing or curing period after potatoes have been placed onto storage. Wound healing requires production of 2-5 new cell layers by cell division. CIPC should be applied after wound healing process/suberisation is complete, but before periderm formation. Hence, it must be applied after curing is completed.

Care must be taken not treat seed potato with CIPC and also avoid storing same in place where, already CIPC treated potato has been stored. CIPC is mainly used for the potato stored for processing purpose.

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C. Ionization methods

Sprout suppression can also be achieved by irradiating onion bulb, potato and yam tubers.

Growth Regulators

Growth regulators like GA3 are useful in extending the shelf life of some climacteric fruits for short duration and retention of green colour of non-climacteric fruits for longer periods. 2, 4-D is widely used herbicide and can be used to prevent stem end rot development in citrus. As a post harvest treatment, 2,4-D induces healing of injuries, retard senescence and control post harvest decay of fruits and vegetables.

Waxing

Fruits and vegetables have a natural waxy layer on the whole surface (excluding under-ground ones). This is partly removed by washing. Waxing is especially important if tiny injuries and scratches on the surface of the fruit or vegetable are present and these can be sealed by wax.

Waxes - are esters of higher fatty acid with monohydric alcohols and hydrocarbons and some free fatty acids.

Waxing generally reduces the respiration and transpiration rates, but other chemicals such as fungicides, growth regulators, preservative can also be incorporated specially for reducing microbial spoilage, sprout inhibition etc. However, it should be remembered that waxing does not improve the quality of any inferior horticulture product but it can be a beneficial in addition to good handling.

A protective edible coat on fruit and vegetable which protect them from transpiration losses and reduce the rate of respiration is called ‘waxing’.

Skin coating (Protective coating)

It is defined as artificial application of a very thin film of wax or oil or other material to the surface of the fruits or vegetables as an addition to or replacement for the natural wax coating.

Advantages of wax application are:

Improved appearance

- Reduced PLW - reduced moisture losses and retards wilting and shriveling during storage
- Reduced weight loss
- Prevents chilling injury and browning
- Protect produce from bruising
- Reducing respiration rate - by creating diffusion barrier between fruit and surrounding as a result of which it reduces the availability of O_2 to the tissues.
- Protects fruits from micro-biological infection
- Considered a cost effective substitute in the reduction of spoilage when refrigerated storage is unaffordable.
- Carrier agent - used as carrier for sprout inhibitors, growth regulators and preservatives.
- Increase in the shelf life
- Mango fruits treated with wax emulsion containing 8 to 12% solids have one or two week’s longer storage life than the untreated ones.

Disadvantage:

Development of off-flavour if not applied properly. Adverse flavour changes have been attributed to inhibition of O_2 and CO_2 exchange thus, resulting in anaerobic respiration and elevated ethanol and acetaldehyde contents.

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Methods of wax application

Performance of waxing depends on method of application. Amount of wax applied and uniformity of application are extremely important. Fruits should be damp dry prior to wax application to prevent dilution. Waxes should never be diluted with water. The following methods are commonly used.

i. Spray waxing

This is most commonly used method. Fruits and vegetables which move on the roller conveyor are sprayed with water-wax emulsion. The waxed produce is dried in a current of air at 55°C. There are two types of spray waxing namely low pressure spraying and high pressure atomizing.

ii. Dipping

Here fruits are dipped in water wax emulsion of required concentration for 30 to 60 seconds. The fruits or vegetables could be waxed by keeping them in wire boxes holding about 100 fruits (30 kg) and dipping in 30 litre capacity tank containing wax emulsion. The fruits are then removed and allowed to dry under electric fan or in the open air or with warm air at 54 to 55°C. The produce should be turned periodically while drying.

iii. Foam waxing

Foaming is a satisfactory means of application because it leaves a very thin coating of wax on the fruit after the water has evaporated. A foam generator is mounted over a suitable brush head, and water is applied to the fruit or vegetable in the foam of foam. Spraying tends to waste wax, but it can be recovered in catch pans.

iv. Flooding

Flooding is similar to dipping and is a safe and convenient method of application.

A. Natural waxing

On the plant when fruit attains desired stage of maturity, nature provides them with thin coat of whitish substance, which is called bloom or natural waxing. Natural coat is clearly visible on fruits and disappears after harvest due to repeated handling of fruit.

Ex: apple, pear, plum, mango and grapes.

B. Artificial waxing

To Prolong the shelf life of produce some of the fruit and vegetables are dipped in a wax emulsion and then dried for few minutes. This process provides thin layer (<1 µ) of artificial wax on skin of the produce by which the small pores present on the skin are fully covered and reduce the transpiration and respiration process resulting in increased shelf life. Artificial wax also provides good shining and luster to the produce, which increases its market value. Artificial waxes like solvent waxes, water waxes and paste or oil waxes are used.

Regulation of ripening

During ripening an inedible mature fruit will turn into edible soft fruit with optimum taste and characteristic flavour. Fruits start ripening after reaching maturity by release of a ripening hormone known as ethylene from the fruit. All fruits especially climacteric fruits produce small amounts of ethylene during ripening that triggers ripening changes. During this ripening process fruits attain their desirable colour, flavour, quality and other textural properties. A series of metabolic activities like increase in respiration rate of fruits, conversion of starch to sugars, reduction in acidity, removal of astringency or tart taste, softening of the fruit, development of characteristic aroma, surface colour and pulp colour occur during ripening. However, in some fruits like grapes, litchi, pineapple, strawberry, plum, which are harvested at ready to eat stage, these changes are not significant.

Control/Delay of ripening

Manipulating the ripening is important in extending the shelf life and ensuring appropriate quality of fruit to the consumer. Unpredictable ripening during storage, transport and distribution can result in spoilage before consumption. The ripening hormone, ethylene is known to trigger ripening in climacteric fruit and senescence in non-climacteric. The risks of accidental exposure to ethylene can be minimized by reducing ethylene concentrations in the storage environment with practices such as oxidation by potassium permanganate, or ultraviolet light. However, these systems, while being effective for certain commodities, have limited commercial application. Recent development of new chemicals like 1-methylcyclopropene (1-MCP) provides a new approach for manipulation of ripening and senescence.

1-MCP (1-methylcyclopropene): The 1- methylcyclopropene (1-MCP or C4H6) is an ethylene action inhibitor. It binds with ethylene receptors and thereby prevents ethylene dependent responses in many horticultural commodities. 1-MCP has been formulated into a powder that releases its active ingredient when mixed with water. This nontoxic compound can be used at very low concentrations (nL L-1). The beneficial effects of 1-MCP in fresh produce include the inhibition of respiration and ethylene production, delayed fruit softening, restricted skin color changes, prolonged cold storage life and alleviation of certain ethylene-induced post harvest physiological disorders. 1-MCP treatment is also useful in reducing chilling injury symptoms and decay in tropical fruit during cold storage

Enhancing ripening

The ripening process of fruits can start when the fruits are still on the tree if left un-harvested. However, once ripe, handling and marketing of fruit will become difficult. Hence, majority of fruits like mango, banana, papaya, sapota, guava and custard apple are harvested in a mature but unripe condition. They are subsequently allowed to ripen by natural release of ethylene from the fruit. But natural ripening is a slow process leading to high weight loss and desiccation of fruits and some times results in uneven ripening in some fruits. Hence, ethylene is externally applied to enhance the ripening process of fruits. Fruits ripened with ethylene will develop better colour, taste and have all the qualities almost near to naturally ripened fruits.

Edible coating

Edible coatings are thin layers of external coatings applied to the surface of fresh produce to enhance the waxy cuticle or as replacements for natural barriers where the produce cuticle has been removed. The application of edible coatings on fresh produce provides a partial barrier to the movement of moisture on the surface of fresh produce, thereby minimizing moisture loss during postharvest storage; a gas barrier, thereby establishing a modified atmosphere around the product, which slows down respiration, senescence and enzymatic oxidation and preserves colour and texture; helps to retain volatile compounds contributing to produce a natural aroma and restrict foreign odours; maintains fresh produce structural integrity, and protects against mechanical damages; and serves as carriers of functional or active compounds, such as nutraceuticals, flavouring and colouring agents, antioxidants and antimicrobials, that will maintain/improve product quality and safety . Edible coatings are composed of hydrophobic groups, such as lipid-based waxes; hydrocolloid/hydrophilic groups, such as polysaccharide or protein-based materials; or an integration of both groups in order to improve the functionality of the coating. Within the last decade, there has been a considerable amount of research and innovations focused on the development of edible coatings from natural or synthetic sources in order to control physiological and pathological challenges of fresh produce.

coating material	purpose of coating

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Guar gum; pea/potato starch + potassium sorbate	antimicrobial
candelilla wax-based	antimicrobial; antioxidant; quality
soya bean gum; jojoba wax; glycerol and arabic gum	overall quality
Shellac +Aloe vera gel	keeping quality

Several edible coatings including chitosan, Aloe vera, polyvinyl acetate, mineral oils, cellulose and protein based have shown desirable attributes on fresh produce with good barrier properties, without residual odour or taste and efficient antimicrobial activity. However, more research is required to enhance moisture barrier properties of hydrophilic edible coatings, improve coating adhesion and durability during storage. To maximize the benefits of edible coatings for fresh produce, it is important to understand the effect of storage conditions on the desired functions and the adverse effect on fresh produce quality. The main limitation for the application of edible coating at the industrial level is the cost of scaling up research concepts or investment for new installation of film production and coating equipment, the lack of edible materials with desired physical and functional properties as well as the challenges of regulatory status for the different coating materials. Furthermore, process parameters, such as the method of coating and the amount of additives, can affect the film barrier properties and overall quality of the food product. One of the commercial coating products is Natureseal, which maintains colour, texture and shelf life of a number of fresh-cut fruits e.g. apples, pears, carrots, celery, etc., has recorded a good success. However, further research development is required to investigate the influence of edible coatings on individual cultivars of fresh-cuts in order to understand the variation in shelf life.

Antimicrobial and anti-browning agents

Over the past decade, the increasing number of reported outbreaks of foodborne illnesses has heightened the concern of regulatory agencies, producers and the consumers about the microbial safety of fresh fruits and vegetable. Outbreaks have been associated with vegetables such as cabbage, celery, cucumber, leeks, watercress, lettuce and sprouts. Antimicrobial and anti-browning agents offer the possibility to maintain safety and can be grouped into chemical- and natural/bio-based agents. Chemical-based agents include chlorine-based solutions, peroxyacetic acid (PAA), organic acids, hydrogen peroxide (H2O2) and electrolysed water A chlorine-based solution such as NaClO has been one of the commonly used disinfectants for fresh produce, owing to its very potent oxidizing properties and cost effectiveness However, its efficacy as an antimicrobial agent is dependent on the levels of chlorine and at high levels may cause taste and odour defects on treated products. Additionally, chlorine-based compounds have been reported to have limited effectiveness in the reductions of microbial load on fresh produce. Surfactants, detergents and solvents, alone or coupled with physical manipulation such as brushing, may be used to reduce hydrophobic nature of the waxy cuticle or remove part of the wax to increase exposure of microorganisms to chlorine. However, chlorine has been associated with the possible formation of carcinogenic chlorinated compounds and this may lead to new regulatory restrictions in the EU.

PAA is a very strong oxidizing agent, with no harmful by-products. PAA has been reported to be effective in controlling E. coli O157:H7 and L. monocytogenes on apples, strawberries, lettuce and cantaloupe. A 5 log reduction in Enterobacter sakazakii was reported for lettuce when treated with PAA.reported that decontamination treatment of fresh-cut carrot with PAA reduced the initial load of aerobic mesophilic bacteria by about 4 log units and yeasts and moulds by 3.5 log units and no further microbial growth was observed during storage.

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H_2O_2 possesses a bactericidal, sporicidal and inhibitory ability, owing to its property as an oxidant and being able to generate other cytotoxic oxidizing species, such as hydroxyl radicals. Treatment with H_2O_2 can extend the shelf life and reduce natural and pathogenic microbial populations in melons, oranges, apples, prunes, tomatoes, whole grapes and fresh-cut produce. However, H_2O_2 treatment requires a long duration of application and can cause injury on some produce. Also, it is accepted as a generally recognized as safe for some food applications but not yet approved as an antimicrobial agent. However, a recent study by Lopez-Galvez et al. found that the newly developed H_2O_2 -based sanitizers provoked a significant increase in the respiration rate and the electrolyte leakage of fresh-cut iceberg lettuce compared with tap water washing.

Organic acid, ascorbic acid and calcium-based solutions have been applied largely to slow down enzymatic and non-enzymatic browning, deterioration of texture and microbial growth on fresh produce. Treatment of fresh-cut melon dipped in 0.52 mM citric acid for 30 s prior to modified atmosphere packaging (MAP) maintained microbial safety and prevented translucency and discoloration. Inhibitory effects of organic acids (acetic, lactic and malic acids) combined with MAP on foodborne pathogens, including E. coli O157:H7, S. Typhimurium and L. monocytogenes. However, there are factors limiting the efficacy of antimicrobial and anti-browning agents such as internalization of bacteria and inaccessible sites within fresh produce such as the calyx. These limitations highlight the need for novel means of applying of antimicrobial and anti-browning agents

6. Low temperature storage

Low temperature storage is the best known, effective and most widely used method for extending the storage life and long terms storage of fruits, vegetables and flowers. In post harvest technology, “temperature management is the most important aspect to be looked after to maintain quality, reduce losses and extend the storage life of these perishable commodities. Cold storage is a system with thermal insulation and refrigeration in which perishables commodities can be stored for a set period of time under controlled conditions of temperature and humidity.

Cold storage

Solar driven cold stores

In tropical countries, solar energy is utilized in refrigeration cycle. In Sudan, such stores have been developed having single stage ammonia/water absorption refrigerator with 13 kw peak cooling power and were designed to keep 10 tonnes of agricultural products (volume 50 m2) at a minimum temperature of 5°C, as tested on bananas. This system is however costly when compared to conventional cold stores operated by electricity.

Jacketed storages

These are double walled storages where heat conducted through the floor, walls and ceiling is intercepted and removed by the refrigeration system before it reaches the storage space. The walls, ceiling and floor act as cooling surfaces. Humidity close to 100% is maintained. These jacketed storages built in Canada are 10% more costly than conventional storages.

Low Pressure Storage / Hypobaric Storage

Fruits can be stored under low pressure of 0.2 – 0.5 atmospheric pressure and temperature of 15 - 240C under airtight chamber. Pressure is reduced by sucking air and creating vacuum.

Mechanism

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Reduced O_2 supply slows down the respiration. When presser reduced from the 1 atm to 0.1atm the effective O_2 concentration reduced from 21 to 2.1%.
Eg. in apples, low pressure reduces level of ethylene to 0.01ppm which does not stimulate ripening.
Released ethylene is removed out of storage.
Volatiles such as CO_2, acetaldehyde, acetic acid, ester etc. are removed/reduced

7. Irradiation

Radiation can be applied to fresh fruits and vegetables to control micro-organism/insects/parasites and inhibit or prevent cell reproduction and some chemical changes. It can be applied by exposing the crop to radioisotope in the form of gamma-rays but X-rays can also be used from the machine which produces a high energy electron beam. Unit of measurement Radiation doses are measured in Grays (Gy). One Gray = 100 rads. One Gy dose of radiation is equal to 1 joule of energy absorbed per kg of food material. In radiation processing of foods, the doses are generally measured in kGy (1,000 Gy). Radiation helps in breaking the chemical bonds in the produce or micro-organism. Ionizing radiation involves damage to DNA, the basic genetic information for life. Microorganisms can no longer proliferate and continue their harmfull or pathogenic activities. Insects do not survive, or become incapable of proliferation. Plants cannot continue the natural ripening or aging process. Cobalt 60 is commonly used as a source of gamma-rays in food irradiation. Radioisotopes cannot be switched on or off so they are immersed in a pool of water to allow operators to enter the processing area. When food is to be irradiated the radioisotopes is raised out of the water and material to be irradiated is usually passed through radiation field on the conveyer belts. The whole processing area is surrounded by thick concrete to prevent the radiation out.
Advantages of Irradiation

- Reduce the spoilage
- Slowing down the rate of metabolism in the produce
- Delay ripening and senescence
- Controlling sprouting in potato, onion, garlic and yams – 0.05-0.3 kGy
- Extend shelf life of fresh produce
- Insect and parasite disinfestations- egg phase is most sensitive followed by larval, pupal and adult stages. Most insects are sterilized at doses of 0.1 -1.0kGy. And survived adults progeny are sterile.

Eg. Irradiation is being is used in Australia to produce sterile male Queensland fruits flies and in Hawaii it is being used in papaya for papaya fruit fly

Factors effecting Radiation of the produce

Moisture content in foods and the surrounding environment during treatment influence the sensitivity of microorganisms to irradiation.
For eg. high RH and high water content in foods reduce the effectiveness of irradiation. Ultraviolet lamps are sometimes used in refrigerated storage for the control of bacteria and moulds.

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8. Treatment with Ozone

Recent research and commercial applications have verified that ozone can replace traditional sanitizing agents. Ozone is a very pungent, naturally occurring gas with strong highly reactive oxidizing properties. Ozone is reported to have 1.5 times the oxidizing potential of chlorine and 3000 times the potential of hypochlorous acid. Contact times for antimicrobial action are typically four to five times less than that for chlorine. Ozone rapidly attacks bacterial cell walls and is more effective than chlorine against the thick-walled spores of plant pathogens and animal parasites, at practical and safe concentrations.. The sensory attributes of papaya of ozone-treated fruit was also superior in sweetness and overall acceptability endorsing ozone as a non-thermal and safe food preservation technique for fresh fruits and vegetable. Ozone can be employed in cold storage, washing system or process water sterilization. irradiation and washing with ozonated water slightly reduced respiration in white asparagus spears, but increased spear tissue toughness. However, neither washing the asparagus spears with ozonated water (3 or 4.5 ppm) nor treating them with radiation (1 kJ m^{-2}) systematically and significantly affected their microbial loads during storage Some commercial use has occurred with commodities such as apples, cherries, carrots,

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garlic, kiwi, onions, peaches, plums, potatoes and table grapes. However, ozone does not penetrate natural openings or wounds efficiently. Additional research is needed to define the potential and limits of the effective use of ozone for postharvest treatments for the quality and safety of fruit and vegetables.

9. Controlled atmosphere storage

The storage of fruits and vegetables in CA Storage is one of the most advanced methods of storage. It was first suggested by W.R. Philips of Canada.

From the construction point of view, controlled atmosphere facilities are similar to refrigeration facilities. However, they should be airtight to allow creation of an atmosphere different from normal. The Oxygen consumption and its replacement by carbon dioxide by respiration, create the atmosphere. When the appropriate combination has been reached, a limited intake of oxygen is required to satisfy the reduced rate of respiration. Accumulation of carbon dioxide is removed by means of different methods.

Physiological basis of CA Storage

Air contains about 20.9% O_2 78.1 % N_2, 0.003 % CO_2 and trace amount of other gases including Ne, He, CH_4 and water vapour. In CA storage, oxygen is reduced and CO_2 is increased and ripening and respiration rates are slowed down.

Essential features of CA Storage

1. Mechanical refrigeration is used to maintain temperature of -1 to 3°C.
2. The CA storage room is constructed gas tight.
3. Reduction on O_2 - Nitrogen gas is introduced into the storage by cylinder to reduce the oxygen level after room is filled and sealed. CO_2 is added into storage from CO_2 gas cylinder.
4. Excess CO_2 is removed by dry hydrated lime, Ethanolamine, Aluminium calcium silicate, Activated carbon, Magnesium oxide, activated carbon are other CO_2 scrubbers.
5. Atmospheric composition is crop specific. However, as a general rule the most common combinations are 2-5% oxygen and 3-10% carbon dioxide
6. The storage room atmosphere samples are taken daily for CO_2 and O_2 monitoring.

Benefits of CA storage

1. Retardation of senescence and associated biochemical and physiological changes
2. Reduction of produce sensitivity to ethylene action at O_2 levels below 8% and/ or CO_2 levels above1%
3. Useful tool for insect control in some commodities.

Limitations of CA storage

1. Causes certain physiological disorders such as black heart in potatoes, brown stain of lettuce.
2. Irregular ripening of produce such as banana, pear, tomato etc.
3. Development of off flavours and off odours at very low O_2 concentrations.
4. Timely non availability of gas
5. Costly and technical knowhow is required

10. Modified atmosphere storage

MA storage implies a lower degree of control of gas concentration in atmosphere surrounding the commodity. The MA and CA differ only in degree of control, CA is more exact.

Advances in the manufacture of polymeric films with wide range of gas permeability have stimulated interest in creating and maintaining modified atmospheres within flexible film packages.

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Biochemical and Physiological Basis of MA

The rate of respiration and metabolism doubles for every 10°C rise in temperature. Respiration can be therefore reduced by decreasing the temperature, O2 level and/or increasing the CO2 level in the storage atmosphere. Both O2 and CO2 levels exert independent effects on respiration. The net effect may be additive or synergistic. When O2 concentration is reduced below 10%, respiration rate is decreased. However, when O2 concentration falls below 2%, anaerobic respiration may set in, thereby leading to the accumulation of ethanol and acetaldehyde.

The desirable effect of MA on plant tissues is also attributed to lower pH, due to dissolution of CO2 in tissues. Ethylene action and biosynthesis are also effected besides water loss and chilling injury

Factor Affecting MA storage

a. Temperature and relative humidity

Ambient temperatures of the surrounding atmosphere affect the commodity temperature. Temperature changes also affect the permeability of the film, which increases with increase in temperature. CO2 permeability responds more than O2 permeability. Relative humidity has little effect on permeability of most film packages. Most common films are good barriers to moisture and vapour because they maintain high internal humidity even in dry, ambient conditions.

b. Light

Green vegetables consume large amount of CO2 and reduce O2 through photosynthesis and would antagonize the process of respiration which aids in maintenance of specified MA within the package. Greening of potatoes can cause loss in quality unless light is excluded. Hence, opaque packages should be used for such commodities.

c. Sanitation Factors

The high humidity maintained within MA packages may enhance the growth of plant pathogens. So care must be taken to ensure proper sanitation and to avoid conditions favourable to growth and reproduction of such micro organisms. Fungicidal treatment of packaged vegetables is thus very important.

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11. Packaging

The main function of packaging fruits, vegetables and flowers is to assemble the produce into convenient units for better handling and to protect them. A good package should aim at protection of produce from physical, physiological and pathological deterioration throughout storage, transport and marketing. In recent times, packaging is becoming an essential part of supply chain of horticultural crops because of the consumer's choice for convenience, appeal, information and branding.

Benefits

- . Packaging serves as an efficient handling unit
- It serves as a convenient storage unit
- Packaging protects quality and reduces waste

- Protects from mechanical damages
- Protects against moisture loss

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- May provide beneficial modified atmosphere
- provides clean produce
- May prevent pilferage
- Provides service and sales motivation

  Reduces cost of transport and marketing

  Facilitates use of new modes of transportation

Requirement

- Package should have sufficient mechanical strength to protect the content during handling, transportation and stacking
- It should be unaffected by moisture content, when wet and high RH for its strength
- Stabilise and secure product against movement within the package while handling
- Free from chemicals that could transfer to the produce and taint it or be toxic to the produce or to humans
- Meet handling & marketing requirement in terms of weight(light), size and shape (rectangle)
- Allow rapid cooling of the contents, and/or offer degree of insulation from the external heat/cold
- Utilises the gas barrier (eg. plastic films) with sufficient permeability to respiratory gases as to avoid any risk of anaerobiosis (ventillation) and any bad odour
- It must be easy to assemble, fill and close either by hand or by use of a simple machine
- Offer the security for the contents, and /or ease of opening and closing in some marketing situation (eg. promotional activity)
- Facilitate easy disposal, reuse or recycling
- It should be easily transported when empty and occupy less space than when full. Eg. Plastic boxes which nest in each other when empty collapsible plastic crates, cardboard boxes, fibre or paper or plastic sacks and.

Cooling in package

Containers designed for pressure cooling should have holes occupying about 5% of the surface area on each of the air entry and exit ends. Ideally respiratory heat should be able to escape readily from the packages. In case of small and /or tightly packed commodities such as green beans, small fruits, green leafy vegetables and cut flowers, the heat of respiration are removed largely by conduction to the surface of the package. Therefore, the mass of the contents (i.e. minimum dimension of packages from the centre to the surface) becomes important factor. The acceptable mass depends on the respiration rate of the commodity. If the mass of the produce is excessive, that near the centre of the package will heat up because respiratory heat cannot dissipate fast enough.

Under dry conditions, produce in containers like wooden boxes, plastic crates may be sprayed with water. Direct wetting is also possible to cool. Fresh cut flowers and foliage are often transported wet usually in plastic buckets (eg. rose, gerbera etc.) and sometimes individual stem in veil of solution (eg. Anthuriam, orchids etc.)

Wood and solid and expanded plastic packages are inherently strong are resistant to high humidity, condensation and rain compared to fibreboard packages. Rigid expanded polystyrene is lightweight yet strong but require much space (collapsible i.e. foldable crates require less space on return journey) and costly. In comparison, fibreboard is attractive and can be made stronger by using two or 3 thickness, such as the bottom and lid of fully telescopic cartons. The strength of the fibreboard lies in the fluting between the inner and outer liners. Fibreboard comprises of 2 layers of fluting sandwiched between three layers is stronger than the single layer of fluting. Normal fibreboard carton rapidly absorb moisture under storage can be protected if fully impregnated with wax but wax impregnation is expensive and not fit for recycle.

Need of ventilation in package

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Suitable packaging for any product will consider the need to keep the contents well ventilated to prevent the build-up of heat and carbon dioxide during postharvest stages of transport, storage and marketing. A tight stack pattern is acceptable only if packages are designed to allow air to circulate through each package and throughout the stack. The effectiveness of ventilation during transport also depends upon the air passing through the load via vehicle.

Emerging technologies

Plasma is an emerging technique for decontaminating FRESH FRUITS AND VEGETABLE. Plasma is composed of ionized gas molecules, which have been dissociated via an energy input. Depending on the mode of particles activation and the excitation energy, they can generate high or low temperatures, referred to as thermal or cold plasma, respectively [90]. Cold plasma at atmospheric pressure can be generated by transforming argon gas into plasma at radio frequency of 27 MHz [91] or by electric discharge between two electrodes separated by dielectric barriers [92]. Three basic mechanisms have been suggested for the inactivation microbial spores in plasma environments, including the erosion of microbial spore surface atom by atom through adsorption of reactive free radicals 'etching'; direct destruction of DNA via UV irradiation and volatilization of compounds from the spore surface by UV photons through intrinsic photo-desorption. Fernández et al. [93] revealed that at the optimal operating conditions of cold gas plasma treatment about 15 min treatment time was required to achieve 2.72, 1.76 and 0.94 log-reductions in viable cells of S. enteric sv. Typhimurium on lettuce, strawberry surfaces and potato tissue, respectively. Recent study by Baier et al. [91] on fresh corn salad leaves showed that the plasma treatment at 20 W for 1 min successfully inactivated E. coli by 4 log-cycles. However, more research is required for a complete understanding of the role of microbial cell structure, physiology and stress resistance mechanisms involved in plasma resistance. Also, the effect of plasma treatment on food enzymes and postharvest quality attributes of FRESH FRUITS AND VEGETABLE requires more detailed study. Safety of gases, consumer perception and the translation of laboratory scale to large commercial scale, also requires further investigation.

Abstract

12. Emerging technologies

Plasma is an emerging technique for decontaminating FRESH FRUITS AND VEGETABLE. Plasma is composed of ionized gas molecules, which have been dissociated via an energy input. Depending on the mode of particles activation and the excitation energy, they can generate high or low temperatures, referred to as thermal or cold plasma, respectively. Cold plasma at atmospheric pressure can be generated by transforming argon gas into plasma at radio frequency of 27 MHz or by electric discharge between two electrodes separated by dielectric barriers. Three basic mechanisms have been suggested for the inactivation microbial spores in plasma environments, including the erosion of microbial spore surface atom by atom through adsorption of reactive free radicals 'etching'; direct destruction of DNA via UV irradiation and volatilization of compounds from the spore surface by UV photons through intrinsic photo-desorption. The optimal operating conditions of cold gas plasma treatment about 15 min treatment time was required to achieve 2.72, 1.76 and 0.94 log-reductions in viable cells of *S. enteric* sv. *Typhimurium* on lettuce, strawberry surfaces and potato tissue, respectively. Recent study on fresh corn salad leaves showed that the plasma treatment at 20 W for 1 min successfully inactivated *E. coli* by 4 log-cycles. However, more research is required for a complete understanding of the role of microbial cell structure, physiology and stress resistance mechanisms involved in plasma resistance. Also, the effect of plasma treatment on food enzymes and postharvest quality attributes of FRESH FRUITS AND VEGETABLE requires more detailed study. Safety of gases, consumer perception and the translation of laboratory scale to large commercial scale, also requires further investigation.

CONCLUSION:

Horticulture is backbone of our country and greater population about -66.05% is directly or indirectly dependent on it. Horticulure produce also earns good in export earnings for the country. Unfortunately about 25-30% of horticulture produce gets wasted due to lack of post-harvest management of vegetables which resulted in huge loss of crores of rupees. A complex series of metabolic adjustments occur in vegetables after harvest which are influenced by dislocation of supply of nutrients, water and growth regulators from the parent plant to the harvested vegetables. The overall process leads to postharvest deterioration of the produce. However, the losses can be reduced with adoption of postharvest management and use of processing technology of fruits and vegetable crops. With the help of new technology and practices we can reduce the postharvest loss of horticultural produce so that waste will be minimum and we will be shelf sufficient in food.

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Handbook of Postharvest Technology

RAWE 01

SEEDLING RAISING OF RABI RICE (BORO) USING WET NURSERY BED

COURSE- CROP PRODUCTION

Submitted to-

Prof. Binoy Saren

Submitted by-

Sheetal Kumari

BAG(SEM-VIII)-34

PALLI SIKSHA BHAVANA

VISVA BHARATI

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I,Sheetalkumari a student of B.Sc.(Ag.) Hons., Sem-VIII, feel proud to present my assignment in RAWE Programme on the topic "Seedling raising of rabi rice (boro) by using wet nurssery bed" which aims to visualize the method of raising rabi rice (boro) seedlings.

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Sheetal kumari

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Introduction

Rice is the staple food for more than 60 percent of the world's population. It is the staple food of most of the people of South-Eastern Asia. In India, rice is the most important and extensively grown food crop, occupying about 44.8 million hectares of land. It flourishes comfortably in warm and humid climate. Rice is primarily a high-energy or high calorie food. It contains less protein than wheat. The protein content of milled rice usually 6 to7 percent. Rice, however, compares favourably with other cereals in amino acids content. The biological value of it's protein is high. The fat content of rice low 2.0 to 2.5 percent and much of the fat is lost during milling. Rice contains a low percent of calcium. Rice grains contain as much B group vitamins as wheat. The by-product of rice milling are used for a variety of purpose. Rice bran is used as cattle and poultry feed. Rice hulls can be used in manufacture of insulation materials and as a litter during poultry keeping. Rice straw can be used as cattle feed as well as litter during winter.

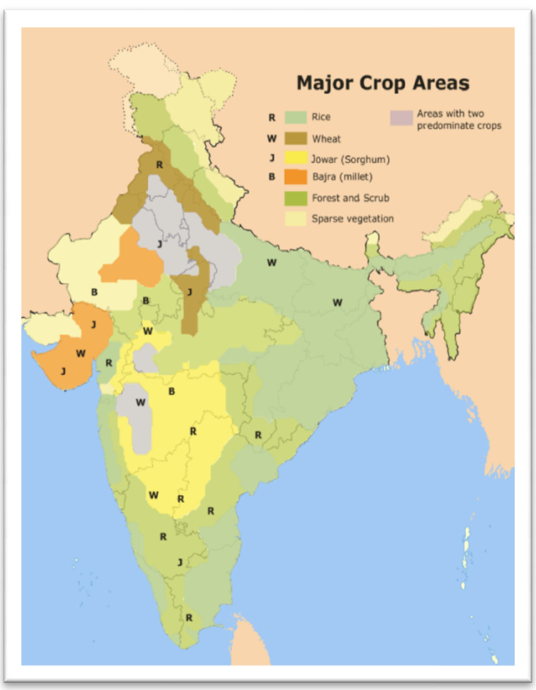

Fig 1: India Map showing major crop areas

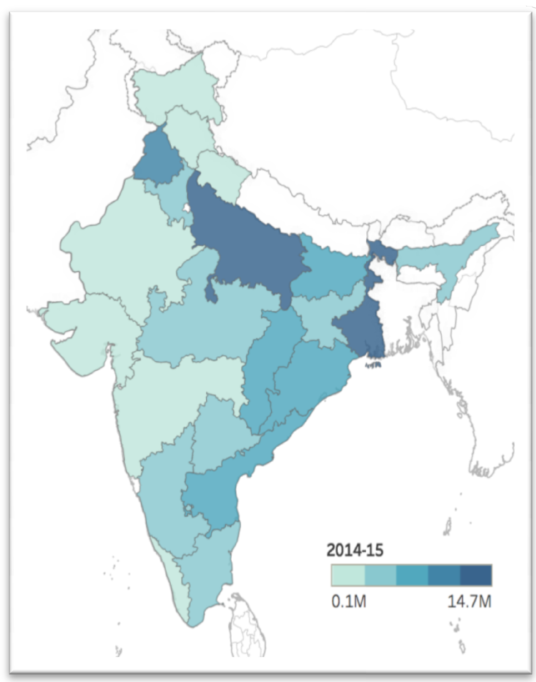

Fig 2: State wise rice production in India

Taxonomy of cultivated rice:

Kindom: Plantae

Phylum: Tracheophyta

Class: Angiospermae

Oder: Graminales

Family: Graminae

Genus: Oryza

Species: sativa

Fig 3: Rice

Rice growing seasons vary in different parts of the India, depending upon temperature, rainfall and other climatic conditions. In parts of eastern region and peninsular India, the mean temperatures throughout the year are favourable for rice cultivation and hence two or three crops of rice are taken in a year. In Northern and Western parts of the country where winter temperatures are fairly low only one crop of rice is taken Kharif. There are three seasons for growing rice in India as given below:

Table 1: Three seasons for growing rice in India

Crop season	Local name	Sowing time	Harvest time
Kharif	Aus (West Bengal, Bihar)	May -June	Sept-Oct
Rabi	Aman or Aghani	June-July	Nov-Dec
Summer or Spring	Dalua (Odisha), Boro (West Bengal)	Nov-Dec	March- April

Aus and Aman rice together (Kharif) constitute more than 95 % of the total rice area in the country, while the rest is contributed by summer rice.

Boro Rice

The boro rice is commonly known as winter rice. The term boro is bengali originated from the Sankrit word "Boro" which refers to a cultivation from Nov-April under irrigated condition. It is photo-insensitive, transplanted rice cultivated in water-logged, low lying or medium lands with supplemental irrigation during November to April. This gives farmers a chance to grow a rabi season crop which normally they could not grow. This type of rice has been cultivated traditionally in river basin deltas of Bangladesh and eastern India including Eastern U.P, Odisha, Bihar, West bengal and Assam. Areas adjoining canals and road are low lying ditches with high moisture retention capacity where water is accumulated during monsoon months and cannot be drained out in winter months. Boro rice system takes advantage of residual moisture after the harvest of kharif rice. With the increase in irrigation facilities, boro crop is now being taken in area outside its traditional boundaries and a new cropping system is emerging.

Table 2: Major areas growing boro rice

State	Districts
Eastern U.P.	Ballia, Basti, Gorakhpur, Deoria, Gazipur (Lake, rivers, nalahs, etc)
Bihar	Purnia, Kathihar, Madhepur, Madhubani, Darbhanga, Saharsa (low

	lying chaurs and chauris)
West Bengal	Burdwan, 24-paragnas, Nadia, Midnapur
Odisha	Balasore, Bhadrak, Kendrapara (low lying areas of coastal belt)
Assam	Nawgaon, karimganj (lake areas)

Why boro rice?

1. Shallow water level and water logging low land can be utilized by using boro rice cultivation, which remains fallow in winter due to excessive moisture and late maturity.
2. Immense potential for improving boro rice yeild over winter crops in low land areas.
3. Boro rice matures before on-set of monsoon and gets sufficient time for harvesting as compared spring rice.
4. Good market price of boro rice due to off season production.
5. Reduces risk of natural calamities like flood for main season under flood prone areas using boro rice cultivation.

Popular boro rice varieties:

Gautam, Prabhat, IR-64, Krishna hensa, IR-36, Joyamati, Vishnu Prasad, Jyoti Prasad, Chinsura hybrid-3, Khumal-11, BRRI dhan-29, BRRI dhan-35, BRRI dhan-36 and Jaya gives good yeild in boro season. A boro rice seeds are sown in early winter, the seeds of the cultivar should be able germinate at lower temperature say, ranging between 12-14°C. The shape of vacuoles and thickness of mesophyll layer in the internal structure of the leaves need to be bigger enough to make the cultivar morecold tolerant. The cultivar needs to have low amylase content (20-50%) in the grain. The expected yeild level has to be 6-7 t/ha with harvest index of 0.50 to 0.55.

Cultivation

In India rice is grown mainly on two types of soils i.e., uplands lowlands. The sysytems of rice cultivation in aregion depends largely on factors such as situation of the land, type of soil, irrigation resources, availability of labourers, intensity and distribution of rainfall etc. The following are the principal systems of rice cultivation.

1. Dry or semi-dry upland cultivation
   (a) Broadcasting the seed
   (b) Sowing the seed behind the plough or drilling
2. Wet or lowland cultivation
   (a) Transplanting in puddled soils
   (b) Broadcasting sprouted seeds in puddled soils

Now, before raising seedlings we should keep following points in our consideration:

1. Select a fertile, well drained field near the source of irrigation.
2. Seed should always be true to the variety, healthy, viable, clean and of high germination percentage (80% or more).
3. In case of bold grain varieties, about 40 to 45 kg seed would be required to raise seedlings enough for one hectare, whereas for fine grain varieties 30 to 35 kg seed is enough.
4. Rice seeds required to raise seedlings should be soaked in water and pregerminated.
5. Later, incubation is done for the 24 to 36 hours.

Methods of raising seedlings

We required to nurse seed before transplanting paddy seedling into lowland puddled soil. The main reason for nursing paddy seed is to give the seedlings a substantial head starts on weeds.

Nursery for paddy may be prepared by following method:

- Wet bed method
- Dry bed method
- Dapog method
- Nursery for System of Rice Intensification

Each type has advantages and disadvantages. Success of in raising healthy paddy seedlings depends mainly on constant supervision of the seedbed and proper management.

Seedling raising of rabi rice (boro) using wet method

The seedbed is usually prepared 25 to 35 days before transplanting before transplanting during the month of Nov-Dec. Steps involved in raising wet bed seedlings are as follows:

- Land where both irrigation and drainage can be controlled should be selected for seed bed. The sand should be fertile and free of excess salts or other soil problems.
- The soil is puddled by two to three runs of puddleror three to four ploughings with local plough. After one or two days of puddling, divide the nursery area into narrow beds of 1.25m width and of any convenient length depending upon the slope.
- Construct the drainage channel 30cm wide in between the seed beds. Apply 225g urea or 500g ammonium sulphate and 500g single super phosphate per 10 square metre.
- Uniformly broadcast about two to three handfuls of seed on a square metre of seed bed. Keep the seed beds saturated with water for five days and then increase gradually the level of water upto 5cm as the seedlings grow.
- Dust the seedlings periodically with fuelwood ash , straw ash, cattle dung ash in order to to avoid chilling injuries and to keep the temperature of seedbed favourable for seedlings farmers fill and drain out water on regular basis.
- Cover the seedlings with a plastic sheet at night to avoid yellowing of seedlings.
- Seedlings would be ready for transplanting at an age of 20-25 days.

At some precautions and extra measures:

- We should drain the excess water in period of heavy rains.
- We should adopt suitable disease and pest control measures.
- In case nitrogen deficiency application of 50g of urea per square metre is recommended.

- In case where soil is deficient of zinc, two zinc sulphate(5 kg zinc sulphate+2.5kg calcium hydroxide mixed in 1000 liters of water for one hectare), one 10 days after sowing and another 20 days after sowing.
- In case of iron deficiency 0.5% ferrous sulphate solution should be sprayed

Fig 4: puddling

Fig 5: Broadcasting of seeds

Fig 6: wet nursery bed

Conclusion:

Raising seedlings of rabi rice (boro) has made it possible to best utilization of the soil moisture in low lying areas with an additional crop to farmers. The crop has become very popular and emerging out as a new cropping system in the region. The need is to develop improved package and practices to make the system more popular.

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PHYSIOLOGICAL FUNCTIONS AND DEFICIENCY SYMPTOMS OF MACRO NUTRIENTS AND THEIR CORRECTIONAL MEASURES

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INTRODUCTION

The term, mineral nutrient is generally used to refer to an inorganic ion obtained from the soil and required for plant growth. The term, mineral nutrient is generally used to refer to an inorganic ion obtained from the soil and required for plant growth. The nutrients indispensable for the growth and development of higher plants are obtained from three sources viz., atmosphere, water and soil. The nutrients indispensable for the growth and development of higher plants are obtained from three sources viz., atmosphere, water and soil.

The term essential mineral element was proposed by Arnon and Stout (1939). These are the composition of both macro and microelements, in the absence of any one of these elements the plant cannot maintain its normal growth and develops deficiency symptoms, affects metabolism and die prematurely.

CRITERIA OF ESSENSIALITY OF ELEMENTS

- ✓ The element must be essential for normal growth or reproduction and the plant processes cannot proceed without it.
- ✓ The element cannot be replaced by another element.
- ✓ The requirement must be direct i.e., not the result of some indirect effect such as relieving toxicity caused by some other substance.

Of the many elements that have been detected in plant tissues, only 16 are essential for all higher plants. They are C, H, O, N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B, Cl and Mo.

MACRONUTRIENTS

The nutrient elements which are required for the growth of plants relatively in larger quantities are called as major nutrients or macronutrients. The major elements required for growth of plants are C, H, O, N, P, K, Ca, Mg and S. Among these nutrients, C, H and O are taken up by the plants from the atmosphere and water. The N, P, K, Ca, Mg and S are taken up by the plants from the soil and they are applied in the form of chemical fertilizers either through the soil or foliage.

MICRONUTRIENTS

The nutrient elements which are required comparatively in small quantities are called as minor or micro nutrients or trace elements. The micronutrients required for the plant growth are Zn, Cu, Fe, Mn, Mo, B and Cl.

PHYSIOLOGICAL FUNCTIONS, DEFICIENCY SYMPTOMS OF THE MACRO NUTRIENTS AND THEIR CORRECTIONAL MEASURE

CARBON

PHYSIOLOGICAL FUNCTIONS

1. Carbon forms the backbone of most plant biomolecules, including proteins, nucleic acids, carbohydrates, lipids and cellulose.
2. During photosynthesis plant take carbon in the form of carbon di oxide from air and converts into

carbohydrates which are used to store and transport energy within the plant.

3. Carbon is an integral part of many biological processes, including reproduction, photosynthesis and respiration.

DEFICIENCY SYMPTOMS

1. Stunted growth. When carbon dioxide levels are low, plants are not able to photosynthesize efficiently and their growth slows.
2. As carbon is an important component of chlorophyll deficiency of it cause chlorosis.

CORRECTIONAL MEASURES

Adding organic matter, such as crop residues, green manures animal wastes or decomposing plant parts (rich in carbon – or the browns in compost), to the soil surrounding growing plants basically fertilizes them, feeding and nourishing the plants and making them vigorous and lush. In addition, various aquatic plants can use hydrogenous carbonate ions (HCO_3^-) as a source of carbon.

Amending soil with organic carbon not only facilitates healthier plant life, but it also drains well, prevents water pollution, is beneficial to useful microbes and insects and eliminates the need for using synthetic fertilizers, which are derived from fossil fuels. Whether carbon dioxide from the air or organic carbon in soil, the role of carbon and plant growth is extremely valuable; in point of fact, without this process, life as we know it would not exist.

HYDROGEN

PHYSIOLOGICAL FUNCTIONS

1. Plants consist primarily of water and carbon compounds, also called organic compounds. Nearly all organic compounds contain hydrogen atoms, which is why plants need the hydrogen they obtain from water molecules through photosynthesis.
2. Hydrogen ions are vital in both aiding proton gradients to help drive the electron transport chain in photosynthesis and for plant respiration.
3. Hydrogen is used by plants during the photosynthesis process. Hydrogen is combined with carbon to produce glucose which is the source of energy in plant and release oxygen into the atmosphere which is used by all living beings.
4. All important biomolecules like DNA, RNA, lipids or fats, sugars and carbohydrates include hydrogen atoms.
5. H_2 has positive effects on seed germination, seedling growth, adventitious root formation, root elongation, harvest freshness, stomatal closure and anthocyanin synthesis.
6. Hydrogen also can enhance plant symbiotic stress resistance commonly through the enhancement of antioxidant defence system.

SOURCES

The source for hydrogen is water (H_2O). Hydrogen gas can be easily produced by splitting water into its constituent elements – hydrogen and oxygen. Plants' powers of photosynthesis allow them to harness the energy of the sun to split water molecules into hydrogen and oxygen at separate times and at separate physical locations in the plant's structure.

OXYGEN

PHYSIOLOGICAL FUNCTIONS

During the photosynthesis oxygen is released as a by-product which is used by plant during the process of respiration. In the denitrification process oxygen interacts with nitrogen and also used in other elements' oxidation process.

DEFICIENCY SYMPTOMS

As plants are obligate aerobes, oxygen deficiency (hypoxia) and its total absence (anoxia) cause dramatic ecological stress. Plants often suffer from sudden molecular oxygen deprivation both under natural condition and as a result of human activity. Most often plants are subject to oxygen deprivation on hydromorphic and flooded soils for the oxygen's poor solubility and low diffusion rate in the water. Oxygen scarcity is also observed in firm soils. In this respect, roots and seeds of plants are the most vulnerable. In northern countries and countries with a moderate climate winter cereals and perennials can be damaged by ice crust, impermeable to gas, that appears on the surface of soil in autumn and winter. Anaerobic stress may damage and even lead to a total failure of crop and wildings thus causing considerable ecologic and economic losses. Problem of hypoxia and anoxia is also important in regard to long-term storage of agricultural commodities like fruits, grain, vegetables.

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CORRECTIONAL MEASURES

Plant don't absorb oxygen from the air, but instead acquire it during the breakdown of carbon di oxide as part of photosynthesis. Only the leaves and stems of a plant acquire oxygen through photosynthesis. Cells in the roots often need to get oxygen from the environment to stay alive. Even though the roots are buried they can absorb it from the environment (soil) in the form of $NO_3^-, H_2PO_4^-, So_4^{2-}, H_20$ through air spaces present in the soil.

NITROGEN

PHYSIOLOGICAL FUNCTIONS

Nitrogen is the fourth most abundant element in plants following C, O and H. Plants contain about 1 to 3 per cent of N on dry weight basis.

1. N is a major structural constituent of the cell. The cytoplasm and the cell organelles contain varying amount of nitrogen largely in combination with C, H, O, P and S.
2. It is an essential constituent of the different types of metabolically active compounds, like amino acids, proteins, nucleic acids, porphyrins, flavins, enzymes and co-enzymes.
3. Being essential for the formation of protoplasm, the deficiency of N inhibits cell enlargement.
4. N plays very important role in metabolism, growth, reproduction and heredity.

DEFICIENCY SYMPTOMS

Nitrogen being a mobile element within a plant, it's deficiency results in movement of N from older to younger (upper) leaves. As a result, the older leaves turn yellow in colour.

1. In young plants, growth is stunted with yellowish green leaves. Yellowing of leaves is due to the collapse of chloroplasts resulting in decrease of chlorophyll content.
2. Yellowing always starts from the older leaves and spreads to young ones.
3. Severe N deficiency affects the leaf tissue to become dry and necrotic.
4. Older leaves are shed prematurely.
5. Root growth is affected and branching is restricted.
6. Shoot become short, thin with up right growth and spindly appearance.
7. Flowering is reduced.
8. In cereals, tillering is poor, number of ears per unit area and number of grains per ear head is reduced.
9. In many plants e.g. Tomato, the stem, petiole and the leaf veins become purple coloured due to the formation of anthocyanin pigments.

CORRECTIONAL MEASURES

Nitrogen can be applied to the plant in various forms like organic NH_4^+, NO_3^-.

- Organic form: dried blood or blood meal (10-0-0), fish meal (5-3-3) and fish emulsion (4-1-1), cottonseed meal (6-2-1), sewage sludge, fresh bat guano (10-3-1), coffee grounds (2-0.3-0.2), crab meal (4-3-0.5), feather meal (11-0-0), hoof and horn meal (12-2-0), soybean meal (7-0.5-2.3).

- Inorganic (NH_4^+) form: anhydrous ammonia (82-0-0), urea (45-0-0), ammonium nitrate (34-0-0), ammonium sulphate (21-0-0), diammonium phosphate (18-46-0), ammonium phosphate (10-34-0)
- Inorganic (NO_3^-) form: sodium nitrate (16-0-0), calcium nitrate (15.5-0-0), potassium nitrate ((13-0-44).
- Slow-release: urea-formaldehyde, thiourea (sulphur-coated).

PHOSPHORUS

PHYSIOLOGICAL FUNCTIONS

1. It is a structural component of the membrane systems of the cell and the mitochondria.
2. It is an essential constituent of nucleoproteins, organic molecules (ATP, ADP etc) which play an important role in the energy transfer reactions of cell metabolism, nucleic acids, and coenzymes like NADP.
3. Phosphorus in the phytin of seeds is regarded as a reserve.
4. The unique functions of phosphate in metabolism are its formation of pyrophosphate bonds which allow energy transfer, Uridine triphosphate (UTP) Cytidine triphosphate (CTP) and guanosine triphosphate (GTP) are involved in the synthesis of ribonucleic acids (RNA).
5. Being a constituent of ADP, Phosphoglyceradehyde and ribulose phosphate, P is involved in the basic reactions of photosynthesis.
6. Phosphorus is relatively more abundant in the growing a storage organ.

DEFICIENCY SYMPTOMS

Generally, the symptoms of P deficiency appear in the older leaves.

1. Young plants are stunted with dark blue green leaves.
2. Stems become slender. Premature leaf fall occurs.
3. Root system is limited. Primary and secondary roots elongate in length with short tertiary roots.
4. In many plant species P deficiency induces the formation of anthocyanin pigment and the leaves acquire purple colour primarily along margins and on the lower stalk (eg. Maize)
5. The formation of fruits and seeds is depressed and ripen slowly.
6. Plant often dwarfed at maturity.
7. Dead necrotic areas occur.
8. In potato, tubers may develop rusty lesions in the flesh.

CORRECTIONAL MEASURES

Phosphorus is most commonly found in the soil in the form of polyprotic phosphoric acid (H_3PO_4), but is taken up most readily in the form of $H_2PO_4^-$. Phosphorus is available to plants in limited quantities in most soils because it is released very slowly from insoluble phosphates and is rapidly fixed once again.

- Organic form: bone meal (1-11-0), animal manures (vary)
- Inorganic (rock powders) form: colloidal phosphate (0-2-2), rock phosphate (0-3-0)
- Inorganic synthetic ($H_2PO_4^-$) form: triple superphosphate (0-46-0); superphosphate (0-16-0); monoammonium phosphate (11-48-0), diammonium phosphate (18-46-0).

POTASSIUM

PHYSIOLOGICAL FUNCTIONS

1. K plays a significant role in stomatal opening and closing. The mechanism of stomatal closure and opening depends entirely on the K flux.
2. K^+ enhances the translocation of assimilates and promotes rate of Co_2 assimilation.
3. K activates the number of enzymes involved in incorporation of amino acids into proteins and the synthesis of peptide bonds.
4. Potassium regulates the membrane permeability and keeps the protoplasm in proper degree of hydration.
5. Potassium is known to increase the resistance of plants to moisture stress, to heat and to diseases caused by pathogenic fungi and other micro-organisms.
6. Inadequate K restricts the formation of xylem and phloem tissue. Lignification of the vascular bundles is generally impaired by K^+ deficiency. This effect probably makes K deficient crops more prone to lodging.

DEFICIENCY SYMPTOMS

1. The most characteristic symptom of K deficiency is tip and marginal scorching of most recently matured leaves.
2. In barley which is the most susceptible of the cereals, numerous small brown areas develop in the areas between the veins.

3. Mottled chlorosis of leaves occurs.
4. Plants growth remains stunted with shortening of internodes.
5. Roots are slender and poorly developed in sugar beet.
6. In certain temperate fruit trees, K deficiency may result in severe "die-back"
7. Resistance of plants to infection by bacterial and fungal pathogens is reduced.
8. Putrescine, (a Diamine) accumulates under K^+ deficiency.

CORRECTIONAL MEASURES

- Organic form: kelp meal (1.5-0.5-2.5), wood ash (0-1.5-8), plant residues
- Inorganic (rock powder) form: granite meal (4% total potash), greensand (7% total potash), langbeinite (sulphate of potash magnesia, 0-0-22 +22% S+11% Mg), muriate of potash (0-0-60),
- Inorganic (K^+) form: sulphate of potash (0-0-50), potassium nitrate (13-0-44), sul-po-mag (0-0-22 +22% S +11% Mg).

CALCIUM

PHYSIOLOGICAL FUNCTIONS

1. Calcium is required for cell elongation and cell division.
2. Calcium plays an essential role in biological membranes. Calcium is deposited in the cell wall as calcium pectate. Ca deficiency obviously impairs membrane permeability and membranes become leakier.

3. Germination and growth of pollen as well as the growth of rhizobium root nodules is affected under low levels of Ca^{2+} supply.
4. Ca appears to play a role in the inhibition of abscission and delays leaf senescence.
5. Calcium is an essential co-factor or an activator of a number of enzymes concerned with hydrolysis like lipase and α-amylase
6. Ca is a structural component of the chromosomes. Where in it possibly binds the DNA to protein. Ca deficiency is known to result in chromosomal abnormality.
7. Calcium plays an important role in neutralizing acids. Particularly citric acid, malic acid, oxalic acid which may become injurious to plants.

DEFICIENCY SYMPTOMS

1. Ca deficiency causes disintegration of growing meristematic regions and young leaves, roots and stems because it is immobile one.
2. Chlorosis occurs in marginal and younger leaves.
3. Roots poorly developed, lack fibre and may appear gelatinous.
4. The apical bud "dies off" and thus small branches arise from lower leaf axils giving the plant bushy appearance.
5. Malformation of young leaves take place.
6. Little or no fruiting.
7. Calcium deficiency causes "bitter pit" disease in apple and "blossom end rot" in tomato and watermelon.

CORRECTIONAL MEASURES

- Organic form: egg shells, oyster shells (33.5% calcium), wood ash, bone meal (24% calcium)
- Inorganic (rock powder) form: calcite limestone (65-80% calcium carbonate), dolomitic limestone (51% calcium carbonate), and gypsum (22% calcium)
- Inorganic form: calcium nitrate, super phosphate, triple superphosphate, burnt lime, hydrated lime.

MAGNESIUM

PHYSIOLOGICAL FUNCTIONS

1. The most well-known role of magnesium is its occurrence at the centre of the chlorophyll molecule. It is therefore essential for photosynthesis.
2. Mg is a constituent part of the chromosomes and also essential constituent of poly ribosomes, the key organelle concerned in protein synthesis.
3. Magnesium is known to play a catalytic role as an activator of a number of enzymes, most of which are concerned in carbohydrate metabolism, phosphate transfer and decarboxylation. The enzyme inorganic pyrophosphatase, as such is inactive. It becomes functional only in the presence of Mg.
4. It is also required for the activation of the enzyme RuBP carboxylase.
5. Nitrogen metabolism is also influenced by Mg nutrition.

DEFICIENCY SYMPTOMS

1. Interveinal yellowing or chlorosis occurs in older leaves and under severe deficiency the areas become necrotic.
2. In cotton, Mg deficiency induces formation of anthocyanin pigments and a reddish coloration of leaves during winter called as reddening of leaves.
3. In citrus, the chlorosis commences at the tips and margins of the leaf and spread in ward towards midrib by leaving inverted V shape at the bottom of the leaf.
4. In general fruit trees are susceptible to Mg deficiency and show varied patterns of chlorosis, necrosis and pigmentation of old leaves which shed pre maturely.

CORRECTIONAL MEASURES

- Inorganic (rock powder) form: dolomite (dolomitic limestone-40% magnesium carbonate) in acid soils.
- Inorganic form: magnesium sulphate (Epsom salts, 10% magnesium) in neutral or alkaline soils.

SULPHURE

PHYSIOLOGICAL FUNCTIONS

1. Sulphur is a constituent of amino acids like cystine, cysteine, and Methionine with which other amino acids form the protein.
2. The characteristic odour of cruciferous plants, onion and garlic is due to the presence of sulphur as a constituent of volatile oils.

3. Several other biological active compounds like vitamins (Thiamine and biotin), lipoic acid, acetyl co-enzyme A, ferredoxin and glutathione contain sulphur as an essential part.
4. The active adenosine-5-phospho sulphate (APS) is an important sulphate donor which is involved in the synthesis of glycosides in mustard oil. Being involved in the activation of number of enzymes, participating in the dark reactions of photosynthesis, sulphur is involved in carbohydrate metabolism of the plants.
5. The total S content in plant tissues is in the order of 0.2 to 0.5 percent in the dry matter.

DEFICIENCY SYMPTOMS

1. Chlorotic symptoms first appear in younger most recently formed leaves.
2. Tips and margins of the leaf roll in ward.
3. Stem becomes hard due to the development of sclerenchyma
4. Shoot growth is more affected than root growth.
5. Leaves become narrow and chlorotic in Cruciferae.
6. Stems often become slender.

CORRECTIONAL MEASURES

- Acid rain
- Organic form: plant residue
- Inorganic (mined) form: gypsum (17% sulphur), elemental sulphur (30-99% S)

Inorganic form: ammonium sulphate (24%S), potassium sulphate (17% S), super phosphate (12%S).

PHOTO DOCUMENTATION

Potato

Oat

Black gram

Rice

NITROGEN DEFICIENCY SYMPTOMS

Rice

Oat

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Pumpkin

Wheat

PHOSPHORUS DEFICIENCY SYMPTOMS

Oat

Cotton

Potato

Okra

Rice

POTASSIUM DEFICIENCY SYMPTOMS


Blossom end rot of tomato


Bitter pit of apple


Papaya

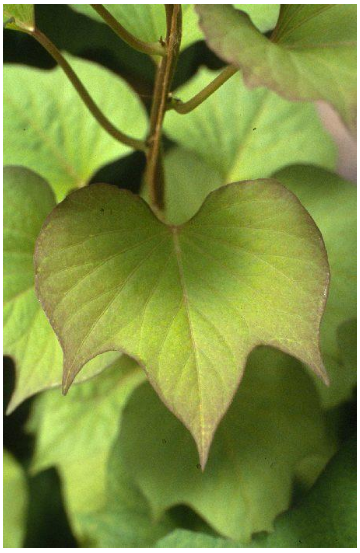
CALCIUM DEFICIENCY SYMPTOMS


Tomato

MAGNESIUM DEFICIENCY SYMPTOMS

Inward curling of leaf tip and margin

Cotton



SULPHUR DEFICIENCY SYMPTOMS

ASSIGNMENT ON RICE MILLING

RAWE 01

SUBMITTED TO:

DR. KISHORE CHANDRA SWAIN

DEPT. OF AGRICULTURAL ENGINEERING

SUBMITTED BY:

SIDDHESWAR PRASAD GHOSH

BAG(SEM-VIII) 36

· विश्वभारती ·

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SIDDHESWAR PRASAD GHOSH

BAG (SEM-VIII) 36

RICE MILLING

INTRODUCTION:

In terms of volume production rice is among the three leadings cereal of the world. It is grown almost exclusively for human consumption and represents over 50% of daily food intake of 1.6 billion people.

Paddy or rice grain consists of husk and brown rice. Brown rice, in turn, contains bran which comprises the outer layer and the edible portion. Rice milling is removal or separation of husk (dehusking) and bran to obtain the edible portion for consumption. The process has to be accomplished with care to prevent excessive breakage of the kernel and improve recovery of paddy or rice. The extent of recovery during milling depends on many factors like variety of paddy, degree of milling required, the quality of equipment used, the operators, etc. Milling is the process wherein the rice grain is transformed into a form suitable for human consumption, therefore, has to be done with utmost care to prevent breakage of the kernel and improve the recovery. Brown rice is milled further to create a more visually appealing white rice.

After harvesting and drying, the paddy is subjected to the primary milling operation which includes de-husking as well as the removal of bran layers(polishing) before it is consumed. In this process the rice which is obtained after milling is called raw rice. Rice milling losses may be qualitative or quantitative in nature. Quantitative or physical losses are manifested by low milling recovery while low head rice recovery or high percentage of broken kernel reflects the qualitative loss in rice grains.

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SOME TERMINOLOGY USED IN RICE MILLING:

Rough rice:

It is also called paddy rice. It is dried to 18% moisture and consists the hull, bran and kernel.

Brown rice:

It is also known as husked rice. It is the least processed form of rice with the husk removed. The bran layer gives the characteristic tan colour.

Milled rice:

Commonly called white rice. This is the final milling Head rice: Milled rice with length greater or equal to three quarters of the average length of the whole kernel. It is often expressed on a % paddy or rough rice basis (on 14% Moisture content basis)

Milling recovery:

Total milled rice obtained out of paddy; expressed as weight percentage of milled rice (including broken) obtained from a sample of paddy. The maximum milling recovery is 69-70% depending on rice variety, Some village type rice mills have 55% or lower milling recovery.

Milling degree:

A measure of the amount of bran removed from the brown rice

Head rice:

Milled rice with length greater or equal to three quarters of the average length of the whole kernel. It is often expressed on a % paddy or rough rice basis (on 14% Moisture content basis).

Head rice recovery:

Weight percentage of head rice (excluding broken) obtained from a sample of paddy. Under controlled conditions head rice recovery can be as high as 84% of the total milled rice or 58% of the paddy weight. Commercial rice mills turn out 55% head rice on average, whereas head rice recovery of village type rice mills is in the order of 30%

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Whole kernel:

A milled rice grain without any broken parts.

Broken kernel:

Also called broken, depending on the rice mill this can be only one fraction or it can contain several fractions of different size:

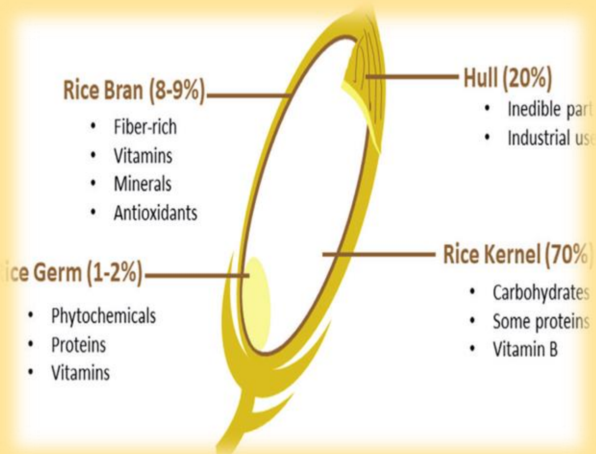
• Large broken kernel: 50-75% of the whole kernel size
• Medium broken kernel: 25-50% of the whole kernel size
• Small broken kernel: less than 25% of the kernel size, cannot pass through a sieve with 1.4mm diameter holes
• Chips: fragments of a kernel which pass through a sieve with 1.4mm diameter holes

Impurities:

Materials in the rice that are not part of the milled rice kernel. May include stones, husk, chaff, weed seeds, etc.

COMPOSITION OF RICE CARNEL:

Most rice varieties are composed of roughly 20% rice hull or husk, 11% bran layers, and 69% starchy endosperm, also referred to as the total milled rice.



In an ideal milling process this will result in the following fractions: 20% husk, 8−12% bran depending on the milling degree and 68−72% milled rice or white rice depending on the variety. Total milled rice contains whole grains or head rice, and broken. The by-products in rice milling are rice hull, rice germ and bran layers, and fine broken.

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WHAT IS RICE MILLING:

Rice milling is a process of removing the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Most rice varieties are composed of roughly 20% rice hull or husk, 11% bran layers, and 69% starchy endosperm, also referred to as the total milled rice.

OBJECTIVE OF RICE MILLING:

- The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities.
- Depending on the requirements of the customer, the rice should have a minimum number of broken kernels
- Helping people making high quality rice for our daily life.
- In recent years, agriculture develops at fast speed, which improves the rice milling industry. Investing in rice milling processing industry will be a boom business.

RICE MILLING SYSTEM:

A rice milling system can be a simple one or two step process, or a multi stage process.

- **One step milling process:** Husk and bran removal are done in one pass and milled or white rice is produced directly out of paddy.
- **Two steps process:** Removing husk and removing bran are done separately, and brown rice is produced as an intermediate product.
- **Multistage milling:** Rice will undergo a number of different processing steps.

Depending on whether the paddy is milled in the village for local consumption or for the marketing, rice milling systems can be classified into two categories: (1) Traditional rice mills and (2) commercial mills.

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- **Village rice mills:** Village-type rice mills can be found in rural communities and are used for service milling paddy of farmers for home consumption.
- **Commercial rice mills:** The objectives of commercial rice milling are to produce edible rice that appeals to the customer. Rice that is sufficiently milled and free of husks, stones, and other non-grain materials and maximize the total milled rice recovery out of paddy and minimize grain breakage.

PROCESSING RICE MILLING:

Pre-cleaning:

- Essential for removal of undesired foreign matter, paddy cleaning is given utmost importance to ensure proper functioning of the Rice Milling machinery. Rough rice is passed through a series of sieves and closed-circuit aspiration system is provided to remove dust and light impurities through positive air suction.

- Undesired material, heavier than rough rice (but of similar size) is removed through a de-stoner/gravity separator.
- This machine works on the principle of specific gravity. Stones and other heavy impurities, being heavier, stay on the screen surface whereas rough rice, being lighter, fluidizes into the positive air gradient created by an external source.

Parboiling:

Parboiling involves partial boiling of the paddy before milling in order to increase its nutritional value, to change the texture of cooked rice, and reduce the breakage in milling. It is a hydrothermal process.

Parboiling is done in three steps: **Soaking**, **steaming** and **drying**.

Advantages of parboiling:

- ✓ Parboiling causes a gelatinization of the starch during the boiling and during cooling the amylase molecules re-associate with each other and form a tightly packed structure.
- ✓ The kernels are harder and appear glassier after the parboiling process.
- ✓ The parboiling process moves micro nutrients contained in the bran, which is usually removed in the whitening process in the rice mill, to the endosperm. Parboiled rice is therefore more nutritious than white rice. It also accumulates vit-B12.
- ✓ Parboiling also mends little cracks that might have developed in the endosperm during post-harvest processing and therefore head rice recoveries of parboiled rice are higher.
- ✓ Parboiled rice takes less time to cook and is firmer and less sticky when cooked.

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De-Husking:

- A streamlined paddy flow is directed into a pair of rubber rolls, rotating at different speeds, in opposite directions. A horizontal inward pressure is applied on the rubble rollers, pneumatically. Due to the difference in the seed of rotation, a shear force is generated on the surface of hull (with two sides being rubber by tow rubber rolls) that breaks apart of the surface/hull.

- Husk, being of lower specific gravity, is then separated form brown rice by a close circuit aspiration system.
- This process leads to breakage of brown rice. Although a proper horizontal inward pressure is most important factor for breakage or rice, de-husking efficiency is equally important and should be maintained between 75 to 85%.

Advantages of de-husking:

• Reduced breakage of milled kernels.
• High hulling efficiency.
• By products are free from sand and silicon.
• Brown rice kernels are not scratched, higher quantity of bran compared to under runner disk husker.
• Machine can incorporate a husk separator.
• Compact in comparison to disc husker.

Disadvantages:

• Capital cost of machine is very high
• High wear rate of rubber rolls resulting in increases operating costs.
• Higher power consumption compared to disc huller.
• Maintenance cost high - more spares have to replace.
• Requires skilled operator.
• Life of machine is shorter than disc huller and steel huller

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Paddy separation:

- The paddy separator separates unhusked paddy rice from brown rice. The amount of paddy present depends on the efficiency of the husker and should not be more than 10%. Paddy separators work by making use of the differences in specific gravity, buoyancy, and size between paddy and brown rice.

- Grain surface with smooth texture, being of higher width, is removed off along with red grains by precision sizes.

De-stoning:

- The de-stoning is an important operation in rice mill, particularly when rice is harvested mechanically, or when rough rice is dried on open pavements. The grain gathers a lot of stones and mudball during handling, which must be removed.
- The de-stoner is a simple vibrating deck and air blower that suspends the grain from the stones. The stones are thrown off in one end and the brown rice in the other end.
- It is the separating small stones from the brown rice.

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Rice Whitening:

Brown rice is rubbed with a rough surface, created using emery stones of specific grid size. The rough emery removes off the brown bran layer. The radial velocity of the stone wheels, grid size of the stones, clearance between stone surface & the other screen and the external pressure on the outlet chamber of the whitening machines determine the extent of whiteness.

The process used to whiten brown rice can be classified as either abrasive or friction.

- **Abrasive whitening:**

In this process the grain is whitened by the abrasive action of the rice kernel passing between a moving abrasive surface and stationary screen. The abrasive process peels off the bran layers from the brown rice and applies less pressure on the grain than a friction process and is therefore better suited for long grain varieties.

- **Friction whitening:**

In the friction whitener the grain kernels are forced against each other and a metal screen by a steel-ribbed cylinder rotating inside a metal-plated cylinder. The frictional forces created between individual rice grains and between the grains and the metal screen surface remove the bran layer from the grain. Friction polishers are always horizontal in design and apply more pressure on the grain than an abrasive whitener.

Polishing:

The surface of whitened rice is still rough and is smoothened by a humidified rice polisher. The process involves rubbing of rice surface against another rice surface with mystified air acting as lubricant between

the two surfaces. Usually a modified version of this process is used to produce superfine silky finish on rice surface.
The bran layer removed from the surface if pneumatically conveyed to a separate room for further processing/storage.

Shifting:

Sifting or screen separating is to separate small broken rice, also referred to as brewers rice, from whole grain and large broken rice. Sifting will also remove germs and bran still present in the milled rice after whitening and
polishing. It is to separate small impurities or chips from the milled rice.

Rice Grading:

Broken rice is removed from whole rice by passing the lot through a cylindrical indented screen rotating at a particular speed. The broken/small grains, fit into the indents of the rotating cylinder, are lifted by centrifugal force and gravitational pull falls the grains into a trough. Adjusting the rotational speed and angle of trough can vary the average length of grains.

Characteristics Considered for Grading of Milled Rice:

- ✓ Dead rice, brokens and brewers percentages
- ✓ Defectives
- ✓ Foreign matter
- ✓ Presence of paddy
- ✓ Whiteness
- ✓ Chalkiness
- ✓ Moisture content

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Objectives of establishing standards and grades:

- To ensure only edible rice reaches the consumer.
- To improve post-harvest practices so as to eliminate or reduce waste.
- To improve agronomic practices to increase farm yields.
- To improve processing practices for better milling recoveries and for market expansion.
- To protect consumers from price/quality manipulation.

Grades of Indian Rice:

- Common variety: Short bold & long bold rice
- Fine variety: Medium slender rice
- Superfine variety: Long slender & short slender rice

Rice colour Sorting:

Discoloured rice grains are removed off from the like coloured grains by Rice colour sorting machines. Photo sensors/CCD (Charged Coupled Device) sensors generate voltage signal on viewing discoloured grains, which are then removed off by air jet generated through solenoid valves.

Blending:

Blending stations allow for mixing of head rice and brokens in the correct proportion, as specified by the grade standards. Generally, 5% broken rice is allowed with 95% head rice.

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Weighing and Bagging:

Now, it is time to know about rice weighing. To put in simple words, rice is normally sold in 50 kg sacks and it should be weight accurately and labelled. These days, most rice mills are preferring to go with the advanced manual mechanical weighing system, so that they can have accurate results. The size of the bag depends on the requirements of the customer. In larger rice mills that cater to supermarkets, milled rice is packaged in plastic bags of 2, 5, 10 and 20kg, and packaging is fully mechanized.

The basic bagging station consists of a bagging bin, a platform scale, and a bag closing-sewing machine.

Flow chart of Rice milling:

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PARAMETERS AFFECT RICE MILLING:

The milling potential of rough rice largely determines the performance of the rice mill in terms of milled rice recovery and quality. These milling potentials can be varietal origin, can be related to the quality condition of rough rice, or can be added through the pre-milling processes. A brief review of the impact of rough rice quality, specific varietal characteristics and parboiling on the performance of the rice mills.

Varietal Characteristics:

Varieties of rough rice are differently grouped. They are classed as short, medium, long and extra-long. A sub-classification – round, bold and slender refers to ratio between length and breadth of brown rice. Most of the short varieties (e.g. Japonica) are round and bold. Most of the medium varieties are bold or slender and most of the long and extra-long varieties (e.g. Indica varieties) are bold or slender.

- **Hull weight of rough rice:**

  The weight of hull as a percentage of the weight of rough rice varies from 17 to 24%. The thicker grains have the lowest percentage of hull weight and the thinner grains have the highest. The milled rice recovery is directly related the brown rice yield. Therefore a lower hull weight will result in higher miller rice recovery and vice-versa.

- **Grain Shape:**

  This refers to the length-width ratio of the brown rice. Round grains with low ratio are difficult to break, whereas the slender grains with higher ratio are easy to break.

- **Hardness:**

  The surface hardness of the brown rice kernel is a varietal characteristic that determines the extent to which the grain can resists the forces applied during milling. Lower surface hardness

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facilitates breakage during milling, resulting in lower milled rice recovery and quality.

- **Chalkiness:**

Chalkiness can be developed as a result of prevailing weather conditions during the growth period or introduced as a result of pre-milling processes such as improper parboiling. Chalkiness reduces the grain's resistance to applied milling forces.

Quality parameters of rough rice:

The extent of quality aspects is determined by prevailing weather conditions during the production period, applied production practices, soil condition, applied harvesting methods and applied post-harvest practices such as field handling, threshing, winnowing, drying and storage.

1. **Moisture Content:**

Rough rice has optimum milling potential at moisture content of about 14%. The drying process is therefore critical, for it determines whether or not fissures and/or full cracks are introduced in the grain structure. These are important as presence of fissures and/or cracks lead to breakage in milling, resulting in lower milled rice recovery and quality. Milling of very dried rough rice (<11% moisture content makes grains too brittle) results in unnecessary breakage during milling.

2. **Cracked Grains:**

Over exposure of matured rough rice to fluctuating weather conditions leads to development of numerous fissures resulting into breakage during the milling process.

3. **Immature Grains:**

Immature grain has a high hull weight and consequently a low yield of brown rice. Immature grains are very slender and dominantly chalky, resulting in excessive production of bran and broken.

4. **Damaged Grains:**

   Presence of black spots around the germ end of the brown kernel, caused by the development of micro-organisms (fungi) leads to excessive breakage of rice during milling.

5. **Varietal impurities:**

   Grains of different varieties vary not only in length-width ration but also in tensile strength. Grains of lower tensile strength / higher length-width ration therefore break in a higher proportion when milled along with other varieties.

Impact of Parboiling:

Hydro Thermal treatment of rough rice leads to breaking of the tight hull seal, a structural change of the outer bran layer, gelatinization of the starchy endosperm, hardening of the grains and discoloration of the grain.

1. **Breaking of the hull seal:**

   Enormous swelling of the brown rice leads to breakage of the hull seal during soaking and steaming of the rice.

2. **Structural changes in the bran layer:**

   As a result of steaming and soaking the structure of bran layers are changed and their components redistributed; heat treatment results in more sticky bran.

3. **Gelatinization of starchy endosperm:**

   This leads to elimination of all fissures and crack. The overall structure of the starchy endosperm becomes more compact and its tensile strength increases many a fold.

4. **Discoloration of grain:**

   During the parboiling process, the colour of brown rice kernel changes from translucent white to a yellowish and sometimes a brownish colour. Colour changes result from microbiological activities, chemical changes and the pigment of hull being absorbed in brown rice along with water.

5. **Increased hardness:**

The hardness of brown rice kernel increases after parboiling and drying, improving the grain's resistance to the milling forces.

PRESENT STATUS OF RICE MILLING:

In rice milling, there has not been any significant increase in the capacities during the last five years, the total number of modernized rice mills available in India are 35000.There are about 92000 rice hullers which need modernization. In addition, there are about 13000 huller-cum-shellers operating in the country. These are helping in recovering good quality rice bran for oil extraction. To an extent of 35 lakhs. To give a boost to this sector, the Rice milling industries act ,1958 has been repealed and any person in the country is free to set up a rice mill.

Due to demand for stored, graded, and polished rice in the export market, particularly for Basmati, a number of units have come up in the last five year to clean, sort, grade, polish and unit pack the milled rice most of which are export oriented unit. Due to ample buffer stocks and fair domestic availability of non-Basmati rice, it may be possible to export 50 lakh of Basmati rice.

Milling machine should ensure consistency in quality of the end product and hence enhance the economic value of the raw material. Energy conservation, proper utilization of human resource and consistently large volumes with least recurring costs is also a need of the hour. With over 94% of Rice

As observed, a modern rice processing unit, as compared to conventional unit, produces consistent quality product with as much as 3-5% less breakage of kernel, a net power saving of 15-20% and practically negligible down time.

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CONCLUSION:

Milling units in India relying completely on conventional Paddy and Rice Processing techniques, there is still lot to be done in the field of Rice Milling Technology adoption and up-gradation. The performance of Rice mill in terms of Milled Rice recovery and quality, not only depends on the type or the condition of the equipment but also on the quality of rough rice (paddy) to be converted into milled rice.

Day-by-day the demand of milled rice is increasing at a faster rate, so to meet the demand a need of huge tonnes of production also there. Improved technology, modern machinery with an assure capital can bring a revolution in this sector.

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PALLI SIKSHA BHAVANA
(Institute of Agriculture)
VISVA-BHARATI

AN ASSIGNMENT ON

PULSE CULTIVATION IN RICE FALLOW -A SCOPE TOWARDS IMPROVING NUTRITION AND INCOME OF MARGINAL FARMERS

[RAWE 01-CROP PRODUCTION(village attachment)]

Guided By:

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Palli siksha bhavana

Submitted by

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Roll no- 37

Semester-VIII

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Sk.MD.Ajaharuddin

ROLL NO- BAG(Sem-VIII)-37

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Pulse cultivation in rice- fallow a scope towards improving nutrition and income of marginal farmers.

INTRODUCTION

Pulses in India have long been considered as the poor man's only source of protein. Pulses are grown on 22-24 million hectares of area with an annual production of 18-19 million tonnes during last 3-4 years India accounts for 33% of the world area and 22% of the world production of pulses. The major pulse crops grown in India are chickpea, pigeonpea, lentil, moongbean, urdbean and fieldpea. About 90% of the global pigeonpea, 65% of chickpea and 37% of lentil area falls in India, corresponding to 93%, 68% and 32% of the global production, respectively. Madhya Pradesh, Maharashtra, UttarPradesh, Andhra Pradesh, Karnataka and Rajasthan are the major pulse growing states in India. These six states contribute about 80% of total pulse production and area.

Growing rice is the predominant activity for rural communities during the kharif season in most parts of country. About 44 million hectares of land is under the cultivation of rice across the country. On an average11.7 million hectares of this area remains fallow during rabi season due to a variety of biotic, abiotic and socio-economic constraints prevailing in these areas. Continuous cultivation of rice in the rice fallows areas causes disturbance in the ecology of the system. Incorporation of pulses improves the soil quality in terms of nutrient dynamics, soil organic carbon and biological activities thereby

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increasing nutritional security and improving sustainability of cropping system. Pulses are the ideal crops that can be grown in the areas vacated after rice, because of their property to establish with the surface seeding and suitability for relay/paira cropping and resistance against soil moisture and temperature stress. Traditionally pulses have been considered important elements of cropping systems. They were popular because of their importance as a source of protein and ability to fix atmospheric nitrogen (N) and thus improve soil fertility .

Legumes are effective source of reversing the process and can contribute significantly to achieving the twin objectives of increasing productivity and improving the sustainability of the cereal based cropping system. Pulse crops suitable for rice fallow areas are lentil,lathyrus, urdbean, mungbean and chickpea. A number of abiotic factors (water and soil related) limit their production in rice fallows. Low moisture content in the soil after rice harvest, faster decline in water table with advancement of rabi season, and risk of soil moisture stress towards flowering and pod filling stages are some of the water related constraints. As pulses are grown after rice on residual moisture, a good rainfall towards terminal period of rice crop provides sufficient moisture for germination and establishment of the pulse crops. During the kharif season water table is generally high but as the monsoon rains withdraw, the water table recedes very fast. Even if the crop gets well established utilizing available soil moisture, lack of rabi rainfall towards flowering stage creates drought conditions leading to crop failure. Terminal drought at pod filling stage adversely affects photosynthesis and translocation of food from source to sink. Thus, the stress developed during pod filling adversely affects the grain yield of the crop. The soil physical constraints following harvest of rice usually present a hostile environment to legume germination and establishment.

Soil Characteristics of Rice-Fallow Agro-Ecosystem:

Rice fallows in the eastern region of India including states of eastern Uttar Pradesh, Bihar, Odisha, West Bengal and Assam have alluvial and calcareous soil which is deficit in organic carbon, phosphorus, zinc and has excessive soil moisture content after rice harvest. In the rice fallows of Central India including areas of Chhattisgarh, Madhya Pradesh and Maharashtra the soil is generally clayey, very hard and develops deep cracks when dried. The soil in these areas also witnesses poor nutrient availability along with severe moisture stress towards reproductive stages of rabi crops.The coastal India comprising of regions of Tamil Nadu, Karnataka and Andhra Pradesh have excessive soil moisture during sowing of pulses and soil moisture stress at reproductive stages. The soil is deltaic alluvial, coastal alluvial, laterite and loamy with pH between 5.0-8.0. The presence of deltaic alluvial soil makes the land very fertile and enriched with potassium, which is an integral macronutrient required by the plant.

Production Constraints of Rice-Fallows

A number of biotic and abiotic factors such as poor crop management practices, lack of awareness about modern methods of cultivation including quality seed of high yielding varieties and integrated pest management and poor linkage to market and government support price policies mostly referred to as production constraints which affect the pulse yield adversely and hence, needs a special attention so as the growing demand region can be met. Abiotic and biotic stresses faced by pulses in rice fallows are summarized below. Some of the important production constraints of rice-fallows are as follows:

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(i) Lack of improved varieties and quality seeds

Majority of the pulse areas are characterized by the resource poor farmers growing traditional varieties with very low or no inputs in high risk conditions. Due to limited success in developing suitable pulse varieties against prevailing natural and climatic conditions of rice-fallows viz. drought, soil salinity, low input supply, surface seeding,etc., these areas have not been benefited much even after four decades of Green Revolution. Sciensists found that the variety management package resulted in an average 93% yield increase over the prevailing traditional system.

(ii) Poor plant stand

The first step in this dir ection is identification of various productions that limits required plant population of pulses in rice-fallows.Under relay (utera) cropping, plant population is often low due to poor seedling emergence on account of compact soil, poor contact of seed with soil and higher soil moisture in surface layer. Sometimes seed rotting is observed due to excessive moisture. Rice harvesting through combine harvester in relay cropping also resulted in seedling mortality to the extentof 10-15 percent. Pulses sown after rice under zero tillage is also affecteddue to improper seed dropping in presence of stubbles and fast drying of surface soil.

(iii) Weed

Weeds are other important constraint as they compete with the pulse crop for limited soil moisture and lead to a substantial loss in production. Weeds are a serious problem under relay cropping as there is no land preparation. Application of pre-emergence herbicide is also not possible due to standing rice crop. Hand weeding is a difficult proposition due to fast drying of soil surface. In many areas, cuscuta infestation is also associated with urdbean and mungbean. Use of pre-

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emergence or pre-plant herbicides is not feasible under these conditions. As far as pulse production is concerned, yield loss due to uncontrolled weed growth may be as high as 62 to 75%. Ratooning of rice after harvest is another major problem in rice fallow relay cropping system in many parts of the country. Therefore, efficient practices need to be developed for weeds and rice ratoon management in this system.

(iv) No use of fertilizers

In rice fallows, generally no manure or fertilizer is applied due to no-tillage practice under relay planting, and consequently the crops suffer due to nutrient stress. Further, the physical condition of soil is poor due to puddled rice and consequently nutrient mobilization is reduced. Due to puddling for transplanting of rice and anaerobic conditions, rhizobial populations are considerably reduced which limit biological N2 fixation. In addition, the mono cropped rice cultivation also creates nutrient imbalance in the soil.

(v) Terminal drought

In rabi season there is a reasonably lesser amount of rainfall received and the crops solely depend upon the residual soil moisture after harvest of rice. After harvest of rice soil moisture content gradually declines causing mid and terminal drought during the flowering stages and early pod filling stage which adversely affects the productivity of pulses in rice fallows sometimes causes 50% reduction in seed yield.

(vi) Disease

Occurrence of various diseases in pulses is very common in many parts of country. Powdery mildew is a serious disease of rabi planted urdbean and mungbean in coastal peninsula. Similarly, rust and Fusarium wilt are common in lentil. In chickpea, dry root rot and wilt in central zone, and Botrytis grey mold and collar rot in eastern plains cause severe losses. This implies that before introduction of new crops in rice fallow areas it is important to consider the potential damages due to diseases, and accordingly the varieties that are resistant to these diseases should be recommended.

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(vii) Insect pest

More than 250 insect species are reported to affect pulses in India. Among these, nearly one dozen cause heavy crop losses. On an average 2-2.4 million tonnes of pulses with a monetary value of nearly Rs 6,000 crore are lost annually due to ravages of insect pest complex. Among them, pod borer (Helicoverpa armigera) causes the most harm, followed by podfly, wilt and root rot. Important pests affecting pulses are the nematodes, wherein root-knot nematodes are known to cause damage to crop yield. However, these pests can be controlled effectively by using bio agents(seed treatment with Trichoderma sp.) and chemicals. In rice fallow areas of peninsular India, urdbean and mungbean are susceptible to mungbean yellow mosaic virus (MYMV), besides they are susceptible to powdery mildew, cercospora leaf spot and also to leaf curl virus. Integrated pest management gives a wider scope for cost effective control of multiple pests and diseases.

(viii) Delayed planting

In rice fallows, planting is dependent upon duration of rice varieties,withdrawal of monsoonal rains and soil moisture status which are highly variable. Delay in transplanting of long duration rice is a common featurewhich lead to late harvest of rice and late sowing of pulses under rice fallows. So there is need to develop or introduce short duration verities ofboth rice and pulses that can help to escape pulses from terminal drought.Thus, promotion of early sowing of early rice will facilitate timely sowing of the rabi pulse crops on residual soil moisture.

(ix) Uncertain rainfall

As a rabi crops in rice fallows system grown on residual soil moisture under rainfed after rice harvest, a good rainfall towards terminal period of rice crop provide sufficient moisture for germination and establishment of the next pulse crop. During kharif season water table is generally high but as the monsoon withdraws, the water table recedes very fast. This restricts investment in irrigation for rabi crops. Further, rabi /winter season rainfall is uncertain and even if the crop has established well utilizing available soil moisture, lack of rabi season rainfall towards growth and reproductive stage creates mid or terminal drought condition leading to crop failure.

(x) Soil constraints of rice-fallows

Soil related constraints include soil hardiness after harvest of puddle rice, soil cracking at drying, low organic matter content in soil and problem of soil salinity and alkalinity. Among these, soil hardiness is the most limiting factor, followed by low organic matter content in the soil. Continuous growing of rice after rice also resulted in deficiency of many important nutrients. Soil hardiness due to puddling hinders germination of surface seeded pulse crop under rice relay cropping.

(xi) Socio-economic constraints

Lack of knowledge, non availability of improved seed, poor technical guidance were few economic institutional constraints while seed storage, poor irrigation and poor marketing were socio economic infrastructural constraints in pulses production. Public extension system is weak to effectively deliver technologies, inputs and recent information to the farmers. Improving farmer’s access to information related to crops and their cultivation practices is important in process of utilization of rice-fallows areas. Farmers lack proper information and

sufficient capital to purchase suitable high yielding and disease resistant varieties, fertilizer and pesticides. Non-availability of these inputs on time, lack of awareness about the improved crop management and post-harvest technologies are the major hindrances in the cultivation of pulse crops in rice fallow areas.

PROSPECTS OF PULSES IN RICE-FALLOWS

A considerable area (about 11.7 m ha) remains fallow after rice harvest, of which >75% area lies in the states like, Assam, Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, West Bengal and North Eastern states and the remaining area in the states like Tamil Nadu, Karnataka and Andhra Pradesh and there exists a scope for expansion of area under pulse crops. Pulses like lentil, chickpea, and black gram may prove as ideal crops under these areas. Traditionally, lathyrus and lentil are sown after rice under relay cropping in low land rice fields of Bihar, eastern Uttar Pradesh and Chhattisgarh, and urd bean / mung bean in coastal peninsula. In recent years, other crops like maize, groundnut etc. are being introduced. India will become self-sufficient in pulses production if one-third of rice-fallow area is brought under pulses cultivation through innovative soil moisture and crop management approaches. Pulses are well known for their role in overall improvement of soil health, system productivity and sustainability. They are also performing well under conservation tillage in rainfed agro-ecosystem of rice-fallows. Therefore, overall productivity and sustainability of the system will improve with inclusion of pulses in rice fallows.

(a) Pulses in soil health improvement

Continuous growing of rice after rice in rice-fallow exerts a negative effect on the soil health. Inclusion of pulses in rice-fallows or cereal based cropping sequences reduces dependence on the requirement for N-supply through chemical fertilizers. Pulses act as a soil conditioner and enrich the soil health by enhancing the soil biological and physico-chemical properties. Amount of atmospheric nitrogen is fixed by pulses root-microbial association, part of this fixed. The fertilizer replacement of various leguminous crops has been reported to vary between 30-80 kg/ha. Pulses contribute to an increased diversity of soil flora and fauna lending a greater stability to the total life of soil. They also foster production of a greater total biomass in

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soil by providing additional N. Soil microbes use the increased N to break down carbon rich residues of crops. The improvement in soil structure is attributed to increase in more stable soil aggregates. Thus, pulses improve the soil physical, chemical and biological properties (biota population, efficiency and synergy, microbial biomass) of soil. Pulses also release organic acids in soil, thereby mobilizing un-available soil nutrients. They also add to the easily decomposable organic matter by leaf fall, root biomass and other crop residues.

(b) Pulses in conservation agriculture

Pulses are considered as hardy crops which can thrive better than many crops under adverse conditions, thus have immense value in Conservation Agriculture (CA). Inclusion of pulses in cereal based crop rotations enhances inputs use efficiencies and hence considered as one of the resource conservation technologies. The basic principles of CA such least disturbance of soil, retention of organic cover on soil surface and crop rotation are met while bringing legumes in production system. Some of the conservation agriculture related values of pulses are as follows:-

- Pulses do not need fine seedbed; they perform well on rough seedbeds with good aeration. Pulses like lentil, lathyrus, urd bean and mung bean are amenable for surface broadcast in rice fallows before rice harvest and under conservation tillage seeding through zero till ferti-seed. Pulses are deep rooted crops which even sometimes break hard pan formed at plough zone.

- Water requirement of most of pulses is lower than cereals, hence these are good candidate under rainfed agriculture water consumption by cereals is > 50% as against <5% in pulses. Pulses have ability to use water more efficiently than other crops due to their morphological and physiological features. Due to their deep root system, pulses are able to draw moisture from deeper layer of soil profile there by having ability to thrive well under dry land situations. By consuming 1 ha-mm of water, chickpea could produce about 12.5 kg grain as against 7 kg in wheat and 2.5 kg in rice.

Cover crops are fast growing crops grown primarily to improve soil quality and suppressing weeds, diseases and pests. Cover crops are of Conservation Agriculture for Advancing Food Security in Changing Climate, interest in conservation agriculture as many of them improve the sustainability of agro-ecosystem attributes. Short growing pulses like cowpea, mung bean, urd bean, horse gram, etc. develop huge biomass and dense canopy in a short period and provide good cover to soil, thereby protecting against wind and water erosion, improving soil quality and reducing run-off. It also suppresses weeds growth by fast covering of ground thus, giving competition to the weed plants for space, light and nutrients.

Diversification of agricultural production system is essential to ensure reliable farm income and to generate employment in agriculture. The ill-effect of continuous cereals cultivation especially rice-rice in rice fallows and rice-wheat in Indo-Gangetic plains has shown increase in number of nutrients deficient in soil and thus do not have enough reserve of plant nutrients to support proper plant growth and development. Pulses on account of their short duration and ability to thrive better than other crops under harsh climate and fragile ecosystems are best candidate under rainfed agro-ecosystem. Thus, inclusion of pulses in rice-fallows not only increases the cropping intensity but also ameliorate the overall soil health.

Being deep rooted crops, pulses have ability to recycle crop nutrients that are deep in soil profile resulting in more efficient use of applied fertilizer and minimizes loss of nutrient particularly nitrate below root zone of shallow rooted crops in rotation. The association of pulses roots with VAM helps in increasing availability of nutrients and water to crop plants. Pulses add organic manure through leaf fall, root biomass and easily degradable crop residue. Pulse crops also releases organic acids in soil, thereby mobilizing un-available soil nutrients.

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Pulses also respond to residue incorporation in system. In rice-chickpea sequence, yield of chickpea was significantly influenced by rice-residue incorporation and highest seed yield was obtained within corporation of chopped straw plus irrigation, while lowest yield was obtained in rice residue removal treatment. Similar results were also observed with incorporation of mung bean residue in succeeding cereal crops.

Pulses not only provide an excellent cover to soil surface due to their dense canopy but also leave substantial amount of easily decomposable crop residue. Thus, soil degradation through erosion can be checked, if pulses are included in cereal based cropping under conservation agriculture.

STRATEGIES FOR PROMOTING PULSES IN RICE FALLOW

a) North Eastern (NE) Region of India

Despite immense importance of pulses in human and animal nutrition, the share of north-eastern region in the total pulse area of Indiais too low (0.97%) and this region contributes only 256.00 thousand tonnes(1.20 %) in all India Pulse Production. Within NE Region, most of the pulse area is occupied by Assam with 58% share in production. After Assam, Nagaland and Manipur are major pulse growing states with37.8 and 30.38 thousand hectares of area and 42.50 and 28.65 thousand tonnes of production, respectively. In Meghalaya, pulses were grown on7.90 thousand ha area and 10.99 thousand tonnes of pulses were harvested in 2013-14.Cropping intensity in the region is also very low (134%) because of mono-cropping of cereal crops like maize, rice and rhizome crops like ginger and turmeric. Cultivation of pulses in north east region under rice-fallows assumes greater significance in view of increasing demand for pulses and their role in soil fertility build up and reducing soil erosion. Most of the pulses are

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of short duration will also be useful in increasing the cropping intensity. The major pulses that can be grown under rice-fallows in the region are French bean (Phaseolus vulgaris), chickpea (Cicer arietinum), lentil (L. culinaris) and field pea (Pisum sativum).Thus, there is great scope available for promotion of different pulses in these states.

b) Eastern India

Rice is the major crop grown over an area of >16 m ha in eastern states comprising Bihar, Chhattisgarh, Jharkhand, Odisha and West Bengal.About 45% of kharif rice area remains fallow during subsequent rabi/winterseason due to various reasons such as cultivation of long-duration paddy varieties, water logging and excessive moisture in Tal areas, lack of moisture at planting time of winter crops, lack of irrigation, non-availability of seeds of short duration varieties of rabi pulses and other socio-economic problems like stray cattle and blue bulls. Mono-cropping system with low yield of paddy of 1856 kg/ha in comparison to highest yield of 3838 kg/ha of Punjab and national average of 2390 kg/ha (2014-15) is attributing to low agricultural profitability in the region. To exploit these rice fallow areas with pulses, location specific and economically viable technology for better performances of pulses are required to be standardized through proper understanding of the system ecology and constraints study. This effort should have strong research support to deliver appropriate varieties and matching crop management technology suited to rice fallow cultivation.Short-duration varieties of pulses like lentil, mungbean, urdbean, lathyrusand field peas could be profitably cultivated under Utera cultivation (relay cropping) in rabi season in rice fallows in eastern India. In low land areas with excessive soil moisture, lentil may be more suitable. Rice-lentil system can be popularized in the lowland areas of Bihar, Jharkhand, Eastern UttarPradesh and West Bengal. Lathyrus can be promoted under relay croppingin Chhattisgarh, West Bengal and Bihar, whereas urdbean and mungbeanin Odisha. Acidic soils are also observed in

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some of the parts of this region.Therefore, liming can be promoted for good harvest of pulse crops.

Central india:

Rice- fallow a reas of Madhya Pradesh, Chhattisgarh and Maharashtra are coming under this region. Chickpea, lentil and lathyrus are common rabi crops of central India. Lathyrus and lentil are generally grown under relay cropping. The productivity of pulses under rice-fallows in this region is very poor (200-400 kg/ha). Soils in these regions are generally medium black, red laterite, deep black and black, mixed red and black with pockets of acidic and saline soils with pH 5.0 to 8.0. These soils are generally deficient in nitrogen, organic matter and calcium; laterite soils are usually low in nutrient status, organic matter, poor water holding capacity and strongly acidic. More than 90% of lentil and 38% of chickpea area is covered in this region.

d) Southern India

Rice-fallows area in this region lies in states of Tamil Nadu, Andhra Pradesh and Karnataka. The rice fallow pulses area fluctuated in the Delta districts of Tamil Nadu depending upon the previous monsoon season single crop paddy (Samba) which is normally based on the release pattern of canal water from river Cauvery. As rice-fallow pulse is a potential crop in Cauvery Delta Zone, appropriate management of these crops will not only increase the production and productivity but also pave ways for bringing additional area of 2.20 lakh/ha under rice-fallow pulses against the present area of 2.96 lakh/ ha accounting a total area of 5.16 lakh/ ha in Wet (Samba)season. Urdbean is major crop under rice fallow in these regions. Short duration varieties like ADT 3 in combination with appropriate agro-techniques need to be popularised in in the rice fallows.

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TECHNOLOGY FOR IMPROVING PULSES PRODUCTIVITY IN RICE-FALLOWS:

There is a need to develop high yielding and early maturing varieties of pulse crops with wide adaptability especially under rice-fallow conditions which can be a major technological advancement for sustaining pulse production in the country. Using improved varieties will also reduce the problem of low productivity. Fast growing and early vigour pulses varieties which can establish even under surface seeding are most suitable for rice-fallows. The fast growing varieties can effectively utilize residual soil moisture for their growth and development. In other hand, early maturing varieties can minimize total crop water requirement which help in escaping commonly occurring mid and terminal season drought. Under para-cropping system, pelleting of seeds with super phosphate and rhizobium culture improves the establishment, nodulation and grain yield of pulses in rice fallows. Generally the soils of rice-fallow regions are poor in N, P, Mo, Zn and native rhizobia. Application of molybdenum through seed priming (at 0.5 g sodium molybdate/kg seed) increased the nodulation by 80-90% and grain yield up to 30%. Integrated management of diseases and pests including use of resistant cultivars (MYMV resistant urdbean/mungbean),use of healthy seeds, modification of cultural practices, and judicious use of chemical and bio-control agents may contribute substantially instabilizing the yields. Further development of plant ideotype for pulses that is amenable to mechanical harvesting may further improve the pulses productivity under rice-fallows. Under rainfed rice-fallows situation foliar nutrition of 2% urea/DAP and micronutrients at flowering and pod initiation, seed priming and following of conservation tillage (zero tillage with at least 1/3rd rice residue retention) can also be promoted to enhance pulses yields under rice-fallows rainfed situations.

Weeds drastically affect pulse production and the problem complexes as the habitat changes from water logged rice field to

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aerobic rainfed rice fallows. Generally under rice-fallows pulses are heavily infested with weeds of diverse nature. In order to get maximum yield benefits, the crops must be kept free from weeds. The commonly used chemical weed control measures like application of pendimethalin cannot be possible under rice-fallows relay cropping because seeding is done in standing rice Crop before harvest. Post-harvest herbicides as imazethapyr (in urdbean and mungbean only) and quizalofop -ethyl can be used for proper management of weeds. Rice ratoons are another major threat in rice-fallows. The re-growth of rice stubbles utilizes both soil nutrients and residual soil moisture. To contain the re-growth of rice stubbles quizalofop-ethyl 100 g/ha can be used at 15-20 days after sowing of pulses.

OPPORTUNITY OF MARGINAL FARMERS FOR PROMOTING PULSE CULTIVATION IN RICE FALLOW:

- Cultivation of pulses in rice fallows is an additional income of marginal farmer as it can be cultivated as a paira crop.
- As pulse crops require minimum amount of soil moisture so farmers need not to go for timely irrigation. So without extra irrigation farmer gets pulse yield. So it is a direct benefit of the marginal farmers.
- Pulse crop fixes the atmospheric nitrogen to the soil by their nodules. So the plant easily uptakes that from soil . Remaining nitrogen is used by the next crop so amount of nitrogenous fertilizer required to the soil for next crop is less. So the cost of fertilizer for next crop is reduced. It is also an indirect income of marginal farmers.

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➢ Pulses are mainly source of protein of poor people as well as vegetarians so price of pulses is relatively high with compare to other crops. So it is a good source of income of marginal farmers.

➢ Being financially week most of the marginal farmers can not have proper amount of protein required for improving their health. If these farmers cultivate pulses in rice fallows it will provide a good income as well as proper nutrition to their family.

➢ As the main cereal crop of West Bengal is rice and most of the time land remains fallow after harvesting of rice so cultivation of pulses in fallow land will provide effective income and nutrition to the marginal farmers.

CONCLUSION

Conservation and sustenance of natural resources including soil and water for increasing food production while protecting the environment is one of the most important challenges of present agriculture. As the world population grows, stress on natural resources increases, making it difficult to maintain food security. The production of pulses in the country has tremendously improved over the last few years. Pulses contain 20 – 25% vegetable protein, which

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is nearly 2-3 times of the value generally found in cereals. Despite increase in production of pulses in the country, the per capita availability decreased to about 33 g/person/day (below recommended level). Therefore, exploring new domain for enhancing pulses production either through vertical or horizontal expansion in pulses acre age is the need of the hour. In India about 11.7 m ha area remains fallow after rice due to some and other reasons. If areas of pulse cultivation in rice fallow can be increased in our country with appropriate crop planning then the poverty and malnutrition may be eradicated to a great extend. Thus, these areas can be utilized for enhancing pulses production. Due to inherent capability to fix atmospheric nitrogen into plant usable form and survival under adverse conditions of drought, pulses are best alternative under rice-fallows areas of country. Thus, promotion of pulses in rice-fallows may enhance pulses production to the extent to meet out the nutritional demand of the country as well as a good source of income of marginal farmers. There are so many projects going on to improve the pulse production in rice fallow system by ICAR, ICRISAT and others organizations. So to ensure the income of marginal farmers and improving nutritional securities in our county government must take so many necessary steps regarding more pulse cultivation in rice fallow system in near future.

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THANKING YOU

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Rawe- 05

A COMPREHENSIVE REPORT ON ENTIRE RAWE-05 PROGRAMME

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Sem- VIII

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Sriniketan

Year-2020

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INTRODUCTION: WHAT IS RAWE PROGRAMME

The Rural Agricultural Work Experience (RAWE) programme is an experiencial activity for the final year B.Sc. (Ag.) students during the last semester. This Programme is a sequel of the recommendation made by the 'Randhawa Committee' constituted by ICAR. Building self-confidence in the agricultural graduates by increasing their professional skills is the key objective of introducing RAWE at the under graduate level.. Accordingly, this semester-long programme has been evolved. The entire programme is split into 5 modules through which the students are exposed to the current and emerging opportunities and challenges in Agricultural and Rural Development. Besides acquiring first hand field experience, the RAWE modules bring about positive changes in the students' mindset, outlook, personality traits, managerial and entrepreneurial skills.

IMPORTANCE: WHY RAWE PROGRAMME IS INITIATED

The Rural Agricultural Work Experience (RAWE) provides exposure to agricultural students to the natural setting of the village situations, work with the farm families, identify their problems and make use of various extension tools for transferring the latest agricultural technologies. The students also get opportunity to study the various on-going schemes related to agriculture and rural development and participate in their implementation. The students were given rigorous orientation and familiarization on various issues and problems expected on farmers' field and hence gain competence and confidence for solving problems related to agriculture and allied sciences.

PERSPECTIVE OF RAWE 05 PROGRAMME

This experiential system in agricultural academic has become imperative for better training to the agricultural technocrats with high level of skill in combination with the modern out-look and management capacity. The learning process essentially provides a direction to the students to think and act and eventually creates self-confidence. Effective work experience training strategies incorporating rural agricultural experiential learning approach provide opportunities to a student to experience the fieldwork activity and to review and analyze critically his own work experience so that they prove to be useful in their real-life situation. Activities focused on intensive observations/ analysis of socio-economic and technological profile of the farm families in rural areas, participatory extension approach and acquaintance with farming situations, farm practices and interaction with progressive farmers.

OVERVIEW OF ENTIRE RAWE 05 PROGRAMME

Under the RAWE 05 programme, we experienced:

- **Visit to Krishi Vigyan Kendra (KVK)**

  We have visited Rathindra Krishi Vigyan Kendra, Sriniketan.and got knowledge about

  i. Origin and history of KVKs, ii. Features of KVKs, iii. About Rathindra Krishi Vigyan Kendra, iv. Mandate, v. Organisational structure of RKVK, vi. Management of RKVK,

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vii. Frontline Demonstration, viii. Achievements, ix. Thrust areas, x.Linkages, xi. Constraints.

- **Visit to SARF**

  We have visited the SARF, Bolpur

  i. General information about SARF, ii. Farm information, iii. Mandates, iv. Activities, v. Organizational Structure, vii. Meteorological observatory, viii. Ongoing and completed research achievements, ix. About seed production and varieties developed, x. On farm trials, xi. Technology transfer activities, xii. Extension and training activities, xiii. Financial performance, xiv. Constraints

- **Study on Community Development Block**

  I have undergone this programme at Sahid Matangini Development Block, Tamluk, Purba Medinipur.

  i.General information, ii.Demographic analysis, iii.Institutional analysis, iv.Livelihood analysis, v.Critical analysis of various development programmes, vi.Organizational structure, vii.Achievements, viii.Constraint analysis.

- **Visit to Agro-based Industry**

  I visited Bhagabati Cereals Pvt. Ltd., Bolpur-Nanoor Road, Village- Rintola Danga, Bolpur.

  i. Profile of agro-processing unit, ii. Steps of processing, iii. Economics of agro-processing unit iv. Marketing behavior of agro -processing unit , v.Risk management of agro-processing unit, vi. Constraints of agro -processing unit, vii. Evaluation of agro -processing unit.

: BRIEF ON :

VISIT TO RKVK

VISIT TO RKVK: On 21st and 22nd December, 2020, we visited the Rathindra Krishi Vigyan Kendra(RKVK), under the supervision of professor, Dr. Anindita Saha. On the first day genesis, development and functions of KVK with special reference to RKVK was illustrated by Dr. Prabuddha Roy (SMS in Agriculture Extension) . On the second day Dr. Subrata Mandal (SMS in Agronomy) gave us a detailed idea about the implementation of On-Farm trials and On-Station trials in KVK system.

GENESIS OF RKVK: Rathindra Krishi Vigyan Kendra (RKVK) , Palli Siksha Bhavana, Visva Bharati was the first KVK in India,. RKVK was established on 4th October,1994 sponsored by Indian Council of Agricultural Research, New Delhi. The KVK is named after Rathindranath Tagore, who was the first agricultural gradute of India. The foundation stone of Rathindra Krishi Vigyan Kendra (RKVK) was laid out by late Dr. Shankar Dayal Sharma, Former Hon'ble President of India. Rathindranath was the first Vice-Chancellor of RKVK.

DISCUSSION ABOUT RKVK AND OBSERVATIONS OVER THERE: The visit to RKVK gives us the preliminary information on KVK, it's mandates, features, achievements, publications, drawbacks, etc. Discussion with the subject matter specialist (SMS) has helped the students to know the multi-disciplinary approach of RKVKsince its inception in 1994 and studied the detail activities of it during recent past.. During the visit to farm, students have seen soil and water testing laboratory, mango orchard, guava orchard, azolla unit, pulse breeding plots, oilseed breeding plots, vermicompost unit, medicinal plants unit, on-farm trial plots, poultry unit, portable fish breeding unit, etc. we learnt about On farm research, Frontline demonstrations, which are carried out by RKVK and the dissemination of technologies were learned from the SMS. Rathindra Krishi Vigyan Kendra conduct vocational training programmes for practising farmers, farm women and rural youths covering beneficiaries of different castes. For field level extension functionaries, the Kendra organise different training programmes. The Agronomy section of Rathindra Krishi Vigyan Kendra conducts Front Line Demonstration on oilseeds and pulses. The Kendra produced Paddy seeds and sell among the farmers as Truthfully Labelled Seeds. Tissue culture banana suckers were distributed among the farmers by this kendra for extensive cultivation. Moreover, the establishment of "Seed Village" and "Fish Club"We got to know about the organizational structure aong with it's staff structure.

Visit to RKVK, Sriniketan

KNOWLEDGE GATHERED: RKVK helps in providing employment to the rural people and provides training to individuals so that they can test the soil whether suitable for cultivation or not. Through these training programmes it has opened new income source and solved the problems of farmers also. With the utilization of hostel facilities the jobless youths are encouraged. The visit to KVK has helped a lot in getting knowledge regarding the genesis of the KVK and also how it has grown and developed in the years. Inspite of having many constraints RKVK is successfully contribution to the development of agriculture in consultance with ICAR. The visit to KVK has helped a lot in getting knowledge regarding the genesis of the KVK and also how it has grown and developed in the years.KVK plays an integral part in development of agricultural sector in our country.

VISIT TO SARF, BOLPUR

VISIT TO SARF: We visited the Sub Divisional Adaptive Research Farm (SARF), at Bolpur on 9th and 10th of January under the guidance of Dr. Anindita Saha and respected Koyel Bramha, the present ADA of Bolpur-Sriniketan Block awared us about different activities of the SARF.

FARM INFORMATION: This is an adaptive research farm under the Department of Agriculture, Govt. of West Bengal, managed by Assistant Director of Agriculture. In Birbhum district, there are 3 sub-divisions viz. Rampurhat, Suri Sadar, and Bolpur-Sriniketan. In each Sub-division there is one Sub-divisional adaptive research farm.

Topic	Relevant Information
Total Geographic area of the farm	25 Acre
Net available area of cultivation	16.63 Acre
Net cultivated area	7.757 Acre
Source of irrigation	Farm pond
No. of farm pond	1 Large and 1 Small (Not used for irrigation purpose as water retention capacity is very low)
Irrigated area	1.5 Acre
Average cropping intensity	151.9%
Area allotted to agricultural marketing and food department	5 acres+3 acres= 8 Acres

OBSERVATIONS OVER THERE:

We got to know about the Organizational structure of the SARF. We visited the research farm and gathered knowledge about the ongoing research activities including cropping pattern, organic farming, soil health management, aromatic rice production, system of assured rice production (SUDHA method or SARP) , etc.

❖ **Available implements**:

- ✓ Power tiller
- ✓ Power reaper
- ✓ Paddy thresher
- ✓ Wheat thresher
- ✓ Winnower cum thresher
- ✓ Seedling transplanter (6 row)
- ✓ Seed processing unit
- ✓ Zero till seed drill machine
- ✓ Power sprayer
- ✓ Submersible

SEEDLING TRANSPLANTER

PADDY THRESHER

WHEAT THRESHER

THRESHER CUM WINNOWER

VARIOUS IMPLEMENTS

❖ At **Agro-meteorological observatory** recording of different weather elements/parameters at stipulated time interval is done. When the observations are recorded for a sufficiently long time and analyzed statistically, reliable crop-weather relations can be obtained. The list of instruments which we came to know are-

- Campbell Strokes Sunshine Recorder
- Anemometer
- Wind vane

- Stevenson Screen
- Rain Gauge
- Self-recording Rain Gauge
- Dew Gauge

Anemometer

Wind vane

Sunshine Recorder

Graph of Self-recording Rain Gauge

Hygrometer

Stevenson Screen

Dew Gauge

Rain Gauge

Self-recording Rain Gauge

At **Agro-meteorological observatory**

❖ Ongoing seed production of some crops

Crop	variety	Sown seed class	Produced seed class	Sowing time
Rapeseed-Mustard	Binoy (B-9);	Foundation seed	Certified seed	Last week of November
Lentil	WBL-77	Foundation seed	Certified seed	15th November
Lathyrus	Nirmal	Certified seed	Truthfully labeled seed	Last week of October **(Paira cropping)**

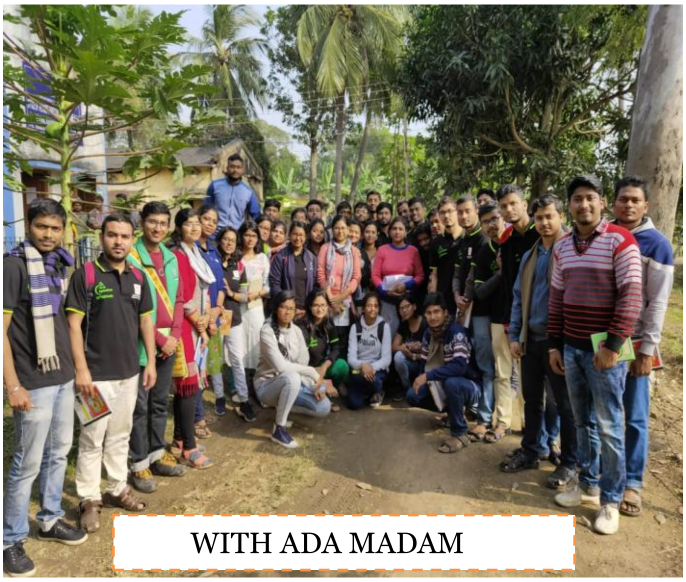
ACTIVITIES OF SARF:

- This research farm serves the need of agricultural research and transfer of technology in Red and Lateritic Zone of West Bengal.
- Farmers problem are reported and possible solutions are provided.
- Seed distribution to the farmers
- Farmers are referred to other departments if the problem can not be solved.


LATHYRUS PAIRA CROP


SEED PLOT OF RAPESEED

EXPERIENCE GATHERED: Within only two days, the elementary functions of SARF have been beautifully described by respected Madam Koyel Bramha and Sir Subir Ranjan Maity. We learned how the field trials are consucted to check the suitability of released variety under tropical climatic condition. We came to know about the seed production techniques for different crops. The most important activity is SARP, which is introduced few years ago and responded very well to the farmers of this area under Bolpur Sriniketan block. We received a clear picture of different agrometereological instruments, their uses, their installation and the procedure of taking readings. We observed different farm equipments machineries and came to know about their functions. We observed that the farm pond was not filled with water which


WITH ADA MADAM

indicated the lack of adequate rainfall this year. We felt the difference between our theoretical knowledge and actual practical situations. The crops in seed plots showed quite different image than the bookish knowledge. ADA madam herself took some real life practical situations of field and made us understand how to fill the gap between organizational structure and the farmers .

STUDY ON CDB, SAHID MATANGINI BLOCK, PURBA MEDINIPUR

Sahid Matangini is a community development block that forms an administrative division in Tamluk subdivision of Purba Medinipur district in the Indian state of West Bengal.

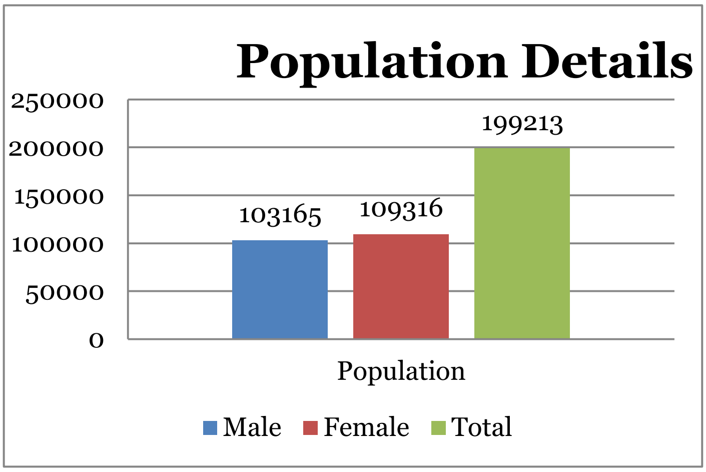
The block is named after Matangini Hazra, an independence activist. She was born in Hogla village in what is now Sahid Matangini block, in 1869. She was shot dead by the police in front of Tamluk Police Station on 29 September 1942.

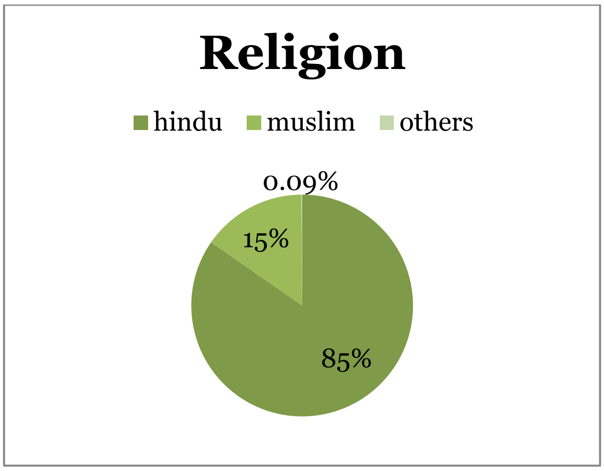
I visited the Sahid Matangini Development Block on 24/01/2020 to gather necessary data and practical knowledge about the workings of the block and the various aspects of the community development carried out in the block. I would also like to expand my special gratitude to Mr. Suman Samanta BDO of Sahid Matangini Block Development Office, Dr. Snehangshu Sekhar Nayek, ADA of Sahid Matangini Block Development Office for their cordial behavior and helped us to know about the activities under the block.

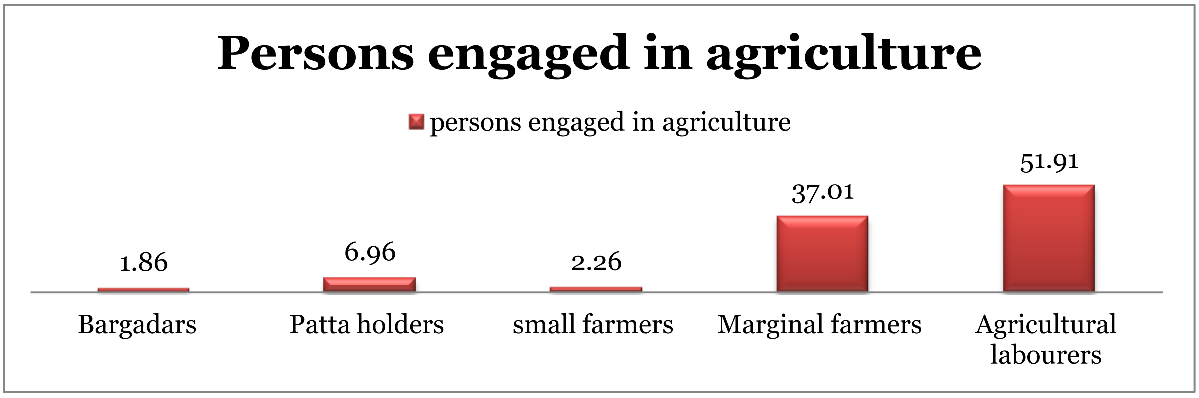
DATA COLLECTION: The data was collected on different aspects like demography, institutions, agriculture, horticulture, animal husbandry, fisheries, ongoing rural development programmes, NGOs, self-help groups and cooperative societies. I have also collected detailed information regarding various activities, working pattern, administrative structure, constraints, target and achievement of different line departments of State Government. I have learnt about the institutional issues and linkage mechanisms among various line departments. It was a great field level experience and survey that helped us even in our capacity building and rapport building abilities. It gave an idea that how a community development block works.

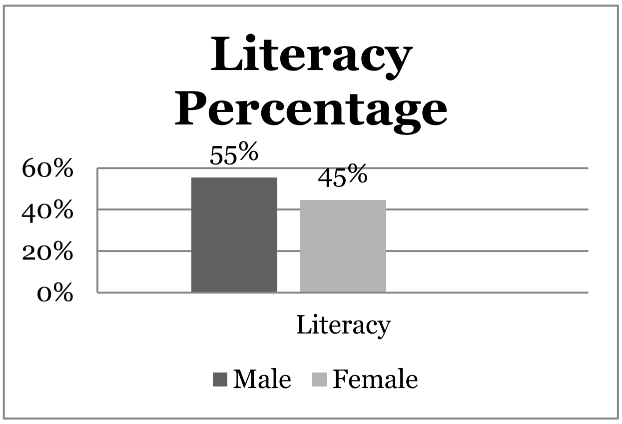
Sl. No.	Name of Programme	Target	Achievement
Agriculture			
1.	NFSM	-	Ongoing
2.	PMKSY/BKSY	-	Ongoing
3.	ATMA	-	Ongoing
Animal Husbandry			
1.	Rural Backyard Poultry Development	2200	On progress
2.	Livelihood Development through rearing of sheep and goat	Vaccination of FMD	On progress

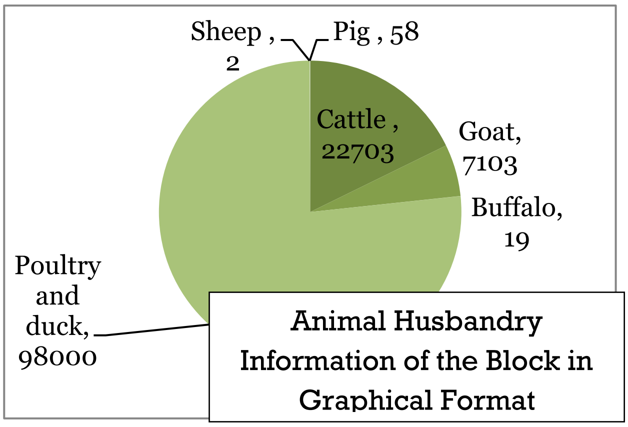
3.	NADCP	Ongoing











EXPERIENCE GATHERED: After visiting the developmental institution of Sahid Matangini Development Block and discussion with officers we understand the present situation and corresponding problems related to production, yield, soil type, different social, cultural, educational, religious institutions, their activities, youth clubs, banks, demographic information, population, literacy percentage, etc. under the block. In this regards we can say that many developmental works are carrying out by different Dept. Implementation of developmental programmes like ATMA,

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PMKSY, MGNREGA, NFSM, NADCP are at its desirable level. Fertility problem is not constraint here as the cropping pattern is rice followed by pulses or oilseeds. Livestock scenario of this Block indicates that for rearing of animals and poultry there are certain schemes going on for vaccination of the animals and birds along with AI facility, cryopreservation system. Rural and cottage industries are flourishing day by day. Agricultural activities are being upgraded day by day through adoption of new technology and implements. Co-ordination among all departments is very good which leads to successful development activities.

Visit to community development block

VISIT TO AGRO-BASED INDUSTRY

Agro processing industries are beneficial to relieve pressure on land, establish linkages between agriculture and industry, increase employment opportunities, improve the economic well-being of rural people by increasing their income, and to prevent migration of rural people to cities, which increases slums. The Indian food processing industry holds tremendous potential to grow, considering the still nascent levels of processing at present. Though India's agricultural production base is reasonably strong, wastage of agricultural produce is sizeable. Majority of the people in our country are those living below poverty line and earn their livelihood from agriculture and other related activities. The aim is to minimize agricultural wastage through proper post harvest handling. It is necessary to pay greater emphasis on the problems faced by agro based units through well furnished governmental policy.

For the visit to an agro-processing industry I went to Bhagabati Cereals Private Ltd. at Bolpur-Nanoor Road, Village- Rintola Danga, PO.-Sian-Bolpur, DT- Birbhum. I paid a visit on one of the working days. The owner Abhishek Ghosh was highly cooperative and made sure that he explained all the process of rice milling in details.

OBSERVATIONS OVER THERE:

I have studied the organizational structure (staffing), functioning (production, processing, marketing), managerial aspects, etc.

Implements & Machineries: Cleaner, Rubber roller, Boiler, parboiler, steam drier, dehusker, polisher, colour sorter, grading machineries, tractor.

Different products : brown rice, white rice (single boil rice , double boil rice, steam rice, raw rice)

Bi-products: rice bran , broken rice

PROCESSING DETAILS:

Milling is a crucial step in post-production of rice. The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities.

Depending on the requirements of the customer, the rice should have a minimum number of broken kernels.

A rice milling system can be a simple one or two step process, or a multi stage process.

1. One step milling - husk and bran removal are done in one pass

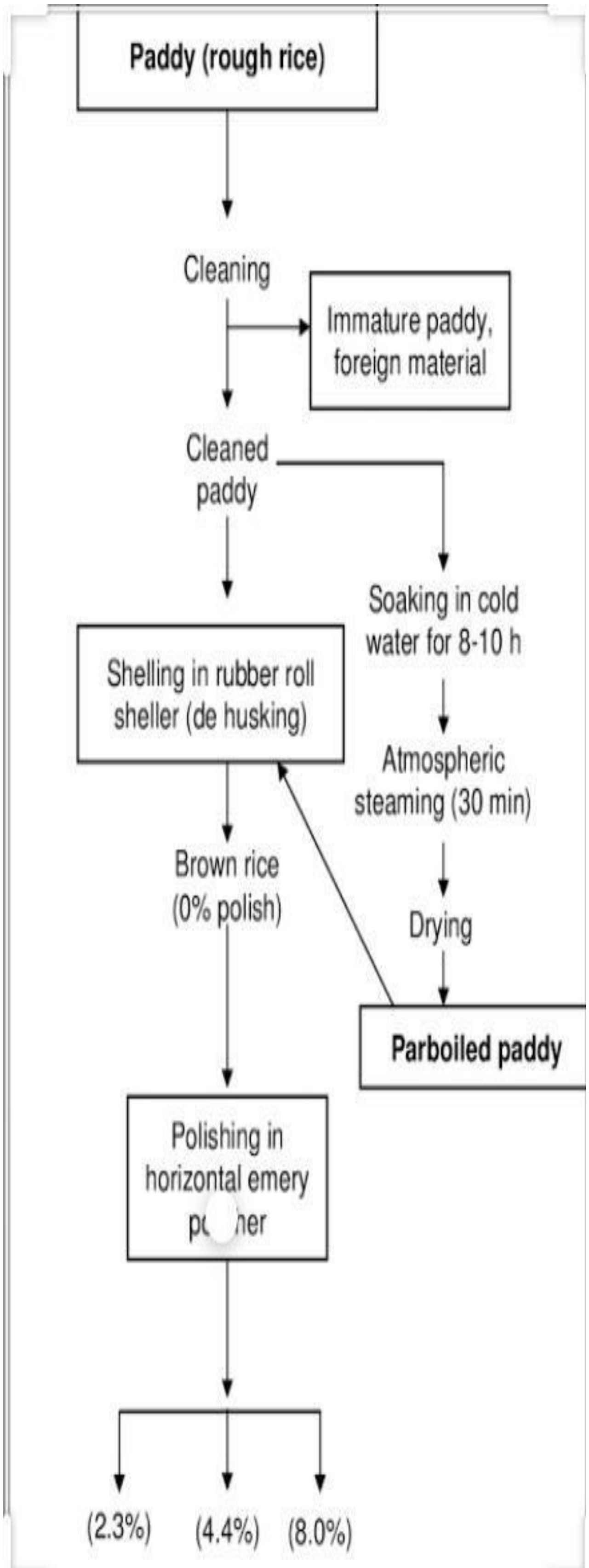
2. Two step process - removing husk and removing bran are done separately

3. Multistage milling - can be done in the **village** or local consumption or **commercially** for marketing rice; rice undergoes a number of different processing steps, such as:

STEPS:

I. Pre-cleaning
II. Parboiling
III. Drying
IV. Milling

(a) Precleaning
(b) Destoning
(c) Dehusking or dehulling
(d) Paddy separation
(e) Whitening or polishing
(f) Colour sorting
(g) Grading and separation of white rice (4-5 % broken rice)



STRATEGY : The industry strategy is to minimizing production cost and maximizing quality produce by inclusion of modern developed technologies and machineries like LSU drier, colour sorter, steam drier, destoner, parboiling technique, etc; to maintain the status of the industry as 'profitable'. Some other mills near that mill became closed due to excessive increase in production cost and decrease in selling price of processed product , due to lack of proper technology and modern machineries.

EXPERIENCE GATHERED: It helped me to gather practical knowledge on key performances of an agroindustry and agri-business.I have visited different units of the industry and observed their functioning in association with the concerned persons and manager.. This agro-processing industry is running well with good risk management and marketing strategy.

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O building of mill


transportation


chimne to release fume


storage


Hoppers


LSU dryer


Paddy to hopper


Pre cleaning inside hopper


Whole processing


Cooling unit and fume management


Conveyer

Visit to agro-based industry

CONCLUSION

Keeping in view students' future requirement a component of experimental learning is placed to understand and identify problems of his/ her interest and field, experimental set up, taking observation and writing and documentation in the form of assignment or report. This provides several opportunities to students to learn various aspects that cannot be taught in a class room or laboratory. In order to provide such opportunities to the graduates of agricultural science, RAWE is proposed as one of the components of the syllabus. This impart analytical skills and capability to work independently.

This taught us to conceptualize, design and implement the proposed work plan. We learned to work as a team- sharing work amongst a group, and learn leadership, to solve a problem through all its stages by understanding and applying management skills. RAWE is an exposure to the principles of "learning by doing" and "seeing is believing", which provides a direction to the students to think and act on their own. It offers a direction to the students to develop their knowledge, attitude and skill to graduate out as an expert and contribute in holistic development of agriculture.

This experiential system in agricultural education has a strong potential to prepare a better agricultural technocrats with high level of skill in combination with the modern out-look and management capacity. A learner-centered approach like RAWE is proved to be a significant in building the competence and confidence of agriculture graduates and developing human resources in the field of agricultural education, research and extension in the country.

Specifically, through RAWE 05 course, we gathered knowledge about Krishi Vigyan Kendra, Community Development Block, Sub-divisional Agricultural Research Farm and Agro-processing industry. This has helped me in learning several things visiting operational institutions where actual work of research, development and functioning takes place. It helped me to understand the rural situations, status of agricultural technologies, function and importance of extension organizations, extension personnels in solving problems of farmers and improving agricultural status of the local farmers.

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STUDENTS OF LAST SEMESTER DURING RAWE 05 PROGRAMME

Acknowledgement

I would like to convey my heartfelt thanks to our respected professor Dr. Anindita Saha who gave me the golden opportunity to come up with a comprehensive report on the entire RAWE-05 programme and always gave me valuable suggestions and guidance for the completion of the assignment.

Secondly, I would like to thank the people who guided me in their institutions to gather detailed information about their institution and helped me in every possible way to complete the assignment.

Last but not the least I would like to thanks my parents, friends and all those people who have directly or indirectly helped me. Without their cooperation I would have never been able to complete the assignment.

Somdatta Achar
BAG (SEM-VIII)-39

RAWE- 01

COURSE TITLE- CROP PRODUCTION (VILLAGE ATTACHMENT)

ASSIGNMENT ON COMPARATIVE STUDY BETWEEN FARMERS' PRACTICE AND IMPROVED TECHNOLOGY ON *BORO* RICE CULTIVATION AND MEASURES TO REDUCE THE YIELD GAP

SUBMITTED BY- SOURAJIT DEY

B.SC. (AG.)HONS.

SEM- VIII

ROLL NO.- BAG (SEM-VIII)-40

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PALLI SIKSHA BHAVANA

VISVA-BHARATI, SRINIKETAN

YEAR- 2020

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ACKNOWLEDGEMENT

I would like to convey my heartfelt thanks to our respected professors Dr. Arun Kumar Barik & Dr. Narayan Chandra Mondal who gave us this golden opportunity to learn very deeply about **Comparative study between farmers' practice and improved technology on *boro* rice cultivation and measures to reduce the yield gap** and always gave me valuable suggestions and guidance for the completion for the assignment.

I would also like to express my deepest gratitude to Dr. Binoy Kumar Soren as he gave me this opportunity to present the assignment in this topic. I am also thankful to our course leader Dr. Joydip Mandal.

I also place my thanks to my friends, whose co-ordination & co-operation helped me to complete the work successfully.

I also take this opportunity to place on record my deep gratitude to my parents for their countless blessings showered on me while doing the work and to complete it and last but not the least I thank the almighty for whatever I have achieved till now.

CONTENTS

INTRODUCTION

Rice is the staple food of more than 60% of the world's population. It is the staple food of most of the people of South-Eastern Asia. Rice is the most important (ranks 1st) cereal crop in India and ranks 2nd in important worldwide. About 90% of all rice grown in the world is produced and consumed in the Asian region.

Rice is primarily a high energy or high calorie food. It contains 70% carbohydrate, 6-7% protein, 2-2.5% fat. The biological value of the protein is high.

There are different rice growing seasons in different parts of India, depending upon temperature, rainfall and other climatic conditions. There are three seasons for growing rice in India.

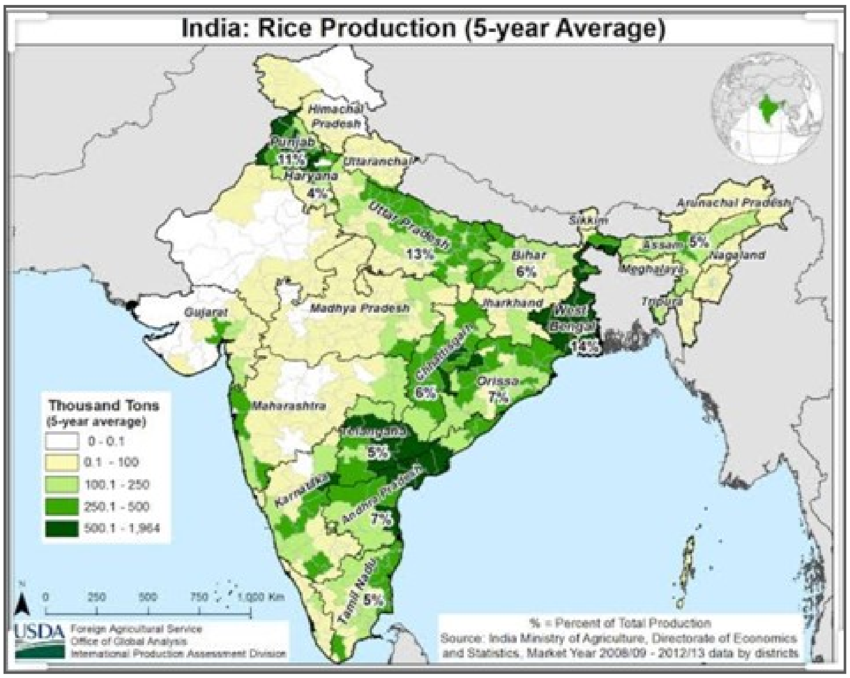

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Table1- Table showing different crop seasons with their local name, sowing time and harvest time.

Crop season	Local name	Sowing time	Harvest Time
Kharif	*Aus* (WB, Bihar)	May – June	September-October
Rabi	*Aman* or *Aghani*	June- July	November-December
Summer or Spring	*Dalua* (Orissa) or *Boro* (WB)	November- December	March-April

Source- Singh, Chhidda., Singh, Prem., Singh, Rajbir. 2018

About *Boro* Rice

Boro rice is cultivated in waterlogged, low-lying or medium lands with irrigation during November to May. This type of rice has been cultivated traditionally in river basin deltas of Bangladesh and Eastern India including Eastern U.P., Bihar, West Bengal and Assam. In these regions, water accumulates during monsoon months and cannot be drained out in winter months. This practice is spreading even to those non-traditional areas where irrigation is available.

"*Boro*" is a Bengali language word derived from a Sanskrit word "*BOROB*". This means a special type of rice cultivation on residual or stored water in low-lying areas after the harvest of *kharif* rice.

Boro rice system takes advantage of residual moisture after the harvest of *kharif* rice. Such areas with high moisture retention capacity are low-lying ditches where water is stored or gets accumulated, areas adjoining canals and roads, *Chaur*-lands/*Tal*-lands, etc. With the increase in irrigation facilities, *boro* crop is now being taken in areas outside its traditional boundaries and a new cropping system is emerging.

Boro is a winter season, photo-insensitive, transplanted rice cultivated on supplemental irrigation. This gives the farmers a chance to grow a *rabi* season crop which normally they could not grow. Rapid expansion of *boro* rice cultivation has taken place in recent years in West Bengal and Bihar, it is likely to expand further to more areas in West Bengal, adjoining areas of Assam, parts of Eastern U.P., coastal areas of Orissa and Andhra Pradesh.

WHY TO CULTIVATE *BORO* RICE?

1. Shallow water level and water logging low land can be utilized by using *boro* rice cultivation, which remains fallow in winter due to excessive moisture and late maturing rice.
2. Immense potential for improving *boro* rice yield over winter crops in low land areas.
3. *Boro* rice matures before on-set of monsoon and gets sufficient time for harvesting as compared to spring rice.
4. Good market price of *boro* rice due to offseason production.
5. Reduces risk of natural calamities like flood for main season under flood prone areas using *boro* rice cultivation.

MAJOR AREAS GROWING BORO RICE

State Districts

- **Eastern U.P.-** Ballia, Basti, Gorakhpur, Deoria, Gazipur (Lake, rivers, *nalahs,* etc.)

- **Bihar** - Purnia, Katihar, Madhepura, Madhubani, Darbhanga, Saharsha (Low-lying *chaurs* and *chauri*)
- **West Bengal -** Burdwan, 24-Parganas, Nadia, Midnapur, Bankura
- **Orissa -** Balasore, Bhadrak, Kendrapara (Low-lying areas of coastal belt)
- **Assam -** Nawgaon, Karimganj (Lake areas)

STATISTICS ON *BORO* RICE

Table2- Productivity of *Boro* rice on 2016-2017

State	Productivity (t/ha)
West Bengal	3.5
Orissa	3.0
Assam	3.5
Bihar	3.0
Eastern U.P.	2.0
Average	3.0

Source- Singh, U.P. 2017.

ADVANTAGES OF *BORO* RICE

Boro rice is known for high productivity (5-6 t/ha) in deepwater areas of Eastern India, where productivity has traditionally been very poor (<1 t/ha) during the *kharif*. This is mainly because *boro* is more manageable than *kharif* rice. For example, water management in *boro* is more systematic as it is an irrigated crop. Consequently, this crop responds well to higher doses of fertilizers resulting in higher production. Being a winter season crop, it is spared from insect-pest infestation.

Another advantage is the lower winter temperature during the earlier crop growth. This facilitates the accumulation of photo-synthates, thereby increasing C:N ratio. During the ripening period, the temperature rises facilitating the process. Variations in these parameters explain variation in yields across the *boro* growing areas.

Increased adoption of *boro* rice cultivation, both within and outside its traditional boundaries, has helped in the emergence of many local cropping patterns. This has also helped in transforming the economy of the farmers.

POPULAR VARIETIES OF *BORO* RICE WITH DESIRABLE TRAITS

Gautam, Prabhat, IR 64, Krishna Hensa, IR- 36, Joyamati, Vishnu Prasad, Jyoti Prasad, Chinsura *Hybrid-3,* BRRI dhan-29, BRRI dhan-35, BRRI dhan-36, Khumal –11 and Jaya gives good yield in *boro* season.

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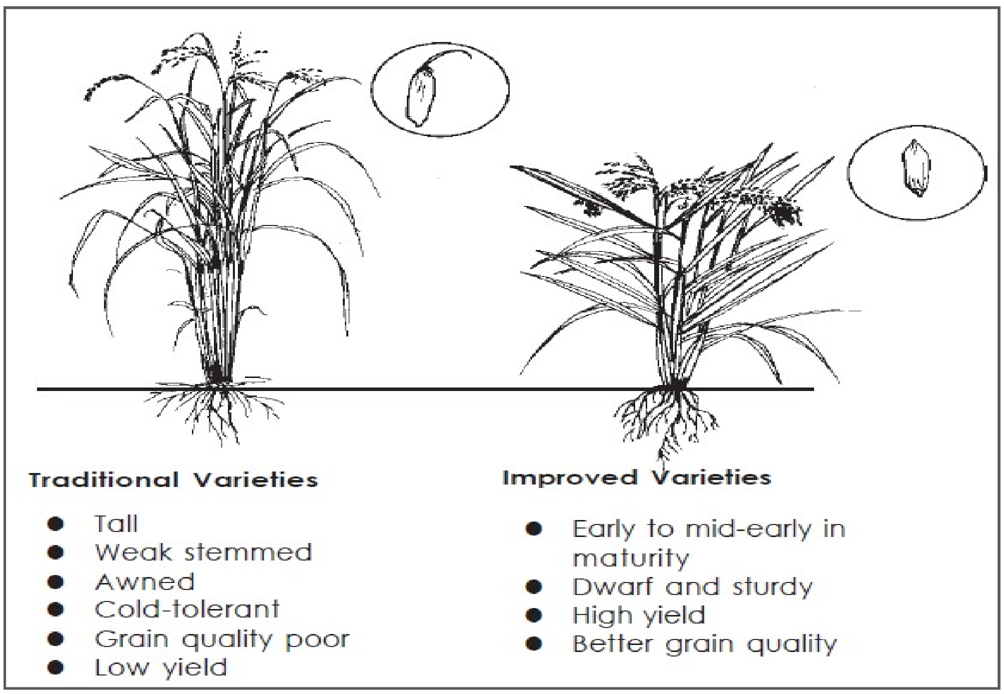
The boro rice cultivars have additional desirable traits over those of irrigated rice varieties grown during *kharif*. The cultivar has to be of short duration having physiological and plant type parameters to shorten the vegetative growth phase and more efficient dry matter accumulation. These would mean cold tolerance, lower loss of water due to transpiration, shade efficiency, less tillering and more effective tillers. Quick establishment capability after transplanting is also a desirable trait.

As *boro* rice seeds are sown in early winter, the seeds of the cultivar should be able to germinate at lower temperatures say, ranging between12-14 ^{0}C. The shape of vacuoles and thickness of mesophyll layer in the internal structure of the leaves need to be bigger enough to make the cultivar more cold-tolerant.

The cultivar needs to have low amylase content (20%-50%) in the grain. The expected yield level has to be 6-7 t/ha with harvest index of 0.50 to 0.55.

AGRO-TECHNOLOGY ON *BORO* RICE

Even a marginal increase in the productivity of *boro* rice in Eastern India will significantly increase the total rice production in the country. Therefore, a sustainable agro-technology for *boro* rice is imperative.



Source- Singh, U.P. 2002.

CONSTRAINTS TO *BORO* RICE CULTIVATION

Boro crop is a 190-200 days crop and may require more resources and care for a longer period. Moreover, improved varieties and agro-techniques are not available for *boro* rice cultivation. Lack of credit facilities and the small size of holdings are major challenges. Some of the environmental constraints are as follows:

I. **Weather fluctuation:** Low temperature at seedling stage can cause poor germination, slow and stunted seedling growth, yellowing of leaves, leaf spots, slow and delayed tillering and non-synchronous and delayed flowering. Dense fog, coupled with greater temperature fluctuation or high day temperature at flowering may cause sterility of flowers.

II. **Pre-monsoon rain:** If seed has no dormancy, early pre-monsoon rain may affect germination. In coastal areas, it may cause grain shattering.

III. **Seedling mortality:** It takes place during nursery stage due to long cold spells. Duration of panicle initiation and maturity period also increases. This increases expenditure on additional irrigation and care. Cold spell also restricts root growth delaying proper establishment of the seedlings. To compensate, the farmer has to do dense transplanting and use more number of seedlings/hill.

IV. **Insect-pests & weeds:** Plant hoppers, leaf hopper, leaf folder, grass hopper, Gandhi bug and yellow stem borer (YSB) are some of the major pests of *boro* rice. Bird damage is also common at the time of grain ripening. Major plant diseases are sheath blight and blasts, which appear during ripening or maturity stage. Problematic weeds also grow.

V. **Depletion of Ground water table:** *Boro* rice is mainly cultivated in residual moisture and for irrigation purpose the mostly ground water is lifted up by pump as it is having higher water requirement; this causes ground water table depletion which is turning out to be a serious issue in *boro* rice cultivation.

VI. **Short dormancy period:** As the rice seeds having very less dormancy period so if it is not harvested at proper time, the seeds could germinate in the field and it could hamper & delay the sowing of succeeding crop.

INTEGRATED PEST MANAGEMENT (IPM) TECHNOLOGY FOR *BORO* RICE

Insect pests in *boro* rice cause significant damage, especially during the reproductive stage of the crop, which coincides with the emergence of the first generation of stem borers after hibernation during winter. The IPM technology for *boro* rice includes:

1. Use of appropriate variety

2. Timely planting and optimum plant population

3. Balanced fertilizer application

4. Split application of nitrogenous fertilizer

5. Regular pest monitoring using pheromone traps for YSB (to reduce pest population)

6. Use of Trichogramma egg parasitoids for YSB and leaf folders

7. Need-based application of pesticides

8. Use of indigenous technical knowledge such as use of bamboo perches, etc.

COMPARISON BETWEEN THE FARMERS PRACTICE AND RECOMMENDED PRACTICES

Table 3- Table showing the comparison between the farmers practice and recommended practices

Particulars	Recommended practice	Farmers' practice
1.Nursery management		
Sowing time at nursery bed	Last week of October to mid-September before onset of the winter season.	First week of November
Source of irrigation	Prepare in low-lying areas near the source of irrigation.	Prepared in low-lying areas near the source of irrigation.
Frequently irrigation	Required	Frequently irrigation is done.
Special practice	Dust the seedlings periodically with fuel wood ash, straw ash, cattle dung ash, etc. Cover the seedlings with a plastic sheet at night to avoid yellowing of seedlings.	Dusting the seedlings periodically with straw ash. Plastic sheets are not used.
2.Transplanting		
Transplanting time	Mid January to February The transplanting is suitable when the minimum temperature of February becomes equal to 10^{0}C. Keep seedlings 18-20 cm high (75-85 days).	1^{st} week of February

Height of standing water **No. of seedlings with spacing**	5-6 cm Place the seedlings 4-5 per hill at a spacing of 20x10-15 cm.	5 cm 5 seedlings per hill at a spacing of 20×10cm.
<u>3.Nutrient Management</u>	Depending upon the soil condition, apply 120-150 kg N, 60-75 kg P_2O_5 and 50-80 kg K_2O along with 20kg/ha of $ZnSO_4$ for optimum yield of *boro* rice.	10:26:26 and urea applied at the rate 250 kg/ha and 200 kg/ha respectively. So the total applied nutrients are 117kg N, 65kg P_2O_5 and 65kg K_2O. 20kg/ha $ZnSO_4$ is also applied.
<u>4.Water management</u>	Need-based irrigations are given from groundwater sources/canals/low-lying catchments. Altogether 12-15 irrigations are necessary during the crop period.	Need-based irrigations are given from groundwater sources.
<u>5.Harvesting time</u>	March-April	1^{st} week of April

MEASURES TO REDUCE THE YIELD GAP

1. **Identify appropriate Varieties:** This may be done through germplasm collection, evaluation, selection, and varietal/cultivars testing.
2. **Characterize *Boro* rice agro-ecosystem:** Undertake agro-ecosystem analysis through rapid rural appraisal (RRA)/ participatory rural appraisal (PRA), system diagnosis, remote sensing and geographic information system (GIS) to prioritize the problems and issues faced by farmers and find out possible solutions.
3. **Develop Crop Management Practices:** There is a need for a crop management package, which may include nursery management, optimum planting time, plant population, planting geometry, fertilizer, and irrigation requirements, weed management and integrated pest management (IPM). Evaluate cultivars/varieties in relation to these parameters.
4. **Develop Appropriate Water Management Techniques:** Such techniques for varying low-lying water bodies help in better land utilization. Management of groundwater is equally important in medium lands. Proper drainage and pumping water from central portion to establish the crop and irrigation reduce menace of aquatic weeds.

5. **Develop Rice-fish Culture:** Viable rice-fish culture enhances the income of poor farmers owning deepwater/low lying waterlogged areas. *Boro* rice-fish culture technology package helps farmers in increasing their incomes.
6. **Encourages Farmers' Participatory Research:** Technology transfer is an important component of agricultural development. Technologies should be well tested on the farmers' field before those are passed on to other farmers for adoption. This is better done by farmers' participatory approach including on-farm trials and demonstrations to test the technology's adaptability, compatibility and feed-back information for refinement of technology according to farmers' needs.

CONCLUSION

Boro rice has made it possible to best utilization of the soil moisture in low lying areas with an additional crop to farmers. The crop has become very popular and has emerged out as a new cropping system in the region. But we have to also keep in mind to have sources of irrigation other than groundwater as it is depleting faster for *boro* rice cultivation. Pluses could be an alternative where groundwater table is low. Use of polythene sheets can avoid yellowing of rice seedling which couldn't be adopted as economy constraints of the farmer. Although, adopting the improved package of practices and suitable variety should be the priority of *boro* rice cultivation for maximum production with utilization of the soil moisture.

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ASSIGNMENT ON CUSTOM HIRING-IMPORTANCE AND FUNCTIONING

PALLI SIKSHA BHAVANA
(INSTITUTE OF AGRICULTURE)
VISVA-BHARATI

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SUBMITTED TO- Dr. K.C. SWAIN

SUBMITTED BY- SOUVIK SADHU
ROLL NO-42
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RAWE-01

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ACKNOWLEDGEMENT

I, Souvik Sadhu, a student of B.Sc (Ag)Hons. Sem-VIII, feel proud to present my assignment of RAWE-01 program which is a flagship activity for the final year B.Sc. (Ag) students during the last semester for building self-confidence in the agricultural graduates by honing their professional skills.

I gratefully acknowledge my sincere thanks to our respected teachers Dr. Joydip Mandal and Dr. K.C. Swain for giving me the opportunity to work on this assignment. It would be my utmost pleasure to express my sincere thanks to them for providing a helping hand in this regard.

From the pen of

SOUVIK SADHU

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PREFACE

As a part of RAWE-01 program and in order to gain knowledge in the field of 'Custom Hiring- importance and functioning' in this assignment I have tried to include the current scenario of Custom Hiring Service in India and its way of functioning and major hindrances in it's way of wide acceptance and adaptability.

During the course of preparing the assignment, I was enlightened with various dimensions of Custom Hiring Service in India and its importance and it's benefits in Indian Agriculture.

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INTRODUCTION-

Indian agriculture is undergoing a gradual shift from dependence on human power and animal power to mechanical power because increasing cost for upkeep of animal and growing scarcity of human labour. Further, use of mechanical power has a direct bearing on the productivity of crops apart from reducing the drudgery and facilitating timeliness of agricultural operations. Thus there is a strong need for taking farm mechanization.

However, the farm power distribution is quite uneven across the States, wherein the highest use of mechanical power is in the order of 3.5 kw/ha in Punjab and less than 1kw/ha in States like Bihar, Orissa, Jharkhand etc. Mechanical power is largely consumed in big land holdings and is still beyond the reach of small/marginal holdings which constitutes around 80% of the total land holdings. This is due to the fact that

small/marginal farmers, by virtue of their economic condition are unable to own farm machinery on their own or through institutional credit. Therefore in order to bring farm machinery available within the reach of small/marginal holdings, collective ownership or Custom Hiring Centers needs to promoted in a big way.

WHAT IS CUSTOM HIRING-

Custom hiring enables farmers to rent the appropriate equipment often along with someone to a operate it for a defined period of time only, thus only paying for the services of the machine without having to own it.

Thus Custom Hiring Service

- is an important mechanism through which most smallholders can access service of Agricultural machineries.
- ensure the use of improved farm machineries even to small and marginal farmers.

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- offers prospects for facilitating rapid mechanization of Agricultural system in the region.

HOW CUSTOM HIRING SERVICE CAME INTO EXISTENCE-

Custom Hiring Service for farm implements was established in 100 NICRA (National Innovation in Climate Resilient Agriculture) villages which could successfully empower farmers.

Each center was established at a capital cost of RS.6.25 lakh provided by the NICRA project.

Under the Sub-Mission on Agricultural Mechanization (SMAM) scheme, Indian states received 160 crore rupees in 2016-2017 to offer financial assistance for setting up custom hiring centers. In addition, the government has directed Indian banks and other financial institutions to extend loans to people interested in starting custom hiring centers.

MECHANIZATION STATUS OF INDIAN AGRICULTURE AT A GLANCE-

Devices used in agriculture:- Power Tiller, Tractor, Harvester, Rice transplanter, Winnower, Thresher etc.

- 1.5 million pumps Used in agriculture
- 80% land preparation by tractor and Power Tiller.
- Maize shelling accomplished almost by maize sheller.
- 100% farmers are using sprayers for pesticide application.

PROBLEMS FACED BY THE FARMERS AND NEED OF CHC-

- Higher Purchase value of machinery.
- Lack of technical knowledge.
- Inadequate expert manpower to service the implements and machinery
- Difficulty in repairing and maintaining farm implement and equipments.
- Scarcity of labour.
- According to the research carried out by Singh and Kingra between 2007 and 2010, two lakh farmers with small landholdings gave up farming because they could no longer afford to continue.

Keeping all these in mind, in order to bring farm machinery available within the reach of small/marginal holdings, collective ownership or Custom Hiring Centres need to be promoted so that farmers of all category can take benefit of using farm machineries without owning it. Moreover, it is also a profitable business in a country like India as farm machineries are part and parcel of farming system and most of the farmers in India belong to small and marginal category.

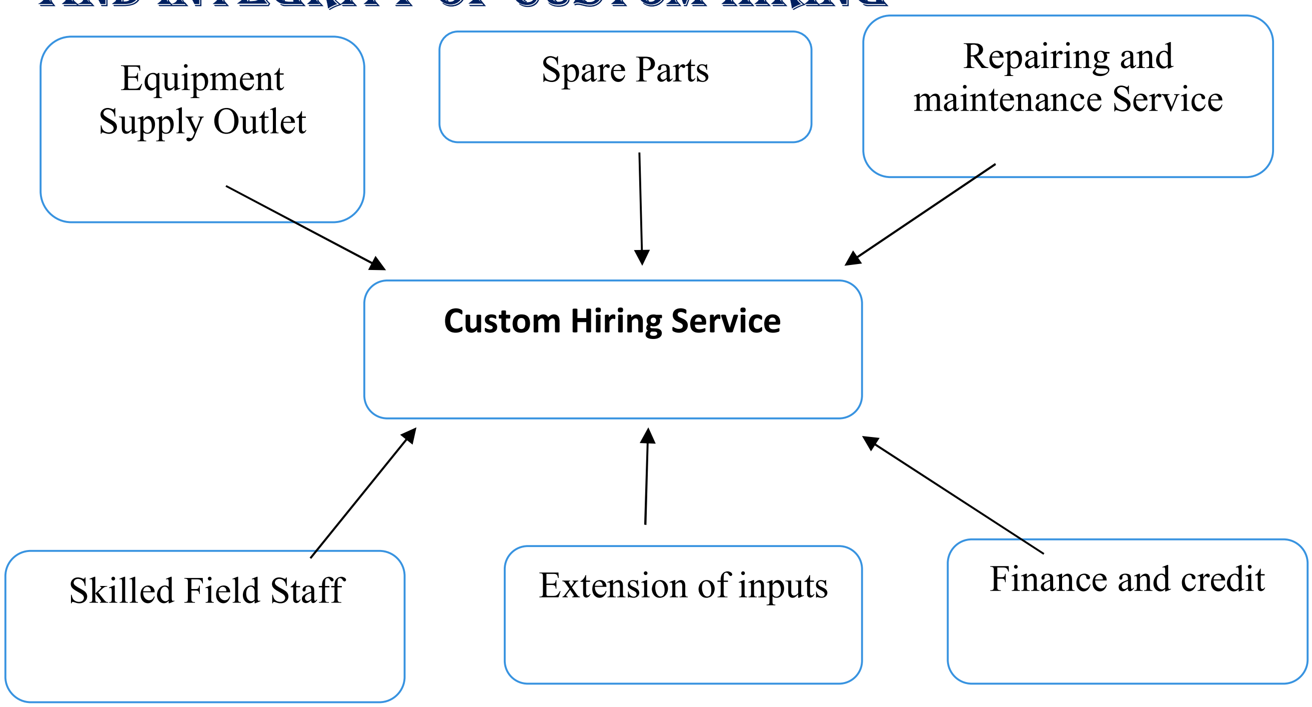
CUSTOME HIRING SERVICE SCENARIO-

The Custom Hiring Service scenario around the world are as follows:-

Activities	Machineries and country
Transportation	4 WT and 2 WT trailer- All country Animal carts- Nepal, Columbia, Laouse
Milling	Engine and motor- All country
Water pumping	Engine, Motor, 2 WT pump- Most country
Threshing	4 WT and 2 WT thresher- Most country Diesel engine- Thailand

Harvesting (Wheat)	Combine harvester- China, India, Pakistan
Harvesting (rice)	Combine harvester- China, Malaysia,India, Thailand,Sri Lanka
Tillage (Dry)	4 WT- Most country
Tillage (wet)	2 WT- Most country
Land levelling	4 WT laser leveller- India, Pakistan, Columbia
Seeding	4 WT seed drill- China, India, Pakistan
Transplanting rice	China, India
Maize shelling	India, Bangladesh
Harvesting (sugarcane)	Thailand, India

SUPPORT SERVICE FOR OPERATIONAL CONTINUITY AND INTEGRITY OF CUSTOM HIRING-



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DIFFERENT MODELS OF CUSTOM HIRING SERVICE OF AGRICULTURAL MACHINERIES-

Individual farmer led.

Farmers group purchased machinery.

Cooperative managed Custom Hiring Service center of Agricultural machineries.

Implements traders' led Custom Hiring Service center.

Individual entrepreneur operated Custom Hiring center.

NGO supported Custom Hiring center.

Government supported centers.

CHC FARM MACHANIZATION APP-

Ministry of Agriculture and Farmers welfare developed and launched multi lingual mobile app 'CHC FARM MACHINARY' which helps the farmers for getting rented farm machinery and implements through CHC centers in their areas.

As on date 44550 CHCs with 138543 Agricultural machinery for renting out are registered on this mobile app. Total 113848 farmers as users have registered.

ADVANTAGE OF CUSTOM HIRING SERVICE-

Access to small and marginal farmers to costly farm machinery

Facilitates timeliness in farm operations and efficient use of inputs

Promotes adoption of climate resilient practices and technologies by farmers because of availability of appropriate machines at reasonable hiring charges

Reduces drudgery

Promotes increase in cropping intensity wherever feasible

Facilitates crop residue recycling and prevents burning of residues

Reduction in cost of cultivation

Provides work opportunities to skilled labour and small artisans

SWOT ANALYSIS OF CUSTOM HIRING SERVICE-

Strength: -

- ✓ Precision and quality operation with farm equipment ensure higher production.
- ✓ Mechanization bring timeliness and precision in Agricultural operation, cost effectiveness and efficiency in use of resources and applied inputs.
- ✓ Low hire cost.
- ✓ Higher business growth.
- ✓ Ensure good quality machinery.
- ✓ Long lasting business.

Weakness: -

- ✓ Lack of trust between Agri-business and farmers.
- ✓ Not very familiar in this region.
- ✓ Lack of extension Service.
- ✓ Insufficient resource.

Opportunity: -

- ✓ Higher initial cost of individual ownership.
- ✓ Farmers lacking knowledge in the aspects of operation maintenance and repairing of equipment's.
- ✓ Less time consuming than manual operation.
- ✓ More profit in Agri-business.

Threat:-

- ✓ Poor rural infrastructure regarding road quality.
- ✓ Fragmented land holding.
- ✓ Lack of appropriate government strategy on Agricultural machanization.
- ✓ Insufficient repair and maintenance Service.

- ✓ Farmers are reluctant to use machines because they think that using tractors on their land can damage the soil.

PRIORITIES FOR FUTURE FARM MACHANIZATION THROUGH CUSTOM HIRING-

- ➢ Expand use of Agricultural residues like biogas, solar and wind energy as source of power of farms.
- ➢ Farm production technique with low energy requirement such as minimum tillage, zero till planting, conservation Agriculture.
- ➢ Farm machineries for higher water use efficiency like laser land levelling, micro irrigation.
- ➢ Farm machinary for higher fertilizer use efficiency:- seed cum fertilizer drill, fertigation.

SUGGESTIONS-

- ❖ The distribution of farm machineries from area to area should be normalized so that the Custom Hiring Service is increased.
- ❖ Technical know-how should be provided to the farmers with respect to appropriateness of farm machineries for the situation and for it's proper use.
- ❖ A standardization and quality marking center of farm equipments should be established in potential areas of the country.

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CONCLUSION-

After completion of the assignment I now have a clear idea how Custom Hiring Service is beneficiating small and marginal farmers by providing them appropriate machinary at the appropriate time without giving them the burden of huge ownership cost. Hire Service have the potential of providing improved livelihood to small scale farmers all over the world. But the fact is this Service is available in our country in very small scale rather than large one. Large scale Custom Hiring Service is not only highly profitable but also have a great opportunity in future. But the crying need is that the government and private organization to come forward for the development of entrepreneurship in Custom Hiring Service.

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Besides these websites the valuable suggestions of our teachers and informal discussion with friends (Classroom discussion) has helped me a lot to complete the assignment.

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ASSIGNMENT ON RESOURCE CONSERVATION TECHNOLOGY AND IT'S FUTURE PROSPECT IN INDIAN AGRICULTURE

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From the pen of

SUBHADIP HENS

INTRODUCTION:-

Resource conservation technology is a broad term that refers to any management approach or technology that increase factor productivity including land, labour, capital and inputs by minimizing the wastage of resources and maximizing judicial resource use.

The rational and efficient use of resources have a special importance not only in Agricultural sector but industrial sector also. Continuous use of conventional farming practice with conventional tillage and burning crop residues has degraded the soil resource base and intensified soil degradation with concomitant decrease in crop productivity. The resource conservation technology involving no or minimum tillage with direct seeding, residue management and crop diversification, conservation agriculture, micro irrigation, precision farming,have potential for improving productivity by soil organic matter build up and at the same time regeneration of soil health.

Resource conservation technology appears to be appealing option to achieve sustainable and intensive crop production and need to be adopted at a wider scale.

NEED OF RESOURCE CONSERVATION TECHNOLOGIES IN INDIA: -

At present, the challenge for agricultural scientists in Indiaistoincreasefoodproductiontomeetfoodsecurity needs of ever-growing huge population of India. However, such production increases must be accomplished sustainably, by minimizing negative environmental effects and, equally important, providing increased income to help improve the livelihoods of those employed in agricultural production. Thereareseveralkeyissuesinthisequationonwhichthere is almost unanimousconsensus.

- In India the demand for food is still increasing, not onlyto meet food security for a growing population, but to provide nutritional security aswell.

- Most of the sources of productivity growth *viz.* improved varieties, fertilizer, and water used in the last 40 Green Revolution years are already being exploited. Future sources of productivity growth will be more complex and harder to find.

- To maintain ecological balance for supporting life and to make the resources available for present and future generation.

- Competition for surface and groundwater resources will be more severe as domestic and industrial needs will compete for it.

- The shrinking agricultural land because of urbanization and its use for other purposes. Expansion is possible in some parts of the India, but the quality of the newlandmaybelessthanthatalreadyinuseforagriculture.

- Fossil fuels will be more costly, adding to production costs directly as well as indirectly. And India is mostly dependent on several other counties of fossil fuels.

- GHGs will increase with subsequent effects on climate,especiallyanincreaseinsevereclimaticeventssuch as drought, floods,etc.

  This will make the challenge more difficult and complex. One obvious way to accomplish this sustainable food production objective is to make more efficient use of the natural resources that are needed to produce food; this includes soils, water, air, inputs and people.

PRACTICES FOLLOWED IN RESOURCE CONSERVATION TECHNOLOGIES: -

In RCTs several practices followed to conserved natural, human etc. resources in agriculture. They are-

CONSERVATION AGRICULTURE- Conservation Agriculture (CA) is defined as a sustainable agriculture production system comprising a set of farming practices adapted to the requirements of crops and local conditions of each region, whose farming and soil management techniques protect the soil from erosion and degradation, improve its quality and biodiversity, and contribute to the preservation of the natural resources, water and air, while optimizing yields.

Conservation agriculture is the main pillar of RCTs. Four main principles of conservation agriculture are-

1. Minimizingmechanicalsoil disturbanceandseedingdirectlyintountilledsoiltoimprove soil organic matter (SOM) content and soil health;

2. Enhancing SOM using cover crops and/or crop residues (mainly residue retention). This protects the soil surface, conserves water and nutrients, promotes soil biological activity
3. Diversification of crops in associations, sequences and rotations to enhance system resilience that complement reduced tillage and residue retention by breaking cycles of pests and disease and
4. Controlled traffic that lessen soil compaction. CA avoids strawburning,improvessoilorganiccarbon(SOC)content, enhancesinputuseefficiencyandhasthepotentialtoreduce GHGs.

SOME CONCEPTS RELATED TO CA FOR RCT-

ZERO TILLAGE- Zero tillage, also referred to as No-tillage or no-till, is a **soil cultivation system in which seeds are deposited directly into untilled soil**.The traditional approaches of ploughing which include 3-4 tillage operations are completely skipped. Hence, cost of production is reduced and timely planting of crop is ensured. Another benefit of earlier sowing under Zero Tillage is that Phalarisminor, aherbicide-resistant weed in wheat, is less competitive than when wheat is sown late under conventional tillage. Zero Tillage also save 80-90% fuel for cultivation of land.

From the view of RCTs, zero tillage save energy,reduce cost of cultivation and minimum soil disturbance which is very must acceptable in Indian context.

CROP RESIDUE COVER-Use of crop residue on the field is one of the RCTs which conserver moisture on the field. Cropresiduesarealso important source of nutrients and maintain or enhance soil chemical, physical and biological properties and prevent land degradation.

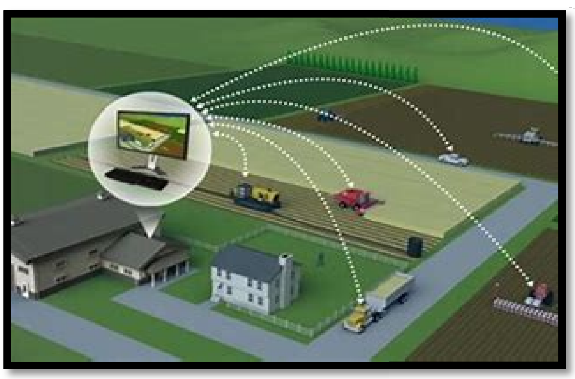
PRECISION FARMING, a tool of RCTs -

Precision agriculture refers to the application of precise and correct amounts of inputs like water, fertilizers, pesticides etc. at the correct time to the cropforincreasingitsproductivityandmaximizingitsyields. Thebenefitsofsodoingaretwofold-i)thecostofproducing the crop in that area can be reduced; ii) the risk of environmentalpollutionfromagrochemicalsappliedatlevels greaterthan thoserequiredbythecropcanbereduced.

It is one of the major tools for Resource Conservation Technology which deals with use of right amount input for maximum yield. Precision farming take care of both nature as well as human.

SOME CONCEPTS RELATED TO PRECISION FARMING FOR RCT-

USE OF GPS AND GIS SYSTEM- Use of Global Positioning system (GPS) and Geographical Information System (GIS) and mapping can provide the right support as cost effective alternative. The GPS makes possible to record the in-field variability as geographically encoded data. Information collected from different satellite data and referenced with the help of GPS can be integrated to create field management strategies for chemical application, cultivation and harvest etc.

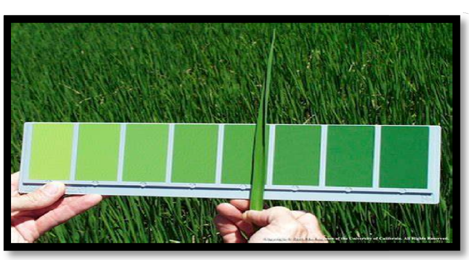


Thoughprecisionfarmingisverymuchtalkedabout in developed countries, it is still at a very nascent stage in developing countries, including India.

SITE-SPECIFIC NUTRIENT MANAGEMENT (SSNM)- SSNM is one of the most importance practices for conserved resources in India. Site specific nutrient management is a set of nutrient management principles combined with good crop management practices that will help farmers to attain high yield and achieve high profitability both in the short and medium-term.

Applying the right nutrient source, at the right rate, at the right time, in the right place is essential to nutrient stewardship and is the core of the 4 Rs. Such 4 R nutrient stewardship for fertilizer best management practices is an approach that considers economic, social and environmental dimensions of nutrient management. Many studies in the country, show that by adoptionofSSNM, acrossthelocations,grainyieldsofmore **than 13 t/ha in rice-wheat system** (with a contribution of 58%riceand42%wheat)and**12-15t/hainrice-ricesystem in India** by taking care of resource conservation. From the point of view of RCTs SSNM can play a leading role in Indian Agriculture.
Wide spread adoption of SSNM technologies based on soil testing require extensive soil sampling and analysis which could be a hindrance considering the available infrastructure.

LEAF COLOR CHART-This instrument is very much useful for N nutrient management in rice. It consist of 6 colour parameter from yellow green to dark green. Farmers compared the colour the leaf colour of rice with the chart and recommend the nitrogenous fertilizer. It was found possible to curtail 20-30 kg of fertilizer N/ha without



sacrificingriceyield,whenNisappliedasperLCCvalues. In this way it reduces the cost of cultivation and conserved the soil health from the use of excess fertilizer.For this we can say use of LCC as part of RCTs.

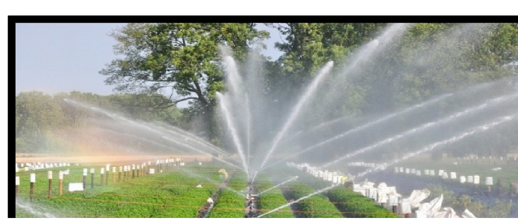
INTEGRATED FARMING SYSTEMS-Integrated Farming Systems hold a special position in conservational agriculture as in this system nothing is wasted, the byproduct of one system becomes the input for other. For example, crop residues from the field can be used for animal feed, while manure from livestock can enhance agricultural productivity by improving soil fertility as well as reducing the use of chemical fertilizers. Moreover, the system helps poor small farmers, who have very small land holding and a few heads of livestock to diversify farm production, increase cash income, improve quality and quantity of food produced and exploit unutilized resources.

In Indian context IFS play a key role for resource conservation because of it reduces the cost of cultivation, use of on-farm input helps in maintain soil health etc.

MICRO IRRIGATION-Micro irrigation anotherRCT,hasthepotential toconservesignificantquantitiesofwater.Micro irrigation includes drip irrigation,sprinkler irrigation, pitcher irrigation.

- **DRIP IRRIGATION-**In this method of irrigation water is apply in the form of droplet at the base of the plant. Its installation is high but in point of view of water conservation it is very much recommended. In this method **35-40% water** is savedthan conventional method and water used efficiency is about 90%/.

- **SPRINKLER IRRIGATIOM-**Sprinkler Irrigation is a method of applying irrigation water which is similar to **rainfall**.Water is spray over the plant in the plant foliar. In

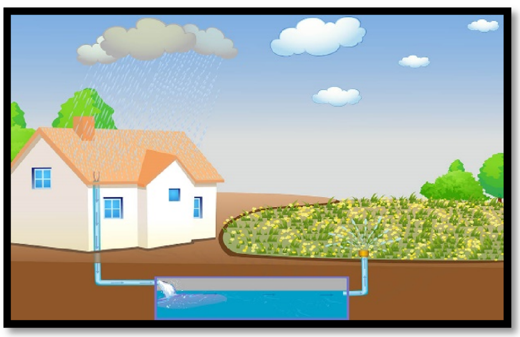


this method water is saved up to **25-30%** and water use efficiency is about 50-60%.

- PITCHER IRRIGATION- In this method a earthen pot is placed near the plant. Water is given on the pot and some small hole in the pot. Water used efficiency is about 90% in this method.

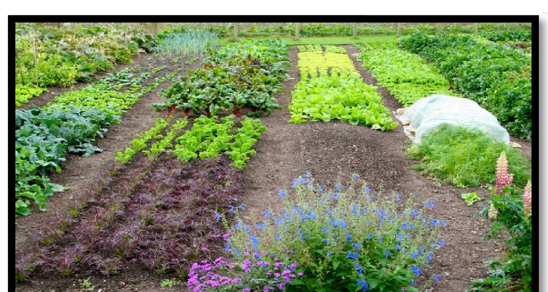
In India there are several places where water scarcity is major problem for agriculture. On those area micro-irrigation technique is very much essential for proper use of available water.

RAINWATER HARVESTING-Water harvesting is a process of collecting and concentrating runoff water from a runoff area into a run-on area, where the collected water is either directly applied to the cropping area or stored in the soil profile for immediate use by the crop, i.e. runoff farming, or stored in an on-farm water reservoir for future productive uses. Various methods ofwater-harvestingandrecharginghavebeenandarebeing applied all over the world to tackle the problem.



In India where rainfall is low and water is scarce, the local people haveusedsimpletechniquesthataregroundwaterrecharge, creatingafarmpondor tankandprotectiveirrigation.

BED PLANTING-Bed-planting,anotherRCT,hasthepotential



toconservesignificantquantitiesofwater(30–50%).Otherbenefitsofbed-plantinginclude,reduced seedrates,conservedrainwater,facilitatedmechanicalweed control, minimized lodging in the wheat crop, costreductionandconservationofresources. Fertilizationapplicationpracticesarealsoeasily performed by trafficking in the furrow bottoms and the fertilizers can be banded through the surface residues, reducingtherebypotentialnutrientlossesunder permanent raised bed planting. The raised bedplantingtechniquealsoprovidesanopportunityfor crop diversity through inclusion of different crops as well as feasibilityofinterorrelaycropping,therebyopeningavenues for generating alternate sources of productivity growth throughefficientuseofresourcebase. We can say that is an effective tool for RCTs in India.

DIRECT SEEDED RICE-Theshortagesoflaborandwater, and soil fertility issues are causing increasing interest in shiftingfrom puddlingandtransplantingtoDirect Seeded Rice.DSR can reduce the labor requirement by 50% compared with transplanting. In Northwest India, about 35– 57% water savings have been reported in research experiments in DSR sown into unpuddled soils.

SYSTEM OF RICE INTENSIFICATION (SRI)-

SRI,anotherRCT,hasthepotential

toconservesignificantquantitiesofwater and seed.SRI cultivation ismore robust against extreme weather events, pests, and diseases due to improved plant vigor and root strength. In India, many farmers adopted this method for cultivation. It’s very cost effective and conserved water and maintains soil & natural resources.

CONCLUSION-In India, population is increases day by day but agricultural land is constant. For our future population, we have to conserved resources and at a same time we have to meet current need of the country. Use of Resource Conservation Technology is one of the best ways to overcome the situation as well as for future.Integrating concerns of productivity, resource conservation and quality and environment is now fundamental to sustained productivity growth.RCTs offer a new paradigm for agricultural research and developmentin India differentfromearlierone,whichmainlyaimed at achieving specific food grains production targets. From the point of view of cost of production,it is very much essential for many farmers of India. It make utilize of all the resources and conserved for future.

From analysis all the this we can say that RCTs is very much essential for future India.

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High Tech Nursery Management

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Thanking you,
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High Tech Nursery Management

Introduction:

Agriculture and Horticulture are vital sciences as they suffice the very basic need of food for the Human beings. Qualitative and quantitative food can essentially be produced from healthy plants which in turn are produced only when their seedlings/sapplings are vigorous and healthy. Nursery is consequently the basic need of horticulture. Plant propagation techniques and practices is the core of horticulture nurseries. The planting materials for horticultural plantations are raised from seeds and vegetative parts.

What is a plant nursery?

- A plant nursery is a place where any kinds of plants are grown for the sake of being moved or transplanted later.
- It can occupy a field, garden, greenhouse, or other form of growing space.

The main phases of nursery management are

- Planning edaphoclimatic and socio-economic considerations
- Demand for planting materials
- Provision of mother block
- Requirement of land area

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- Proper layout
- Water supply
- Working tools
- Growing structures and inputs availability
- Accessibility
- Trained man power
- Plant protection
- Disposal of planting materials etc

The key elements of nursery management

The key elements of nursery management are (3P'S)

1. **The place,**
2. **The plant**
3. **The person behind**.

✓ The place

This is broadly devided into two part:

1. Selection of site
2. Lay out

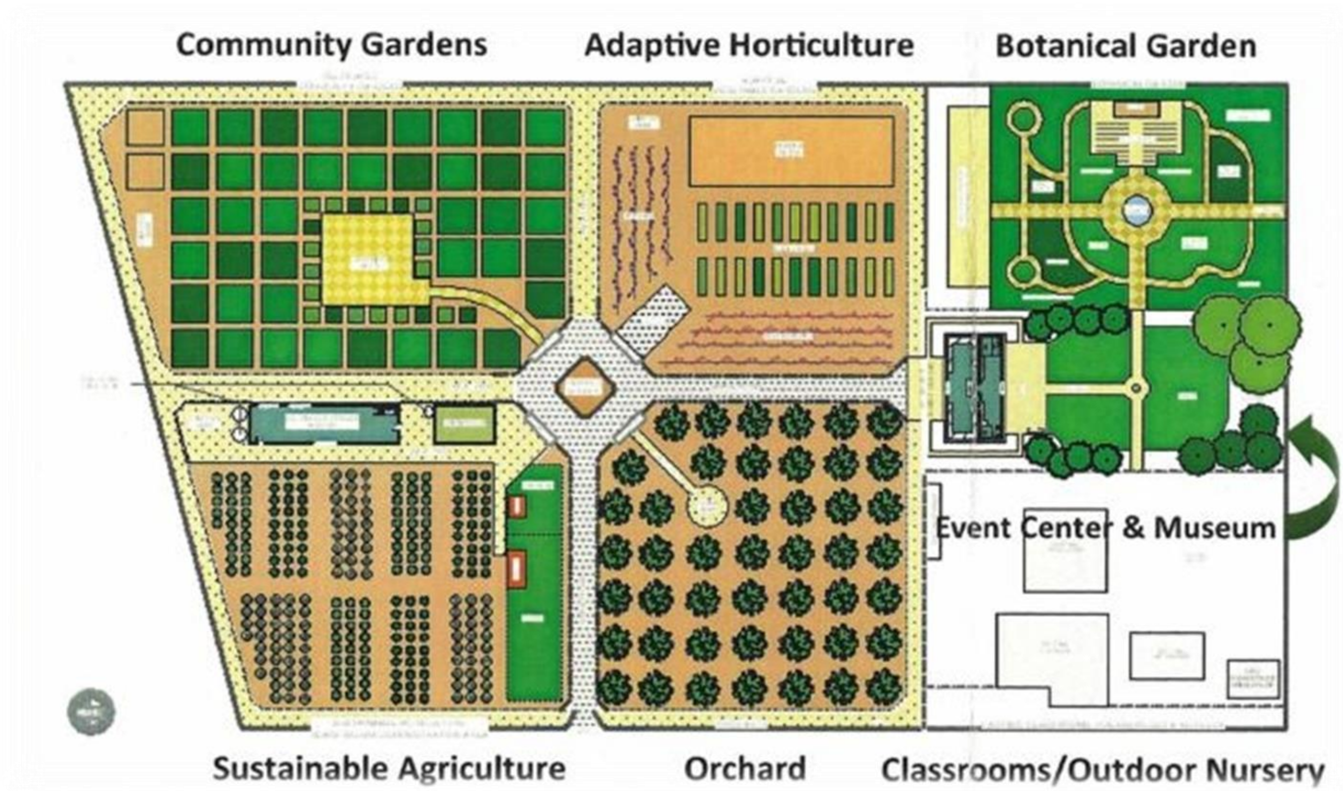
Selection of site:

In our country, less emphasis is given on selection of site for the nursery

- An unsatisfactory site will increase the cost of operation and poor stock production. However, no site is perfect in all respect, hence site selection requires some compromise
- Therefore, setting up of a nursery is a long- term venture requires careful planning, because mistake committed initially can not be rectified easily at later stage and may adversely affect the returns from the investment.

Layout:

- The nursery lay out should be compact and in rectangular or square shape
- Wind break/ shelter break must be done all along the boundary not only to protect against hot wind and wild life but also to modify the micro-climatic situations.
- The nursery should be connected by main road for better approach and disposal of produce.
- There should be proper provision for road and path, irrigation and drainage chann els, mother block, nursey beds, growing structure, store, compost pit, display site-cum-sale counter etc.



✓ The plant

1. Plant types and propagation techniques:

- The type of planting materials intended to be multiplied are based on the agro-climatic situations, type of nursery e.g. for fruits, vegetables, ornamental plants or mixed plant types and farmers demand.
- The important arid zone fruits are: datepalm, ber, pomegranate, guava, Citrus species, phalsa, mulberry, fig etc. which can be grown successfully under arid zone but very little efforts have been made so far to standardize their nursery management practices.

- Similarly, there are vegtetables melon,cluster bean, Capsicum spp,chilli, brinjal etc. and ornamental plants (Bougainvillia, Vinca rosa, annual chrysanthemum, which can withstand to typical hot arid climate.
- Normally, seed propagation is not recommended in fruit crops owing to variability in growth and fruiting because of the cross pollination, long juvenile phase, chances of transmission of seed born diseases etc.
- but, where vegetative propagation is unsuccessful, difficult, expensive; for raising rootstocks as clonal rootstocks are not standardized in most of the fruits
- and multiplication of clonal materials is also expensive and time consuming, for evolving new varieties etc. the seed propagation is the feasible alternative. Still, the seed propagation is commercially practiced in case of papaya, phalsa, etc.
- Though, the availability of stock (seeds or mother plant) of recent released varieties are low at initial stage but by multiplying them even at smaller quantity, one can fetch better price in the market.
- Recently, emphasis has been given for multiplication of plants by tissue culture technique and protocol has been standardized in some horticultural plants like date palm and banana.
- but it has so far not been commercialized, as setting up a hi-tech tissue culture laboratory require high cost and specialized skill.
- Most of the vegetables are grown by directly sowing the seeds in the field, however some of the vegetables are first sown in the nursery beds where seedlings are raised and then transplanted in the field at desired site.
- The soil of seedbed should be worked well to break the clods.
- The weeds, stones and stubbles should be removed.
- Height of the raised bed should be 10-15 cm with a width of 1.25 m and length may be according to requirement and convenience but generally, it is to be kept 6.25 m long.
- Two parts of fine soil, one part of FYM can be incorporated to each bed to improve aeration and fertility of the soil.
- Before preparing the bed, soil should be drenched with 0.4 per cent formaldehyde or 0.3 per cent copper oxychloride to kill pathogens in the soil.

2. Plant standard:

Production of quality planting materials is another factor, which not only decides the establishment of plants in the field but also useful in handling and transportation and ultimately earning of better returns.

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So far, least emphasis has been given on standard of planting materials. There is a misconception among the growers particularly in case of fruit plants that while purchasing the plants from the nursery, they demand plants of big size, thick stem, large size leaves, straight growing etc,, with the view that they will establish better and come in early fruiting.

Therefore, there is need to educate the farmers about the standard of quality planting materials, which differ with the plant types.

✓ The person behind

- The ultimate success depends upon the person who is dealing the whole affairs of nursery management.
- The nursery manager must understand the dynamics of business terrain.
- He should always keep in touch with the organizations working on nursery management to understand the innovations made in recent past.
- A good nursery manager knows how to "think like a plant", and create a propagation environment that modifies all physical and biological factors that may be limiting to plant growth.
- Nursery manager should also consider the provision of incentives for the workers, as nursery management is a teamwork. He should analyze the reasons for success and failure, which will help in refining the activities in subsequent year for better out.

Steps of high tech nursery management:

- Think before you start the nursery
- Planning structures and flow of work
- Planning crops and developing propagation protocols
- Three phases of crop development
- Propagation environments
- Media for raising nursery
- Mother block and
- raising rootstocks Use of containers

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Think before you start the nursery:

- What are the truly needed and wanted plants for your immediate customers?
- Who are the potential clients of our plant materials at this time?
- Who might be potential clients in the future?
- What are the needs and priorities of the potential clients?

Think further…………………..

- The species the nursery is capable of growing.
- The types of environments in which plants will be out-planted.
- Specific end-user requirements for species (for example, seed source, special properties).
- The size and age of stock preferred.
- The season during which people prefer to plant.
- The quantities of species people may plant.
- The distance people are willing to travel to obtain the plant mataterial.

Think further on financial aspects: …..

- How much money can be invested in the nursery at the outset?
- The labour force that can be hired.
- In what timeframe the nursery can start to produce plants for sale?
- How many plants can be produced?
- What price can be charged for the plant materials.

Select a Site for the Nursery

- Access to good-quality, affordable, abundant water.
- Unobstructed solar access.
- Inexpensive and reliable energy.
- Easy access by the nursery staff.
- Adequate land area.
- Freedom from problematic ecological concerns (for example, free from neighboring chemical pollution, unmanageable noxious weeds, and so on).

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Planning Structures and Flow of Work

- Although crop production is the core of nursery activities, it is only part of the whole picture.
- Preparation, cleanup, and storage must also be well planned.
- Where will seeds be cleaned, stored, treated, and tested? Where will containers be cleaned, sterilized, and stored when not in use?
- If crops are to be stored during rainy season, it is essential that they are in an appropriate environment to ensure their survival.
- As nursery activities are planned, think about the flow of work and the design structures that facilitate the movement of people and plants in an effective and safe way.

Growing structures:

- Nursery stock is grown in different structures like greenhouse, shade net house, walking tunnels, low tunnels, mist chambers etc.
- These structures enable year round production in nursery and efficient use of resources like planting material, irrigation water, fertilizers, plant protection chemicals, etc.

Shade Net House for Mango Nursery

Poly house for Banana Nursery

- The environmental manipulation i.e. managing microclimatic conditions (relative humidity, temperature, light and gases), edaphic factors (propagation media, mineral nutrients and soil moisture) and biotic factors (interaction of symbiotic mycorhiza fungi and other organisms) is essential for better success of nursery activities.
- There are several type of growing structures based on ecological situations, requirements and cost involvements like; plastic covered green house, fibre glass house, Ultraviolet resistant fibre glass house, polyhouse, shade net, lath (wooden frame) house etc. with or without provision of misting.
- These structures are not only for controlling temperature, humidity and misting but also there is photoperiod control system, heating and cooling systems .
- Mostly, partially controlled structures are used in our country. Now a days, fully controlled automatic hi-tech nursery green house has been developed to regulate nursery activities year round.
- However, in some cases if rootstocks are raised inside the shade net, the stocks are thin and long; resulting poor success when they are used for grafting and budding.
- To overcome this problem, the photoperiodic requirement, and optimum input supply coupled with proper management should be standardized.
- This problem is not serious when plants are raised by cuttings. The plants raised under control environments also require hardening before planting at desired site.
- The infestation of pest and diseases are also low in controlled environments but once plants infected it is transmitted easily.

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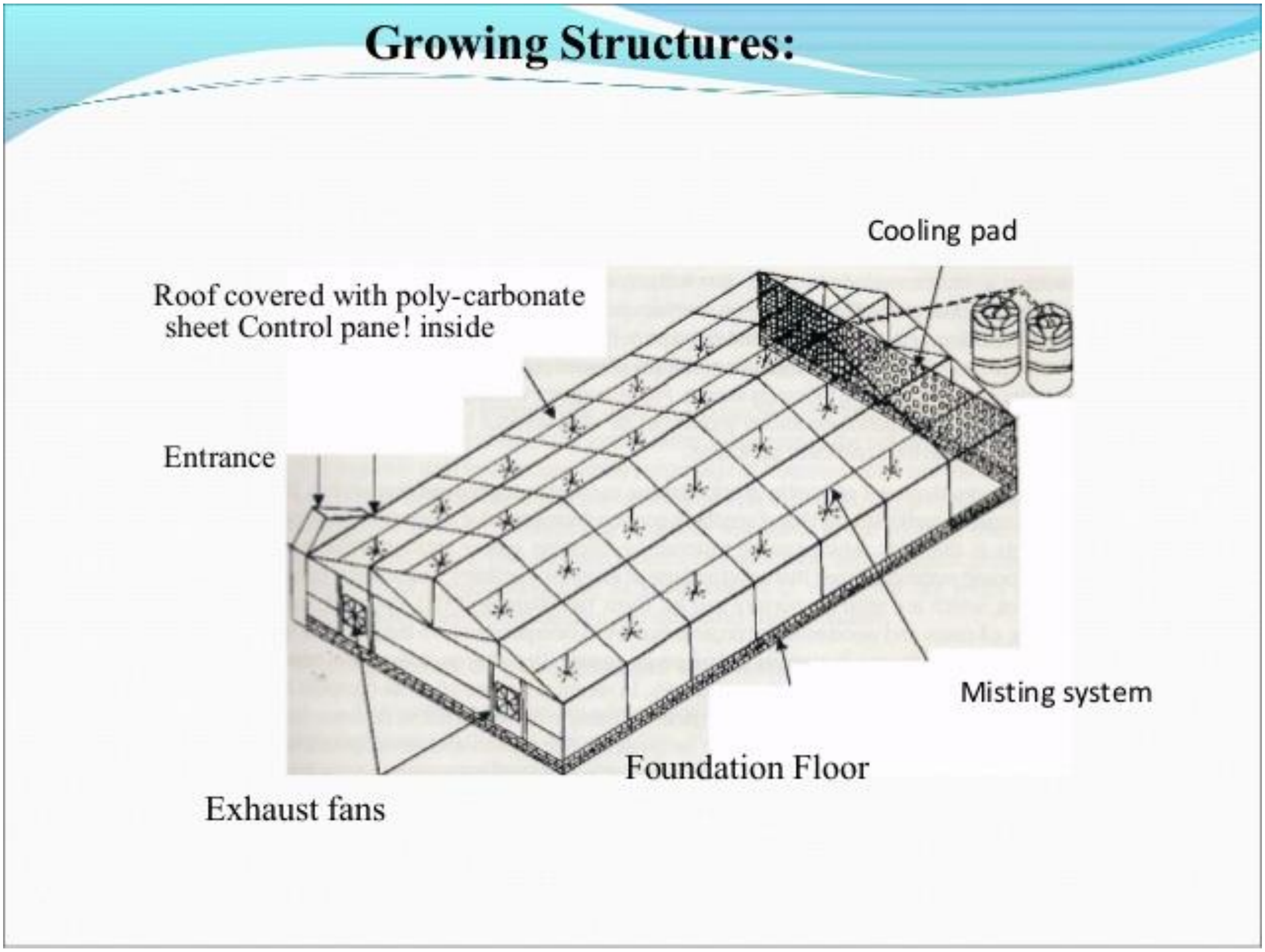

Planning Crops and Developing Propagation Protocols :

In crop planning…………

- Identify the seed dormancy of each species and apply treatments to overcome dormancy.
- Understand the three growth phases crops go through (establishment, rapid growth, and hardening) and the distinct requirements for each phase.
- Develop growing schedules for crop production from propagule procurement to out-planting.
- List space, labour, equipment, and supplies required to support the crop during the three growth stages.
- Keep written records, including a daily log and plant development record.

- Develop and record accurate propagation protocols so that success can be replicated next time.

Benefits of creating a propagation protocol

- Invaluable resource for crop planning and scheduling.
- Beneficial for improving nursery productivity and seedling quality over time.
- Useful for teaching and sharing information about the plants to clients, the public, or nursery staff.
- A way to preserve and perpetuate propagation information.

Key Crop Planning Components

- Determine available growing space.
- Plan crop layout in the nursery based on the number of plants required.
- Schedule seed treatment and plot planting.
- Schedule pot treatment.
- Determine a growing schedule to meet a target date of delivery.

Three phases of crop development

1. Establishment

- The establishment phase is the phase from the sowing of the seeds through the germination, emergence, and development of the first true leaves or primary needles.
- For plants grown from cuttings, the establishment phase extends from placing cuttings into containers through the development of roots and shoots.
- The establishment phase typically lasts than 6 to 12 weeks.
- The goal of this phase is to maximize the amount of growing space filled with healthy plants, thereby minimizing losses.

2. Rapid Growth

- During this phase, plants, particularly their shoots, increase dramatically in size.
- Often the terminal shoot begins to approach target size.
- Plants are still at least somewhat protected during this phase. Rapid (but not excessive) shoot growth is encouraged.

3. Hardening

- During the hardening phase, energy is diverted from shoot growth to root growth.
- Shoot growth is discouraged or even stopped.
- It is a common mistake to rush hardening, resulting in plants poorly prepared for conditions on the out-planting site.
- When plants are not properly hardened, they may have the correct physical characteristics but survival after out-planting will be low because of an inadequate physiological condition.
- The goal of the hardening phase is to get plants conditioned for stress, prepared for out-planting, and ready to be delivered to the client in a timely fashion to avoid problems with holdover stock.
- The plants raised under growing structures or protected environments with high management become tender and require hardening off before planting out in the field.
- In fact, hardening off is a term applied to any treatment that makes the tissues firm to endure better in the unfavourable environmental conditions.
- The techniques employed for hardening are;
  (i) by watering the plant sparingly till it is not wilted and providing increased ventilation
  (ii) lowering of temperature also retards growth and adds to the hardening process.

- These methods are employed according to the kind of the plants e.g. tomato, brinjal, and chillies are less hardy and they should not be hardened severely.
- Vegetables like cabbage and lettuce can withstand low temperature. In hot region, hardening is done to withstand plants against possible burning due to sunshine, hot winds and deposition of warm sand,
- While in cold region hardening may develop protection against freezing. The process of hardening should be such that there is an assurance of high survival and slow growth under the conditions to be expected at the time of transplanting.
- Conditions, withholding watering followed by shifting of the plants under partial shade or lath house is the best and practical method for hardening. Three phases of crop development
- Over hardening should be avoided as it delays renewal of growth after setting out.
- Hardening should be gradual in order to prevent a severe check on growth or the possible killing of plant.

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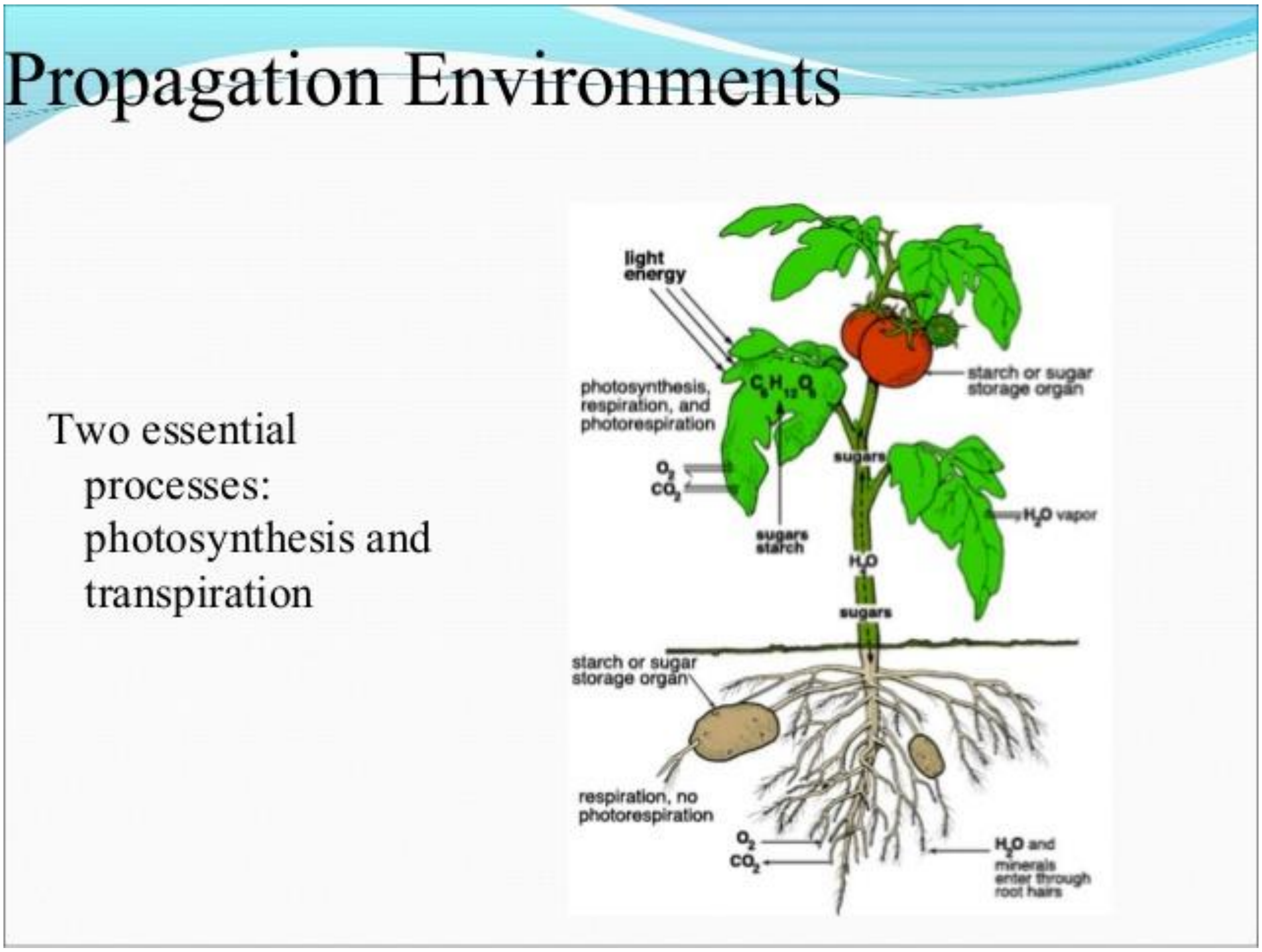
- It is better to maintain a moderate rate of growth through out the plant growing period than to have rapid growth up to the time of hardening and then check it suddenly.

Propagation Environments

Two essential processes: photosynthesis and transpiration



Atmospheric – light, temperature, humidity, carbon dioxide, and organisms

- Propagation structures can be built to modify the local climate so that plants will grow more rapidly. For example, a greenhouse will modify light, temperature, and wind compared to the outside environment, which affects not only temperature but also humidity and carbon dioxide levels inside the greenhouse.

- The greenhouse also affects the organisms that interact with the crop. For example, although a greenhouse structure can exclude insect pests, it also creates a more humid environment for new pests such as algae and moss.

Growing Medium –

- Growing medium limiting factors include water and mineral nutrients. The type of propagation environment can certainly affect water use; mineral nutrients are supplied through fertilization, both water and mineral nutrients are held for plant uptake in the growing medium.
- Organisms can be limiting in either the atmosphere or the SlideShare Explore Search growing medium. Animal pests, including insects, can be excluded from a nursery through proper design, and beneficial microbes, such as mycorrhizal fungi, can be promoted. environment

Types of Propagation Environments

Minimally Controlled Environments –

A minimally controlled environment is the simplest and least expensive of all types of propagation environments. The most common type is an open growing compound. It consists of an area where plants are exposed to full sunlight and usually nothing more than an irrigation system and a surrounding fence.

Semi-controlled Environments –

This next category of propagation environments is called "semi-controlled" because only a few of the limiting factors in the ambient environment are modified. Semi-controlled environments consist of a wide variety of growing structures ranging from simple cold frames to shade houses.

Fully Controlled Environments –

Fully controlled environments are propagation structures in which all or most of the limiting environmental factors are controlled. Examples include growth chambers and greenhouses. Fully controlled environments are often used because they have the advantage of year-round production in almost any climate. In addition, most crops can be grown much faster than in other types of nurseries. These benefits must be weighed against the higher costs of construction and operation. The more complicated a structure is the more problems that can develop. This concept is particularly true in the remote locations of many rural areas, where electrical power outages are more common and it is difficult, time consuming, and expensive to obtain specialized repair services.

Media for raising nursery

- Proper media is required for satisfactory germination of seed, subsequent seedling growth and anchorage or directly planted vegetative part of a plant and their root and shoot development;
- The media may be solid, liquid or spongy moss. In general; good soil, compost, Farm Yard Manure, shredded bark, saw dust, sand, peat, vermiculite and perlite having better water holding with acidic pH.
- These media are being used either alone or in combination.
- Sometimes, the amendments like gypsum and pyrite are also added in the beds while raising the nursery.
- In some cases, organic media may also contain some toxic materials to plants, especially when fresh.
- The media should have sufficient amount of plant nutrients, which are essential for growth and development.
- For raising seedling, soil should be friable and should absorb water readily and dry quickly at the surface, but it should not become dry too early.
- Loam and sandy loam soils well supplied with organic matter are good, provided that they are free from pathogen.
- To make the soil free from soil borne diseases especially damping off, it may be disinfected by soil fumigant. Media for raising nursery

  In general, the media should have following characteristics;

1. The media must be sufficiently firm to provide anchorage to seeds or cuttings.
2. It should be decomposed materials with high C/N ratio.
3. Its volume must be fairly constant when either wet or dry.
4. It should have better water holding capacity.
5. It should be porous to drain excess water.
6. It should be free from weed seeds and harmful pathogens.
7. Slightly acidic medium is preferred.
8. It should be readily available, reusable and cheaper.

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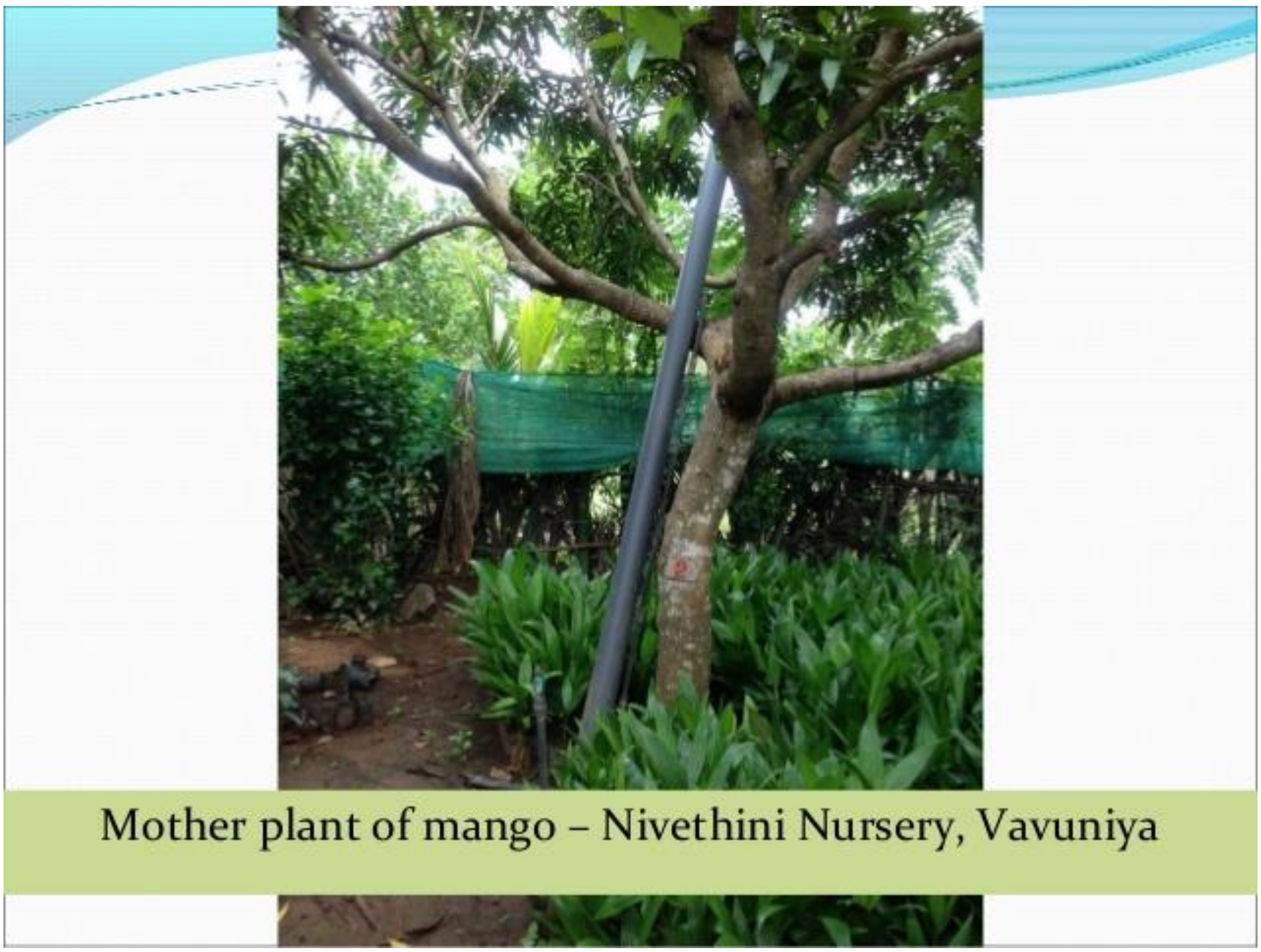
Mother block

- The planting stock that maintained as a source for commercial propagation is referred to as a mother block.
- As far as possible mother block should be in the close proximity of the nursery site. The scion shoots should be taken only from bearing plants.
- There should be proper record and certification of planting stock.
- Commercial planting stock can be referred as certified stock if it is grown under supervision of the DOA with prescribed regulations designed to maintain minimum standards of cleanliness and clonal identity.



Mother plant of mango – Nivethini Nursery, Vavuniya

Raising Of Rootstocks

- The plants propagated by grafting or budding require raising of rootstocks, upon which scion shoot or bud of a promising cultivar is grafted or budded.

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- Plan for activities such as collection/ purchase of seeds to be sown for rootstock purpose, preparation of seed bed, use of poly containers, filling mixture, type of seeds, seed quality, seed treatment, time and method of sowing, irrigation, pest, disease and weed management, thinning, removal of basal and side branches if required after care etc.

Use of containers

Use of polythene bags/ tubes

- This is very useful particularly under sandy soil.
- This is very cheap and convenient method for raising large-scale plantations.
- It is normally transparent but black and blue coloured polythene bags are also used some times.
- The size of polythene bags should be decided judiciously as small bags do not give large seedling and large bags require more filling mixture owing to more cost.
- The per unit production efficiency of planting materials is also reduced by using over size polybags, besides difficulty in transportation.
- The chief advantage of using polybags is that the seedling can be raised almost year the round under controlled conditions; therefore plantation programme will not suffer due to dry spell or shortage of labourers. It has suggested that the rootstock can be raised in polythene tubes (25x 10 cm) filled with a mixture of FYM, sand and clay (1:1:1)

.

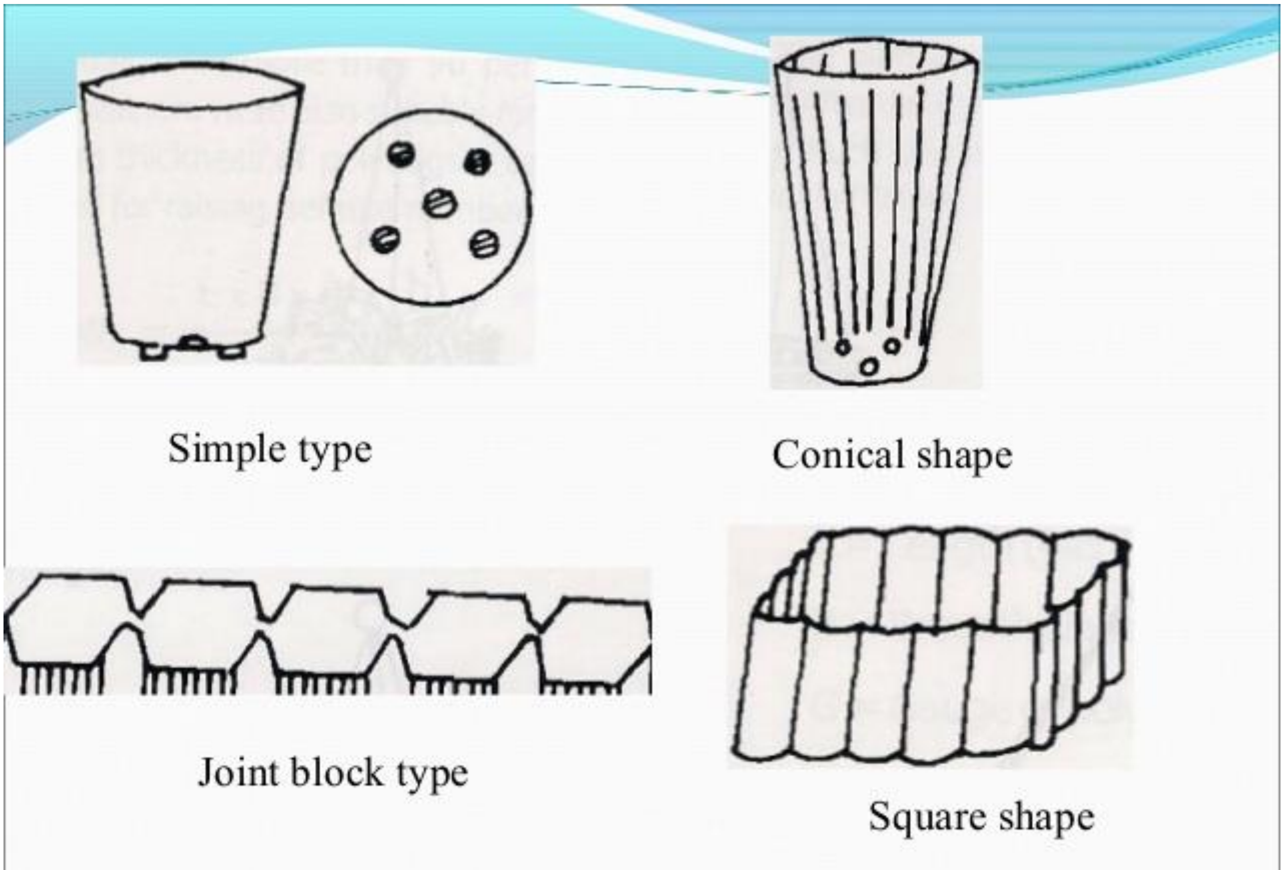
- Nursery is not raised generally in wooden boxes, clay pans and earthen pots except for the flowers but it is convenient to raise particularly vegetable seedlings as it has several advantages like;
  i) it is very easy to sow and transplant comfortably.
  ii) sowing or transplanting may be continued whatever may be the weather outside,

iii) it is convenient to check the plant growth during abnormal temporary weather condition, Plants raised in boxes can easily be removed for transplanting without any damage to their roots and there is an economy of labour and space if trays or boxes of standard size are used for this purpose. There are different types of pots available in the market which can be use for growing of ornamental plants particularly under indoor gardening.

Root trainers

- There should be a strong uncoiled tap root system with sufficient lateral roots. Though, the use of poly containers/ poly bags have several advantages, if seedling or component plant left for a longer period or undersized poly bags used; the tap roots coiled up, thereby poor performance after out planting.
- In order to overcome these problems, root trainers are used and the seedlings grown in root trainers are vigorous and have rapid growth rate as compared to seedlings grown in poly bags.

- The root trainers are semi-rigid or rigid containers with internal vertical ribs or corrugated walls and thus roots tend to develop straight down rather than spiral growth. There are various types of plastic or metal containers e.g. simple plastic trainers, corrugated walled plastic trainers etc. designed to prevent root coiling. They have holes at the bottom for aerial pruning of tap-root, aeration and drainage. These root trainers are generally made of black colour plastic.



Different types of root trainers

Other management activities :

Water management : give proper irrigation at frequent days interval

Weed management : As weeds are the competitor plants so proper weed management is nessary.provide herbicide if nessary.

Disease management : disease management is very much necessary .

Pest management: use pesticide and intregated pest management skills .

Conclusion :

Now a days commercial nursery is one of the best business occupation for this high-tech nursery management is very much necessary. It provide .....

- Better planting material .
- Gives better economic planning for nursery management.
- Provide good healthy plants .
- It also provide job and occupational opportunity for poor peoples .

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Rererances:

- tnau nursery management handout
- wekipedia
- https://docplayer.net/55580264-High-tech-nursery-management-in-horticultural-crops-a-way-for-enhancing-income.html

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Comprehensive Report on Entire RAWE 05 Programme

RAWE 05

PALLI SIKSHA BHAVANA

(INSTITUTE OF AGRICULTURE)

VISVA BHARATI

SUBMITTED BY –

Subrata Goswami
BAG(Sem- VIII) -45
B.Sc.(Ag.) Hons., Sem-VIII

GUIDED BY-

Dr.(Mrs.) Anindita Saha
Dept. of Agril. Extension
PSB, Visva Bharati

ACKNOWLEDGEMENT

I feel proud to present my Report on entire RAWE 05 Programme which aims to visualise the Working of KVK, SARF, CD Block and an Agro-based Industry.

I gratefully acknowledge my sincere thanks to our Course-Coordinator **Dr. (Mrs.) Anindita Saha** (Dept. of Agril. Extension, Palli Siksha Bhavana, Visva Bharati) for her constant guidance and support in completing the entire RAWE 05 course work which was meticulously planned and arranged.

I also take this opportunity to place on record my deep gratitude to all the officials and staffs of the concerned organisations for their kind cooperation.

-Subrata Goswami

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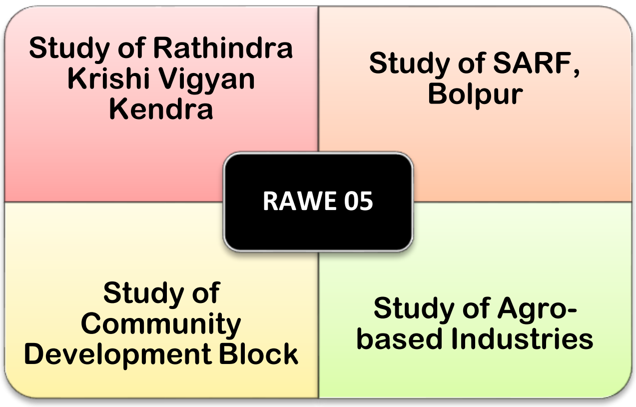
Comprehensive Report on Entire RAWE-05 Programme

The ***Rural Agricultural Work Experience (RAWE)*** Programme is a flagship activity for the final year B.Sc. (Ag.) students during the last semester. Building self-confidence in the agricultural graduates by honing their professional skills is the key objective of introducing RAWE at the under graduate level by ICAR. It is a compulsory course offered to students to understand the rural situations, status of Agricultural technologies adopted by farmers, prioritize the farmer's problems and to develop skills and attitude of working with farm families for all-round development in rural area.

Palli Siksha Bhavana (Institute of Agriculture), Visva-Bharati has also introduced this programme for the students of Semester- VIII, B.Sc. (Ag.) Hons. for a period of six months. The programme contains five core courses:

- RAWE-01 Crop Production [Village Attachment]
- RAWE-02 Crop Protection [Village Attachment]
- RAWE-03 Rural Economics [Village Attachment]
- RAWE-04 Extension Programme [Village Attachment]
- RAWE-05 Research Station/ KVK / DAATT Centre Activities and Attachment to the Agro-based Industries

❖ The RAWE 05 programme mainly sub-divided into the following :



In this course, we were guided by ***Dr. (Mrs.) Anindita Saha*** who meticulously planned and arranged the entire schedule of the course work.

We had selected Rathindra Krishi Vigyan Kendra, Sriniketan to study about the various activities of KVK and we visited the Sub-divisional Adaptive Research Farm, Bolpur for having an exposure to a research station. For the remaining two studies we were assigned specific blocks, preferably our home blocks, in group of two.

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Study of Krishi Vigyan Kendra

Introduction

KVKs are grass root level organizations meant for application of technology through assessment, refinement and demonstration of proven technologies under different 'micro farming' situations in a district. Transfer of technology is not a primary function of KVKs and the same is the responsibility of State departments. The KVKs on the other hand will assess and refine the newly released technologies, demonstrate the proven ones and train farmers and extension functionaries on the same in the locality according to changing needs of farmer. The most important role of KVK is to keep the environment harmonious and balanced through appropriate cropping and farming systems and by using the resources selectively and judiciously.

Methodology

a) Formal and informal discussion
b) Semi-structured interaction
c) Participant observation
d) Photo documentation

Mandate of KVK

With effect from 1st April, 1992, on first-line transfer of technology projects of the ICAR viz. National Demonstration (ND), operational research project (ORP) and Lab to Land Programme (LLP) have been integrated with the KVKs. In the reorganized system, the major mandates of the KVK are to conduct –

1. On farm trials(OFT)
2. Frontline demonstration(FLD)
3. Training programme
4. Entrepreneurship development

Structure and Method of functioning

1. Whole financial expenditure of KVK is given by ICAR.
2. It is an example of dual management system where it is under control of respective host institute, and staff recruitment is performed by host institute.
3. Activities of KVK are monitored by ICAR extension division under supervision of the Director General of Extension (presently Dr. A.K. Singh)
4. Agriculture Technology Application Research Institute (ATARI) maintains activities of KVK under supervision of ICAR and has 11 zones in India. Each and every ATARI has a director (scientist) and is supported by many scientists.

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Rathindra Krishi Vigyan Kendra

As of January 2020, there were approximately 716 KVKs throughout India distributed in 11 zones. No. of KVKs in each zone enlisted below. Rathindra KVK is situated in Zone-V.

The Rathindra Krishi Vigyan Kendra, Palli Siksha Bhavana, Visva Bharati was sanctioned on 4th October 1994 and started functioning in the month of April, 1995. This KVK was renamed as Rathindra KVK as Rathindranath Tagore, elder son of Rabindranath Tagore was one of the first Agricultural Graduate in the Asian continent.

Infrastructure of Rathindra Krishi Vigyan Kendra

The Rathindra Krishi Vigyan Kendra is widely distributed in about 16 hectare of land.

Structures of RKVK		
Sl No.	**Name of building**	**Area(m²)**
1.	Administrative Building	550.00
2.	Trainees' Hostel	305.00
3.	Threshing floor	180.00
4.	Farm go-down	46.25
5.	Poultry unit	80.00
6.	Soil test Lab	
7.	Portable Carp Hatchery	15.00
8.	Duckery unit	80.00
9.	Plant Diagnostic Laboratory	25.00
Source: Document of RKVK		

Experience gathered

From our study we have gathered the following experiences:

1. We have experienced how a KVK conducts Front Line Demonstration for transfer of technology.
2. We have seen how On-Farm tests are performed in KVKs and understood the importance for having such a set-up.
3. We have seen improved ways of cultivation of Azolla in portable structures in a small area.
4. We have experienced how irrigation practices are practiced in Mango Orchard.
5. We got a clear picture of how a KVK provide training to develop skill and knowledge of farmers, rural youth and grass-root level extension workers.

Ongoing Activities of RKVK

1. Artificial rearing of giant prawn in ponds.
2. Portable hatchery unit.
3. RKVK maintains 17 extinct variety of mango.

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4. 4 variety of guava also maintained.
5. Vermicomposting unit for research on vermicomposting.
6. A small garden of different medicinal plant variety also maintained.

Success Stories:

1. Glass Jar Hatchery
2. Wide spread adaption of Broccoli Cultivation
3. Commercial Cultivation of Capsicum
4. Mechanization in Potato planting

Research Work and Projects:

ICAR gives the technologies to KVK for refinement and then demonstration and for further passing it to State Government.

1. Development of Seed materials for agriculture, horticulture and fisheries.
2. Improved animal breed development.
3. Production of planting materials.
4. Feed based research on Giant Prawn to study their growth under ATMA.
5. ATMA funded Vermicompost research on various species of Earthworm.
6. Research on North American Azolla Sp. (*A. pinnata*)
7. Preserving endangered 17 Mango varieties in farm.
8. Research on implementation of Zero-Tillage in Wheat and Paddy in the locality.
9. Research on commercial seed production of various vegetables.
10. Research on Portable Fish Breeding unit.

Constraints

1) Present human resources are not sufficient.
2) Resource Base is not much wider.
3) Lack of proper Infrastructure.
4) Dual Control is a hindrance due to administrative control by Visva Bharati and financial assistance by ICAR.
5) Non Availability of latest technologies of communication and required resources.
6) No proper of dissemination of technologies from ICAR.
7) Financial support for proper coordination of training is not available

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Photo Documentation

RKVK Seminar Hall

Oilseed seed production unit

Fish Breeding Unit

Medicinal Plants Garden

Suggestions

1) Financial Support by the ICAR should be increased for proper maintenance and improvement of the KVK.
2) More mechanization should be introduced in the farm of KVK to fill the gap of the less labour force and maintain more area in short time.
3) More personnel's should be recruited by the ICAR as per the need of the KVK.
4) Proper and latest communication technologies should be introduced for easy dissemination of information among the farmer of the locality.
5) The dual control mechanism over KVK should be eased by the host institute and ICAR for proper functioning of the KVK.

Study of Sub-Divisional Adaptive Research Farm

Introduction

This is an adaptive research farm under the Department of Agriculture, Govt. of West Bengal, managed by Assistant Director of Agriculture. In Birbhum district, there are 3 sub-divisions viz. Rampurhat, Suri Sadar, and Bolpur-Sriniketan. In each Sub-division there is one Sub-divisional adaptive research farm. The farm located in Bolpur-Sriniketan conducts pre-release trial tests of various new crops under the climatic extremes at Tropic of Cancer i.e. under hot humid conditions during summer and cold of winters on lateritic soils of Birbhum.

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Objectives

Our visit to Sub-divisional Adaptive Research Farm, Bolpur-Sriniketan Sub division was conducted with some specific objectives. They are as follows:

- To gather general information about SARF, Bolpur.
- To study the organizational structure of SARF, Bolpur.
- To know about different ongoing field trials of SARF, Bolpur.
- To study the various extension activities of SARF, Bolpur.
- To study the procedure of certified seed production of SARF, Bolpur.
- To know about ongoing training programmes of SARF, Bolpur.
- To study in detail about the meteorological observatory located in SARF, Bolpur.
- To know about the achievements and constraints faced by SARF, Bolpur.

Methodology

1. Formal & Informal discussion with the officials of SARF.
2. Interaction with Smt. Koyel Bramha ADA(Admin.) and Sri Subir Ranjan Maity
3. Participant Observation
4. Photo documentation

FARM INFORMATION:

Topic	Relevant Information
Total Geographic area of the farm	25 Acre
Net available area of cultivation	16.63 Acre
Net cultivated area	7.757 Acre
Source of irrigation	Farm pond
No. of farm pond	1 Large and 1 Small
Irrigated area	1.5 Acre
Average cropping intensity	151.9%
Area allotted to agricullural marketing and food department	5 acres+3 acres= 8 Acres

Organizational Structure of SARF, Bolpur:-

The Sub-divisional Adaptive Research Farm comes under the umbrella of Director of Agriculture. The detailed structure is provided below:

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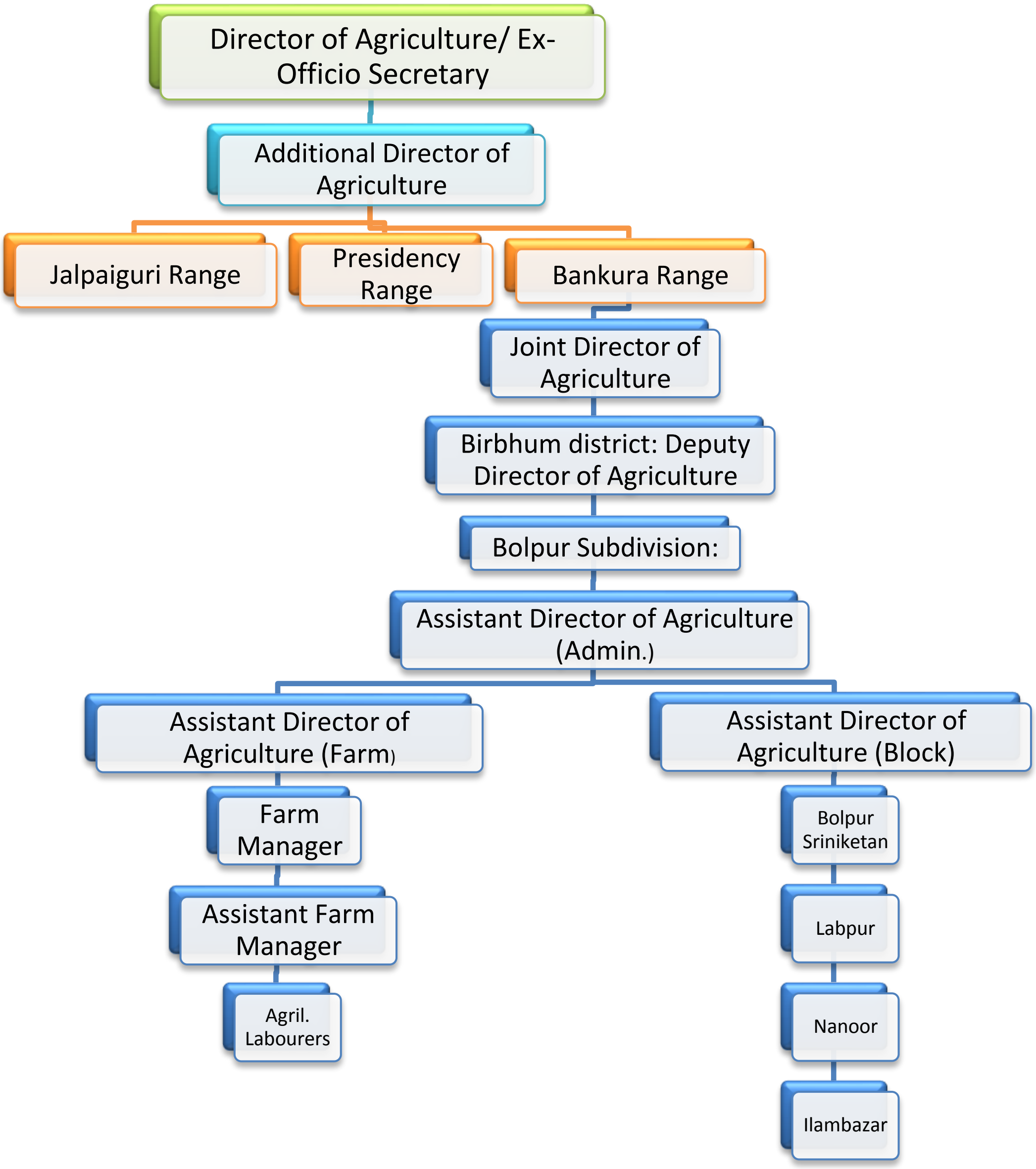

Activities of SARF :

The general activities of the SARF are as follows:

- To avail the small and marginal farmers all kinds of good quality foundation, certified and truthfully labelled seeds of cereals, pulses and oilseeds at a lower cost.
- To disseminate among the farmers, the new technologies to increase the productivity.
- To take up breeder and foundation seeds are and multiply.
- To distribute foundation seeds among other farms, where they are multiplied to obtain certified seeds.
- To supervise the production of quality seed (mainly paddy, potato, mustard, red gram, black gram, sesame, lentil) to ensure the recommended criteria are fulfilled.
- To see if the seeds are recommended or not recommended and then sell the recommended seeds to the farmers.
- To conduct research trials from the Commodity Research Station, Chinsurah Field Crop Research station, Burdwan, Zonal Adaptive Research station, Nalhati.

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AGROMETEOROLOGICAL OBSERVATORY OF SARF :

Agrometeorological observatory is a place where all the necessary instruments are maintained to observe and record different weather elements/parameters at stipulated time interval. when the observations are recorded for a sufficiently long time and analysed statistically, reliable crop-weather relations can be obtained.

In each subdivision, there is a special observatory which measured 180/120 ft as standard. But in this SARF, this observatory is measured as 100/120ft to maintain wind speed.

INSTRUMENTS FOR MEASURING WEATHER PARAMETERS:

1. Campbell-Stroke Sunshine Recorder
2. Windvane
3. Anemometer
4. Stevenson Screen
5. Dewgauge
6. Ordinary Rain Gauge
7. Self Recording Raingauge
8. Thermohydrograph

Ongoing projects and thrust area of SARF:

i)A strategy to develop organic farming has been chalked out since 2016.It is a 3year plan.
ii)Research work is being carried out in ZARS (Zonal Agricultural Research Station, Nalhati).

Two trials are presently being conducted :

- Aromatic rice (Pusa basmati)
- SUDHA method or SARP (System of assured rice production)

Training:

- **ATMA** exposure visits
- Seed treatment is encouraged
- Disease acknowledgement
- Single seed transplanting
- Pulse production is encouraged

Constraints

1) Lack of proper Fencing leading to occasional damage by cattle grazing.
2) Scarcity of KrishiShramiks
3) Posting of night guard
4) Scarcity of irrigation facility and sole dependence on farm pond
5) Scarcity of open threshing floor for sun drying of seed grains and pre-threshed crops.

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Suggestions

1. Co-ordination among different sectors should be increased.
2. Proper distribution of benefits to all sectors should be done.
3. Pulse cultivation should be promoted.
4. More Research should be set-up.

Photo Documentation

Paddy Transplanter

Interaction with ADA(Admin.)

Study of Community Development Block

Introduction

As a part of RAWE programme, Study of Community Development Block has a great importance to understand rural development work procedure carried out by a block. The main aim of this study is to gather practical knowledge about the functioning of a block and getting exposure of various developmental aspects of the rural areas. This study will help us in various aspects of future career development. This block carries out developmental works on agriculture, live stocks, women & child health, nutrition, rural reconstruction etc.

The Community Development Block is a rural area earmarked for administration and development in India. The area is administrated by a Block development Officer. A community development block covers several Gram Panchayats, the local administrative unit at the village level. Presently there are 341 community development blocks in India.

Objectives

The specific objectives the present study are:

- To study profile of the block.
- To study demographic pattern of the block.
- To study social institutions present in the block.
- To study agricultural situation of the block.
- To study animal husbandry and dairy status.
- To study cottage and rural industry of the block.
- To study different ongoing programmes under the block.
- To know the organizational structure of the block.
- To study pattern of co-ordination among various departments in the block.
- To study achievements of the block.
- To identify the present constraints & overall evaluation of the block.

Methodology

The information were collected mainly by visiting different departments of the block through a structured interview schedule and formal and informal discussions with the officials of different departments at the block like BDO, BLDO, ADA, KPS etc.

❖ INFORMATION GATHERED:

A. General :

1. Name of the Block: Suri-I
2. Sub- Division: Suri (Sadar)
3. District: Birbhum
4. Police Station: Suri
5. No. of Villages: 105(114 Mouzas)
6. Total Area of the Block: 155.38 sq. km.
7. Nearest Railway Station: Suri Station (2.5km)
8. Nearest Highway: NH-60
9. Telephone Office: Sub-office of BSNL,Suri (03462-255409)

B. Demography:

1. Total no. of family: 24977
2. Total Population: 110250
3. Male Population: 56457
4. Female Population: 53793
5. Educated Male: 37113
6. Educated Female: 35138
7. People engaged in agricultural operations: 19362

C. Social Institutions:

Cultural Institutions:	Educational Institutions:	Religious Institutions:	Economic Institutions:
• Cultural Auditorium: 3 • Cinema hall-2	• Primary School: 119 • Upper Primary School: 26 • Primary with Upper primary: 1 • SSK: 16 • MSK: 1 • Higher Secondary School: 14 • Colleges : 3	• Temple: 27 • Mosque: 14 • Madrasa: 1 • Church: 2	• Post Office: 10 • Commercial Bank: 22 • Gramin Bank: 03

❖ **Panchayati Raj:**

- Total No. of Anchal:07
- Names of Anchal:
  Alunda, Bhurkuna, Karidhya, Khatanga, Mallickpur, Nagari, Tilpara

- Total No of Gram Panchayat: 07
- PanchayatSamity : 01
- Gram Sansads (VillageCouncils): 60

❖ **Youth Club:**
- Total No: 16
- Activities:
    1. Sports like Cricket, Football tournaments etc.
    2. Social activities such as Blood Donation Camp, Tree plantation campaign etc.

D. Agriculture:

1. Gross Cropped Area: 14505 ha
2. Net Cropped Area: 10540 ha
3. Area u\nder Vegetable Cultivation: 950 ha
4. Cropping Pattern:

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- Paddy-Mustard-Rice
- Paddy-Potato-Sesame

❖ Principle Soil Type: Loose lateritic soil and alluvial soil (near river)

❖ Forest cover : 3.5% of the total district

E. Animal Husbandry:

1. Existing Breeds
    - Cattle: Indigenous, Gir, Sahiwal, Holstein,Jersey
    - Buffalo: Indegenous, Murrah
    - Goat: Black Bengal, Jamunapuri, Boer
    - Poultry: Deshi, Broiler, Rhode Island Red
    - Duck: Indegenous, Khaki Campbell

2. Total Population of Animals:
    - Cattle: 22568
    - Buffalo: 1361
    - Goat: 16379
    - Poultry and Duck: 62991

3. Area under fodder cultivation: 4-5 ha

4. Total no. of AI Centres: 5

5. Prevailing Cattle & Poultry Diseases:
    - Cattle: Foot and Mouth Disease, Black Quarter, Haemorrhagic Septicaemia,Worm infestation
    - Poultry: Ranikhet disease, Fowl pox
    - Duck: Duck plague

F. Cottage and Rural Industries:

1. Handicrafts Centres- 13
2. Pickle & Jelly Making: 5
3. Rice mill: 3
4. Furniture Making: 7

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G. Development Programmes (Agriculture, Horticulture,Animal Husbandry and Rural Development):

1. Table for Various programmes

Name of Programme		Target	Achievement
Agriculture & Horticulture	BGREI, RKVY, TRFA, NFSM, Dry Land, ATMA, PMFBYetc.	Schemes for enhancing yield and supporting farmers with supply of various inputs, increasing Cropping intensity	• Crop yield increase • Reduced disease and pest incidence • Introduction of new varieties • Technical assistance to farmers of the block
Animal Husbandry	FMD-CP, Goat Pox-CP, Animal health camp, AI awareness camp, Mass AI Programme, Cattle insurance.	To aware about various disease-pest and AI and other important practices for poultry and cattle rearing.	• Reduction in Cattle diseases • Enhancement of livestock status in some areas • Introduction of new breeds
Rural Developmen t	MGNREGS, ISGP, PMAY/BAY, NSAP, Manabik Prakalpa, Rupashree, Kanyashree, Sabujshree, JAP, PUP etc.	Rural development & welfare and promoting women welfare and health & hygiene	• Improved livelihood for Rural population • Increased literacy rate for women

- The various developmental programmes related to agriculture were catered with the help of officials and panchayat samiti members.
- Prani Bandhu helps in extending the Cattle programmes along with assistance of the staffs under BLDO
- Rural developments schemes are implemented by the office of BDO

✓ The following channels are usually used to inform the public about the development programmes:
- Through village level meetings
- Meeting with Panchayat Samiti members
- Publicity through miking, leaflet, poster,flex, hoarding etc.
- Awareness camps

✓ People are also involved in the building up of the block programmes. People participate in the meetings, ask their queries, and show enthusiastic and co-operative behaviour.

H. Organizational Structure of the Development Block:

Suri-1 Community Development

↓

SURI-1 PANCHAYAT SAMITI &
SURI-1 DEVELOPMENT
BLOCK
(BLOCK DEVELOPMENT OFFICER &
JOINT BLOCKDEVELOPMENT OFFICER)

↓

7 GRAM
PANCHAYATS

- Panchyat& Rural Development Officer
- Block Disaster Management Development Oficer
- Education Welfare Development Oficer
- Small Scale Industries Development Officer
- Family Welfare Development Oficer
- Relief & Re-habitation Development Oficer
- Self Help Group Development Officer
- Labour Welfare Development Oficer
- Fishery Development Oficer
- Health & Environment Development Officer
- Assitant Director of Agriculture
- Food Supply Development Oficer
- Land Development Officer
- Live Stock Development Officer
- Child Education Development Oficer
- Small Savings Development Oficer

LINE
DEPARTMENTS-

- ADA
- BLDO
- BL & LRO
- CDPO
- SIS(PRIMAR Y)

Major Achievements of the block:

- 2nd position in Birbhum district in implementation of MGNREGS (with avg. household person days- 82 as on 22/01/2020)
- ODF,PMAY, NSAP, MANABIK, Rupashree, Kanyashree
- Activities like demonstration, training, field visit, group training and meeting, KCC distribution and all other activities under Govt. Schemes are more or less completed in due time period.

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Existing constraints of the Block:

- Mainly drought prone area
- Communication problem in some interior area.
- Lack of staffs in few departments.

The on-going developmental programmes are going on quiet satisfactorily though certain problems like shortage of staffs, lack of co-ordination among various line departments, lack of awareness among common mass etc. need to be addressed.

Photo Documentation

Office of the BDO

Office of the BLDO

With BDO, Suri I CD Block

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Suggestions for improvement

- Proper distribution of benefits to all concerned should be done
- Fodder cultivation should be promoted
- More SHGs should be set up
- People should be made aware about different programmes their befits through campaigns, meetings etc.
- Efforts should be taken up to increase the literacy rate
- Alternative employment opportunities should be created

Study of Agro-based Industries

The basic necessity of this study is to understand the structural setup and functioning of an agro based industry. In this regard I visited a rice mill, **Amardyuti Agro Private Limited, Tasarkata, Suri, Birbhum.**

The main aim of this programme is to gather practical knowledge how the key performance is done by an agro based industry. This study will help us in various aspects of future career development.

Objective

The general objective of carrying out this study on Agro-based industries is to know about the various activities and processingmethodology in an Agro-based Industry. The specific objectives are as follows:
1) To study the organizational structure
2) To study the processing methodology
3) To study various ongoing activities
4) To study the interaction between the functionaries involved
5) To know about the economics of the unit
6) To gather information about various processed products developed in the units
7) To study the various marketing strategies and activities
8) To study the constraints and risk involved

Methodology

1. The information were collected mainly by visiting the Agro-based industry (Amardutty Agro Tech Pvt. Ltd.) through a structured interview schedule
2. Formal and informal discussions with the owner, manager and staffs of the unit
3. By general observations
4. Photo Documentation

Information gathered

❖ General Information:
- Name of the agro-processing industry: Amardutty Agro Tech Pvt. Ltd
- Location: Tasharkata, Suri, Birbhum

- Owner: SwapanGhosh
- Manager: AlokDey
- Year of establishment: 2008
- No. of Office staffs: 10
- No. of Labourers: 50
- Variety used: Swarna, MTU- 1010, Ratna
- Area: 18bigha (2.4 ha)
- Milling unit: 25,000 sq. ft.
- Source of raw paddy: KishanMandi, Local farmers and Co-operative societies of Sainthia, Ahmadpur, Suri etc.
- Supply processed product: All over West Bengal and other neighbouring states like Jharkhand, Bihar etc.
- Implements & Machineries: Threshing unit, Cleaner,Rubber roller, Boiler, Parboiler, Bran separator, Paddy strainer, Blower, Heat exchanger, Steam drier, De-husker, polisher, Colour sorter, Grader, Tractor, Lorry

❖ Objective of commercial milling:

A commercial rice miller will have following objectives:-

a. Produce edible rice that appeals to the customer- i.e. rice that is sufficiently milled and free of husks, stones, and other non-grain materials.
b. Maximize the total milled rice recovery out of paddy.
c. Minimize grain breakage.

❖ Economics:

- Paddy are bought from farmers @ Rs. 1835 / quintal
- Processed rice is marketed @ Rs. 2500- 3000/quintal (Depend on market, quality, Govt. policy)
- Rice bran is marketed @ Rs. 23/kg
- Rice husk is marketed @ Rs. 5/kg
- Salary of office staffs like Manager : Rs. 10000/month
- Daily labour charges : Rs. 200/day (as perGovt. rate)
- Daily 120 tonnes rice is processed in the mill.
- Electric bill – Rs. 50 lakhs/annum
- Repairing cost – Rs. 3 lakhs/annum

❖ Marketing behaviour of agro-processing unit:

i) Primary stage of the rice supply chain is held by the paddy farmers who supply paddy to the rice processing companies, which is supplied both directly and through intermediaries, depending on the type of farmers and their productivity.

ii) After operations process the rice is finally distributed to the 'Retailers' or directly to the 'Industrial Buyers' , through the 'Distribution Centres' or 'Distribution Agents'.

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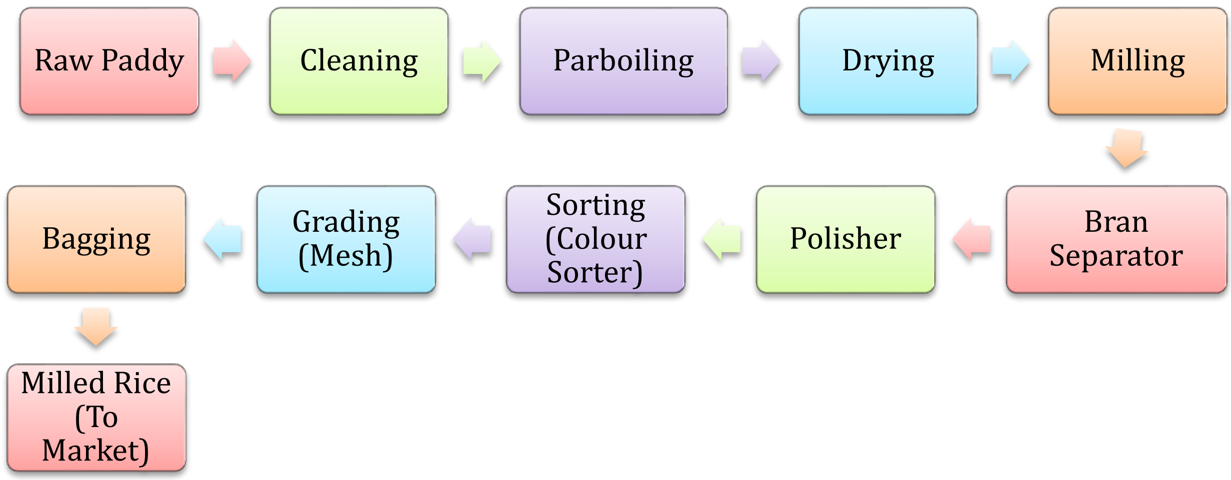
❖ Flow diagram of a modern rice mill:



❖ Risk Management of agro-processing unit:

- Drier are used instead of sun drying in long open yard during rainy season.
- Insurances are provided for machineries in case of any accident.
- Use proper marketing channel for selling the produce.
- Provide a good amount of salary and a beautiful environment to the workers.
- Import and use modern machineries in the mill to produce quality product which give them a better position in market.
- They get financial assistance from different financial institution a low interest rate for running the mill successfully.

❖ Constraints:

- Labour problem
- Transportation sometime become cumbersome
- Proper care is to be taken in the parboiling step of milling Paddy.
- Proper maintenance is necessary for proper separation through Sorter separator.
- It is to be taken care that the Cooling system of the Sorter separator is functioning properly throughout the procedure.
- Technological upgradation is mandatory from time to time to compete in the market.

Photo Documentation

❖ Suggestions:

- The Government must analyse the perspective problems of entrepreneurs of these agro based units before launching any developmental policy for them.
- The related groups of agro industries have to be set up in a co-ordinated manner so that the utilization of by-products can be possible simultaneously.
- Advanced management and marketing methods need to be introduced in agro industries, which cater to the export market.
- Both backward and forward linkages are to be ensured in respect agro industries so that maximum growth impulses are generated.
- Suitable strategies have to be formulated to promote rural savings and ploughingthem in rural areas for productive investments through attractive deposit and creditinstruments.
- Extension & dissemination of information through mass media, technology
- Development, research activities and training programmes need to be improved.

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Overall Conclusion of RAWE 05 Course

Through the ***Study on RKVK*** we came to know about how a KVK works, what are its activities and functions, its organisational structure, their role in development of rural areas, their extension activities, types and methods used in training of farmers, transfer of technology as well as their linkages with Government and Non-Government Organisations. We observed and experienced the actual technological implementations and constraints faced by officials in reality.

The ***Visit to SARF*** enriched our knowledge about the basic structure, activities, and functioning of a Research Station. We were exposed to the various equipments at the Agro-meteorological Observatory of SARF. We learned how the field trials are conducted to check the suitability of released variety under tropical climatic condition. The elementary function of SARF was beautifully precised by Smt.Koyel Bramha, ADA (Admin.) and Sri Subir Ranjan Maity during our two day visit to SARF, Bolpur.

The ***Study of Community Development Block*** has a great importance to understand rural development work carried out by a block. We gathered practical knowledge about the functioning of a block and had exposure of various developmental aspects of the rural areas. This study will also help us in various aspects of future career development. The block carries out developmental works on agriculture, live stocks, women & child health, nutrition, rural reconstruction etc.

Through the ***Study of Agro-Processing Industry***, I had an exposure of a modern rice mill. I formed an overall idea about how Paddy is converted into various processed products following various technologically advanced processes, their forward and backward linkage, its organizational structure, procedures followed, marketing behaviour and risks and constraints involved in the industry. The Indian food processing industry holds tremendous potential to grow, considering the still nascent levels of processing at present. Though India's agricultural production base is reasonably strong, wastage of agricultural produce is sizeable. However, these industries are facing several problems such as–Infrastructural problem, Lack of proper Skills, Upgrading technological, Support services etc. Although some of the problems could be dealt with by the industries and also requires government intervention and the cooperation and support of international agencies. Hence, it is necessary to pay greater emphasis on the problems faced by agro based units through well-furnished governmental policy. It lies in the long term interest of the entrepreneurs to actively contribute in Indian economy.

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“ PRECISION AGRICULTURE & ITS FUTURE IN INDIAN AGRICULTURE’’

SUBMITTED BY

TRINAYANEE SHARMA

VIII SEMESTER

ROLL NO-47

PALLI SIKSHA BHAVANA

VISVA-BHARATI

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ACKNOWLEDGEMENT

I, Trinayanee Sharma, a student of B.Sc. (Ag.) Honours, Sem-VIII, feel proud to present my assignment on **PRECISION AGRICULTURE & ITS FUTURE IN INDIAN AGRICULTURE**.

I gratefully acknowledge my sincere thanks to our respected teacher Dr. BINAY SAREN sir for his valuable guidance and supervision throughout the assignment work. It would be my utmost pleasure to express my sincere thanks to his for providing a helping hand in this regard.

I also take this opportunity to place on record my deep gratitude to my parents for their countless blessings showered on me while doing the work and to complete it. & last but not the least I thank the almighty for whatever I have achieved till now.

Rigorous hard work has been put in this project to ensure that it proves to be the best. I hope that this project will prove to be a breeding ground for the next generation of students and will guide them in every possible way.

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Introduction

"Agriculture is the backbone of the Indian economy and the villages are the life lines of growth of India."

Agriculture is a very important sector for the sustained growth of the Indian economy. About 70 per cent of the rural households and 8 per cent of urban households are still principally dependent on agriculture for employment. Since some three-quarters of the population live in rural areas, a majority of households thus depend principally on this sector. Though, industrialization of the Indian economy has adversely affected the share of agriculture in the GDP, the fact cannot be ignored that India has undergone a series of successful agricultural revolutions-starting with the 'green' revolution in wheat and rice in the 1960's and 1970's, the 'white' revolution in milk to the 'yellow' revolution in oilseeds in 1980's. As a result, India has achieved self-sufficiency in agriculture. Applications of agricultural inputs at uniform rates across the field without due regard to in-field variations in soil fertility and crop conditions does not yield desirable results in terms of crop yield. The management of in-field variability in soil fertility and crop conditions for improving the crop production and minimizing the environmental impact is the crux of precision farming. Geographically, India is widely distributed into several agro-climatic zones, and the information need for the farming systems in these areas is entirely different. Integrating the application of available technologies to realize farmers' goals requires a systems approach to farming. The concept of fully automated villages was a dream till few months back. But the reality has come to true with the rapid growth of information and communication technology in the world scenario. The wired villages and info villages have shown that Information can be disseminated in more useful manner and as farmers need.

❖ What is Precision agriculture ?

Precision agriculture is an agricultural system that has the potential of dramatically changing agriculture in this 21st century. Precision agriculture lends it self to most agricultural applications and can be implemented at whatever levels are required. Precision agriculture is based on information technology, which enables the producer to collect information and data for better decision making. Precision agriculture is a pro-active approach that reduces some of the risk and variables common to agriculture. Precision agriculture is more environmentally sound and is and integral part in sustaining natural resources. To better understand the need for an accurate definition of precision agriculture lets look at how precision agriculture is being considered. Precision agriculture is

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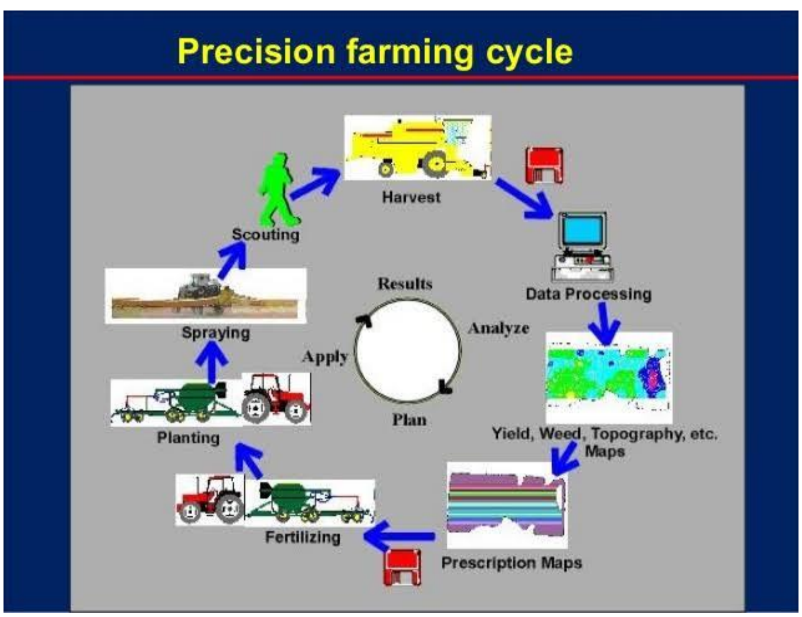
considered a concept, management strategy, and even a philosophy. It is said, “Precision agriculture is a phrase that captures the imagination of many concerned with the production of food, feed, and fiber.” The concept of precision agriculture offers the promise of increasing productivity while decreasing production cost and minimizing environmental impacts. Precision agriculture conjures up images of farmers overcoming the elements with computerized machinery that is precisely controlled via satellites and local sensors and using.

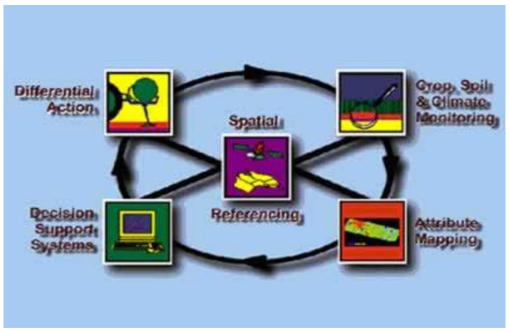
Stated some point which define PA clearly-

- Precision agriculture refers to the precise application of agricultural inputs with respect to soil, weather, and crop need in order to improve productivity, quality, and profitability in agriculture.
- It is a modern agriculture practice involving the use of technology in agriculture like remote sensing, GPS, and Geographical Information System (GIS) for improving productivity and profitability.
- It enables farmers to use crop inputs more efficiently including pesticides, fertilizers, tillage and irrigation water.
- More effective utilization of inputs will bring in more crop yield and quality without polluting the environment and will results in sustainable agriculture and sustainable environment.
- Hence precision agriculture is about doing the right thing ,in the right place, in the right way, at the right time.



❖ Need of Precision Agriculture :

The potential of precision farming for economical and environmental benefits could be visualized through reduced use of water, fertilizers, herbicides and pesticides besides the farm equipment. Instead of managing an entire field based upon some hypothetical average condition, which may not exist anywhere in the field, a precision farming approach recognizes site-specific differences within fields and adjusts management actions accordingly. Precision Agriculture offers the potential to automate and simplify the collection and analysis of information. It allows management decisions to be made and quickly implemented on small areas within larger fields.



❖ Components of Precision Agriculture :

In Precision agriculture, the field is broken into "management zones" also called 'grids' based on soil pH, nutritional status, pest infestation, yield rates, and other factors that affect crop production. Management decisions are based on the requirements of each zone and precision agriculture tools such as GIS, GPS, etc ., are used to control zone inputs. The exact location can be identified with the help of one of the main precision farming technology of Global Positioning System (GPS), while application on the exact location can be made with the help of advanced equipment available. To accomplish this, the farmer must mount a GPS receiver on the tractor/ system applying the chemical so that the equipment knows its location in the field. An in-vehicle computer must contain the fertilizer/pesticide (or whatever needs to be applied) – need map, which compares to the field position data recorded from the GPS receiver. In addition to fertilizer/pesticide requirements, plant population can also be chosen to optimise soil nutrients and plant variety selection can be chosen to take advantage of the field conditions. Crop yield can also be monitored to create maps that show the high and low production areas of a field for improved management decisions In order to collect and utilize information effectively, it is important for anyone considering precision farming to be familiar with the modern technological tools available. The vast array of tools include hardware, software and the best management practices. These are described briefly in the following..

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➢ Mapping

- The generation of maps for crop and soil properties is the most important and first step in precision agriculture.
- These maps will measure spatial variability .
- Data collection occurs both before and during crop production.
- The data collection technologies are grid soil sampling, yield monitoring, RS and crop scouting.

- During crop production, the data are c
- Collected through sensing instruments such as soil probes, electrical conductivity and soil nutrient status.
- Mapping can be done by RS, GIS and manually during field operations.

➢ Global Positioning System (GPS) receivers

- Global Positioning System satellites broadcast signals that allow GPS receivers to compute their location.
- This information is provided in real time, meaning that continuous position information is provided while in motion.
- Having precise location information at any time allows soil and crop measurements to be mapped.
- GPS receivers, either carried to the field or mounted on implements allow users to return to specific locations to sample or treat those areas.

➢ Yield monitoring

- In highly mechanized systems, grain yield monitors continuously measure and record the flow of grain in the clean-grain elevator of a combine.
- Linked with a GPS receiver, yield monitors can provide data necessary for yield maps.
- Yield measurements are essential for making sound management decisions. Soil, landscape and other environmental factors should also be weighed when interpreting a yield map.
- Used properly, yield information provides important feedback in determining the effects of managed inputs such as fertilizer amendments, seed, pesticides and cultural practices including tillage and irrigation.

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➢ Grid soil sampling and variable-rate fertilizer (VRT) application

- Soil cores taken from random locations in the sampling area are combined and sent to a laboratory to be tested. Crop advisors make fertilizer application recommendations from the soil test information.
- Grid soil samples are analyzed in the laboratory, and an interpretation of crop nutrient needs is made for each soil sample.
- Then the fertilizer application map is plotted using the entire set of soil samples.
- The application map is loaded into a computer mounted on a variable-rate fertilizer spreader.
- The computer uses the application map and a GPS receiver to direct a product-delivery controller that changes the amount and/or kind of fertilizer product, according to the application map.

➢ Remote sensing

- Remote sensing is collection of data from a distance. Data sensors can simply be hand-held devices, mounted on aircraft or satellite-based. Remotely-sensed data provide a tool for evaluating crop health.
- Plant stress related to moisture, nutrients, compaction, crop diseases and other plant health concerns are often easily detected in overhead images. Electronic cameras can also record near infrared images that are highly correlated with healthy plant tissue.
- Remote sensing can reveal in-season variability that affects crop yield
- The images can then be used to develop and implement a spot treatment plan that optimizes the use of agricultural chemicals.
- Satellite Remote sensing has provided a tool for acreage estimation one month in advance, with more than 95% accuracy and in mono-crop area yield estimation with more than 90% accuracy ten days in advance.
- The most popular procedure is to take images from satellites such as LANDSAT or SPOT.

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- Finally, images are used for generating maps and calibration of the measurement, assuming that measurements are taken in field to ground-truth accuracy.
- These images allow mapping of crop, pest and soil properties for monitoring seasonally variable crop production, stress, weed infestation and extent within a field.

➢ Geographic information systems (GIS)

- Geographic information systems (GIS) are Computer hardware and software that use feature attributes and location data to produce maps.
- An important function of an agricultural GIS is to store layers of information, such as yields, soil survey maps, remotely sensed data, crop scouting reports and soil nutrient levels.
- Geographically referenced data can be displayed in the GIS, adding a visual perspective for interpretation.
- In addition to data storage and display, the GIS can be used to evaluate present and alternative management by combining and manipulating data layers to produce an analysis of management scenarios.

➢ Farm Variability

- Every farm presents a unique management puzzle. Not all the tools described above will help determine the causes of variability in a field, and it would be cost-prohibitive to implement all of them immediately.
- An incremental approach is a wiser strategy, using one or two of the tools at a time and carefully evaluating the results.

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➢ Soil Variation

- Soil variation is a spatial variable. Water-holding capacity or organic matter variation, along with topography, provides even a more interesting view of a field.
- Other variables could be layered within this field to create a series of interacting elements. Collection and analysis of the samples only provides one portion of the base layer of information.
- Individual samples represent points; to be of value, they must be interpolated. There are as many interpolation schemes as there are sampling schemes.
- These schemes include central tendency, proximal, inverse distance methods, splines, and geostatistical.
- None of these methods or schemes are described herein, but all have been used to determine variability across a field.
- Topographic variation within fields can be collected from topographic maps, but the resolution on these maps is often insufficient to provide the necessary detail about variations within fields.
- Topographic maps can be generated from differential or kinematic geographic positioning systems. The role of topographic variations on water use, plant growth, soil processes, yield, surface runoff, and groundwater hydrology has not been quantified for agricultural fields.

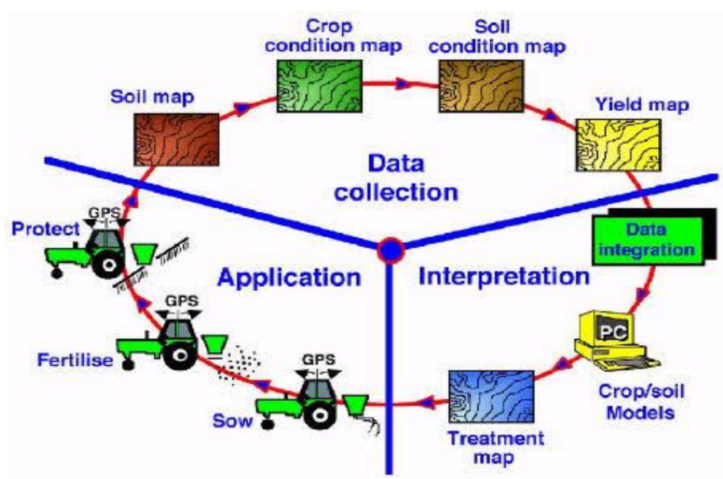
➢ Variability of Soil Water Content

- It is well established fact that soil water content in a field varies over time and location and this temporal and spatial variability in soil water content patterns may have profound implications for Precision Agriculture in general, and water management in particular.

- Knowledge of the underlying stable soil water distribution could provide a useful basis for precision water management and lead to savings in energy, water, equipment cost, labor, and improved production efficiency.

➢ Time and Space Scales

- Precision Agriculture requires an understanding of time and space scales.
- Time scales are critical because operations occur when they will benefit the crop most.
- Space scales become a fundamental principle of field management because inputs and cultural practices are varied with soil type, pest population, or crop maturity.
- The challenge is to determine how to use time and space scales to advantage in developing an improved understanding of agricultural management. To fully achieve the goals of precision agriculture, management must be applied in a space and time context.
- The challenge of monitoring in space and time is important to document the changes that are naturally occurring within a field. To fully realize the potential impact of principles of precision agriculture on environmental quality, however, will require the design and implementation of experiments in space and time.



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Opportunities of precision farming :

1) It will enhances agriculture productivity and prevent soil degradation in cultivable land resulting in sustained agricultural development.
2) It will reduce chemical usage in crop production.
3) Water resources will be utilised efficiently under the precision farming.
4) GPS allows agricultural fields to be surveyed with ease. Moreover the yield and soil characteristics can also be mapped.
5) Dissemination of information about agricultural practices to improve quality, quantity and reduced cost of production in agricultural crops.
6) It will minimize the risk to the environment particularly with respect to the nitrate leaching and groundwater contamination by means of the optimization of agro-chemical crops.
7) Non uniform field can be sub divided into smaller plots based on their unique requirements.
8) It provides opportunities for better resource management and hence reduce wastage of resources.
9) The opportunity exists to show producers how changing production practices will not place crops at risk and produce positive economic and environmental benefits.
10) Conducting experiments on precision agriculture will require field or farm scale studies and perhaps watershed-scale adoption of new management practices.

Drawbacks of precision farming :

1) High capital costs may discourage farmers to not adopt this method of farming.
2) Precision agriculture techniques are still under development and requires expert advice before actual implementation.
3) It takes several years before the actual collection of sufficient data to fully implement system.
4) It is an extremely difficult task particularly the collection and analysis of data.
5) Lack of technical expertise knowledge and technology.
6) Not applicable or difficult/costly for small land holdings..
7) Heterogeneity of cropping systems and market imperfection.

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❖ How could India benefits from Precision Agriculture ?

The agriculture sector contributes 17 percent to India's GDP, and 60 percent of rural households depend on agriculture and associated industries. With 160 million hectares, India has the second-largest arable land globally—second only to the US.

Yet, the sector is bleeding. Today, around 70 percent of agricultural households, mostly comprising small farmers with less than one hectare of land holding, depend on loans for their farming activities and struggle to make ends meet. Only 45 percent of the net sown area has access to irrigation facilities, leading to challenges in the production phase itself.

The model advocates the use of special tools and resources to understand the nature of the soil and the crop growth pattern**.** The land is broken down to "management zones" or "grids" according to the soil pH, nutritional status, pest infestation, and yield rates and based on this analysis, best practices are given to the farmer.

A brief discussion in following ,

- Refinement and wider application of precision agriculture technologies in India can help in reducing production costs, increasing productivity and better utilization of natural resources.
- It has the ability to revolutionalise modern farm management in India through improvement in profitability, productivity, sustainability, crop quality, environment protection, on farm quality of life, food safety and rural economic development.
- Site specific application of irrigation in wheat of Punjab and Haryana, pesticides in cotton and fertilizers applications in oil palm plantation in South India, and coffee and tea gardens of eastern India can highly reduce production costs and also reduce environmental loading of chemicals.
- It can increase the efficiency of irrigation efficiency when water resource are low.
- Farmers can use forecast and mitigate problems like water stress, nutrient deficiency, and pest-disease.
- It also increase opportunities for skilled employment in the agriculture sector and also provides new tools for evaluating multifunctional aspects including non market functions.
- It has the essential role in the monitoring of greenhouse condition s in agricultural fields.

❖ Challenges in adopting precision agriculture in india

- The adoption of precision farming in india is yet in the nascent stage due to its unique patter of land holding, poor infrastructure , lack of farmers inclination to take the risk, social and economical conditions and demographic conditions.

- The small size of landholding in most of the Indian agriculture limits economic grain from currently available precision farming technology.

❖ The Future :

Opportunities will continue for Precision Agriculture studies. Tools will become available to apply chemicals, fertilizers, tillage, and seed differentially to a field and collect the yield or plant biomass by position across the field. Remote sensing technology will allow us to observe variation within a field throughout the growing season relative to the imposed management changes. Monitoring equipment exists for capturing the surface water and groundwater samples needed to quantify the environmental impact through surface runoff or leaching. The technology exists to capture the volatilization of nitrogen or pesticides from the field into the atmosphere from modified practices. The future direction of agriculture will depend upon the research community's ability to conduct this type of study, with confidence from the environmental and producer communities that changes will benefit the environment and increase the efficiency of agricultural production

❖ Conclusions :

Precision Agriculture gives farmers the ability to use crop inputs more effectively including fertilizers, pesticides, tillage and irrigation water. More effective use of inputs means greater crop yield and/or quality, without polluting the environment. However, it has proven difficult determine the cost benefits of Precision Agriculture management. At present, many of the technologies used are in their infancy, and pricing of equipment and services is hard to pin down. This can make our current economic statements about a particular technology dated. Precision Agriculture can address both economic and environmental issues that surround production agriculture today. Questions remain about cost-effectiveness and the most effective ways to use the technological tools we now have, but the concept of "doing the right thing in the right place at the right time" has a strong intuitive

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appeal. Ultimately, the success of Precision Agriculture depends largely on how well and how quickly the knowledge needed to guide the new technologies can be found.

The approach required to be adopted by the policy makers to promote Precision farming at farm level:

- ✓ Promote the precision farming technology for the specific progressive farmers who have sufficient risk bearing capacity as this technology may require capital investment.
- ✓ Identification of niche areas for the promotion of crop specific organic farming.
- ✓ Encourage the farmers to adopt water accounting protocols at farm level. Promote use of micro level irrigation systems and water saving techniques.
- ✓ Encourage study of spatial and temporal variability of the input parameters using primary data at field level.
- ✓ Evolve a policy for efficient transfer of technology to the farmers.
- ✓ Provide complete technical backup support to the farmers to develop pilots or models, which can be replicated on a large scale.
- ✓ Policy support on procurement prices, in formulation of cooperative groups or self help groups Designation of export promotion zones with necessary infrastructure such as cold storage, processing and grading facilities.

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THANK YOU

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