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ESTIMATION OF SEED, FEED AND WASTAGE RATIOS FOR MAJOR FOODGRAINS IN WEST BENGAL

Executive Summary

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Introduction

Food security in the sense of sustainability of well being of population at all times has been the prime consideration of agricultural policy in India. In the early 1960s; India was deficient in foodgrains production. The focus on Indian policy in this period was to increase foodgrains production with a view to ensuring food security. From the situation of chronic shortage of foodgrains, India has made considerable strides towards achieving self-sufficiency in foodgrains, due to the green revolution beginning with wheat and then expanding to rice. Considerable success was achieved in the growth of agriculture in the 1980s. India is now self-sufficient in its foodgrains production. However, although India achieved self-sufficiency in foodgrains, the country is likely to face insufficiency in foodgrains in the coming years due to ever increasing population on the one hand, slow rate of growth of foodgrains on the other. As the scope for increasing agricultural production through bringing in additional area under cultivation has nearly exhausted, increasing demand for food due to continuous rising of population could only be met through improvement in productivity.

Of all the food articles, foodgrains constitute the major. Thanks to the government initiatives, the country, after launching various programmes to raise the production of food crops, has achieved remarkable success in boosting up foodgrains production. Foodgrains production in India has increased manifold since the inception of planning from 50.82million tonnes during 1950-51 to 213.46million tonnes during 2003-04. It is however obvious that all the foodgrains production are not available for human consumption. A part of the production is kept as seed by the farmers just after harvest. A portion of the produce is utilized as feed for the animals. In addition, a sizable quantity of production is wasted at different stages of handling of produce by the farmers stretching from the harvest upto the marketing of products. While foodgrains production are estimated through crop-cutting surveys, so far enough attention has not been given for estimating seed, feed and wastages ratios. In 1986, Government of India constituted a Committee of experts comprised of members from different organizations such as DES, NSSO, CSO, IASRI, Ministry of Civil Supplies and Ministry of Agriculture with the

objective to assess the seed, feed and wastage ratios for foodgrains. This committee, on the basis of available data reported that 12.50 per cent of the total production of foodgrain crops accounted for seed, feed and wastage. The committee however stressed the need for a fresh study for getting reliable estimates of the net quantity of foodgrains available for human consumption. Keeping in view the need for fresh estimates of seed, feed and wastages ratios, the present study was undertaken in West Bengal at the instance of Directorate of Economics & Statistics, Ministry of Agriculture, Government of India with the following straightforward objectives;

1. To estimate the total quantity of food grains consumed for seed, feed and wastage and
2. To estimate the net availability of food grains for human consumption.

Methodology

The study is based on both primary and secondary data. For secondary data, the study draws upon different state government publications and official sources. For primary data, the study is confined two crops viz. one cereal crop and one pulse crop selected on the basis of area predomination in the state. Among the cereal crops, rice is dominant and among the pulses, lentil is the major and accordingly the chosen crops are rice and lentil. Keeping in view the concentration of area of these two important food crops, the two districts viz. Midnapore (East) for cereal crop(rice) and Murshidabad for pulse crop (lentil) have been selected purposively for the study. After the selection of the district, a total number of four strata were formed by suitably combining the adjoining blocks. From among the list of villages of these blocks, five villages from each strata were randomly selected. After that, a complete list of farmers growing selected cereal and pulse crops in the villages was prepared following the complete enumeration method. In the next stage, considering the size of land held by the farmers, all the farmers in the village were grouped into three size categories following the standard categorization of land holdings viz. marginal (below 1ha), small (1-2ha) and medium (2-4ha). Farmers in the large category (4ha and above) were not available in the selected villages and the deficit has been filled by taking the sample farmers from the existing size categories of landholdings. A sample of 15 (fifteen) farmers (five farmers from each of the three groups) was selected from each selected village totaling to the sample size of 300 farmers from 20 villages in each district. The study is thus based on a total sample of 600(six hundred) cultivators in the state comprising 300 farmers from Midnapore (East) district and another 300 farmers from Murshidabad district.

In order to estimate of seed, feed and wastage ratios, a detailed information on cropping pattern, production and disposal of crops, consumption of feed by animals, wastages at harvest and post-harvest stages for each selected crop from each selected cultivator were collected through well-structured schedules. Tabular analysis and simple analytical tools such as averages and percentages are used for analyzing primary data. Finally, having estimated the magnitude of post harvest losses, functional analysis has been done to assess the influence of different socio-economic factors on post harvest losses using farm level survey data collected from 300 farmers for each selected crop viz. rice and lentil. The reference year taken for the study is 2004-05 and the data is collected for khariff and rabi seasons.

Results

Crop-wise Estimates of Grain for Seed

Although, seeds constitute a very small fraction of the total inputs used in the production process yet this is considered to be the crucial input for the enhancement of crop production. Now we give an account of the crop-wise seed requirement of the sample farmers for the selected cereal and pulse crops in the selected districts.

The sample farmers of Midnapore (East) district were observed to be keeping 4.82 per cent of rice grain production as seed whereas in Murshidabad district, the percentage quantity of rice used as seed to its total production found to be 4.06 per cent. Pulse growing farmers are keeping less percentage of seed out of their total production as compared to that used for rice grain. The percentage of production kept for seed in case of pulses was of the order of 4.01 per cent in Midnapore (East) and 2.96 per cent in Murshidabad. Notably, in the district selected for pulse (lentil), the percentage of quantity retained for seed in case of selected pulse (lentil) crop is much less as most of the farmers in the district are found to have purchased seeds from the market.

Sample farmers were also found to have met their seed requirements keeping seeds out of their own previous year's crop production. The percentage quantity kept as seed constituted 3.19 per cent for rice and 2.63 per cent for pulse (lentil) crop in Midnapore (East). The corresponding figures in Murshidabad district were 3.51 per cent and 2.65 per cent respectively.

Crop-wise Estimates of Grain for Feed

The following analyses present crop-wise estimates of the quantity of selected cereal and pulse grains used for feeding livestock and poultry birds. Livestock comprised of cows, bullocks, buffalos and calves. Other components of livestock are goats, sheep

etc. and they are not fed grains by the sample farmers in the selected districts. It is noticeable that no buffalo was fed the selected cereal grain in Midnapore (East) district. In the district, the annual consumption of rice per animal was of the order of 80.65 kg for cow, 80.61 kg for bullocks and 40.32 kg for calves. Animal-wise relatively more feed were provided to cows. Again within cows, the milch animals were provided higher feed than dry animals. Annually about 92.67 kg of rice grain per cow was fed to the cows in milk while in case of dry it was 74.65 kg. In the district of Murshidabad, the average per animal quantity of rice fed to different types of livestock was of the order of 29.13 kg for cows, 42.24 kg for he-buffaloes, 33.62kg for bullocks and 23.71 kg for calves. Here again the variation in the extent of feeding across the milch and dry cows is noticed. Annually milch cows, were given 35.92 kg of rice grain per cow while the dry cows were given 25.74 kg.

With regard to the percentage quantity of selected grain (rice) fed to livestock taken with respect to the total production of sample farmers, we find variation across the selected districts. The percentage quantity of selected rice grain fed to livestock is found to be less in Murshidabd district as compared to Midnapore (East). The percentage quantity of rice grain fed to the livestock taken with respect to total rice production of the sample farmers in Midnapore (East) district constituted 0.74 per cent for cows, 1.13 percent for bullocks and 0.08 percent for calves. The sample farmers of Murshidabd district have fed rice grain of about 0.24 percent of their total rice production to cows, 0.11 percent to he-buffaloes, 0.35 percent to bullocks and 0.04 percent to calves.

While considering the pattern of feeding of pulse grain, we find significant variation across the selected districts. The sample farmers of Midnapore (East) were not found to be feeding pulse (lentil) grain to their livestock. But in the district of Murshidabad selected as representative of pulse (lentil) crop, the sample farmers were found to be feeding pulse grain which was annually about 11.95 kg of pulse grain for cows, 19.20 kg. for he-buffaloes, 14.71kg for bullocks and 9.42 kg. for calves. Annually cows in milk were given more grains (15.62kg) as compared to dry milch cows (10.11kg). The percentage quantity of pulse (lentil) grain in relation to the total production fed to livestock worked out at 0.88 per cent for cows, 0.46 percent for he-buffaloes, 1.36 percent for bullocks and 0.13 per cent calves. The annual quantity of selected cereal grain given as feed to poultry birds varied significantly across the selected districts. In Midnapore (East), annual quantity of cereal (rice) consumption per bird was found to be 3.44 kg for hens and 3.80 kg for duck which averaged 3.65 kg for all the

poultry birds. The corresponding figures in Murshidabad district were observed to be 1.73 kg and 2.40 kg for hens and duck respectively and for all the poultry birds together the figure works out to 2.11 kg. In terms of proportions taken as percentage of total rice production of the sample farmers, the figures work out negligible proportions of 0.08 and 0.03 per cent for hens in Midnapore (East) and Murshidabad respectively. The corresponding figures for duck are estimated at 0.12 and 0.15 per cent in the districts of Midnapore (East) and Murshidabad respectively.

The quantity of selected pulse (lentil) grain fed to the poultry birds across the selected districts clearly reveals that though sample farmers of Midnapore (east) possessed about 702 poultry birds none of these birds were fed selected pulse (lentil) grain. The sample farmers of Murshidabad district were found to have fed pulse grain to the poultry birds where the average per bird quantity of selected pulse fed by the sample farmers stood at 1.98 kg per year. The quantity of selected pulse grain consumption per bird is found to have varied across hens and ducks. The average per bird quantity of selected pulse fed by the sample farmers was found to be 2.31 kg. in case of duck which was much less at 1.55 kg. for hens. This is attributable to the fact that sample farmers in Murshidabad district are leaving hens open so that they could be fed by themselves. The same reason applies to Midanpore (East), where both hens and duck are left open for obtaining feed by themselves. The quantity of selected pulse (lentil) grain fed to poultry birds taken with respect to the total production of the sample farmers of Murshidabad district formed 0.23 percent for hens and 0.45 percent for duck. Notably, in Murshidabad district where pulse grains are fed to poultry birds, the percentage quantity of pulses (lentil) fed to poultry bird population was observed to be more as compared to the estimated percentage for selected cereal (rice) grain fed to poultry birds.

Crop-wise Estimates of Wastages

The wastages of foodgrains occurred at different stages of handling of produce by the farmers. These stages ranged from the stage of harvest to various operations at post-harvest stages and the total wastages were estimated as a sum of losses at all the stages. The percentage total wastages of selected cereal grain in Midnapore (East) was thus estimated at 7.73 per cent of total production while the corresponding percentage quantity wastages in Murshidabad district was observed to be 8.32 per cent. The stages during which wastages occurred were at harvest and post-harvesting stages inclusive of threshing and shattering, left in straw, transportation, storage, wastages during home consumption and left in animal/poultry feed. In Midnapore (East), the percentage wastages of selected

cereal (rice) grain was found to be highest in storage (2.89 per cent) followed by harvesting (1.57 per cent), threshing and shattering (1.02 per cent) left in straw (0.97 per cent), transportation (0.87 per cent), wastage during home consumption (0.18 per cent) and left in animal and poultry feed (0.23 per cent). All these wastages put together came to be a total of 7.73 per cent for the selected cereal (rice) grain in the district of Midnapore (East). In Murshidabad district, the percentage total wastages of the selected cereal (rice) grain worked out at 8.32 per cent of total production, little higher than that of Midnapore (East). The highest percentage of wastage was located in storage (3.42 per cent) followed by harvesting (1.60 per cent) left in straw (1.19 per cent), transportation (0.91 per cent), threshing and shattering (0.71 per cent), during home consumption (0.34 per cent) and left in animal/poultry feed (0.15 per cent).

Estimate of wastages of the selected pulse (lentil) crop revealed no significant variation across the selected districts. The percentage of total wastage of the selected pulse crop (lentil) at harvest and post-harvest stages for the sample farmers of Murshidabad district was marginally higher (5.68 per cent) than that of total wastages of 5.08 per cent in Midnapore (East). The percentage loss of production of selected pulse (lentil) in Murshidabad district was found to be highest in storage (3.58 per cent) followed by threshing and shattering (0.81 per cent), harvesting (0.56 per cent), left in straw (0.38 per cent), during home consumption (0.34 per cent) and left in animal/poultry feed (0.02 per cent). In Midnapore (East) district, the percentage quantity wastages of the selected pulse (lentil) taken with respect to total production worked out at 5.08 per cent. The highest wastage was in storage (3.36 per cent) followed by threshing and shattering (0.73 per cent), harvesting (0.57 per cent), during home consumption (0.28 per cent) and left in straw (0.14 per cent).

Crop-wise Estimates of Percentage of Seed, Feed and Wastage and Available Quantity for Human Consumption

Here we present total information on the quantity of selected cereal grain as well as pulse grain used for seed, kept as seed, used for animal feed and various wastages occurring during harvest and post-harvest stages to arrive at the final quantity available for human consumption. Overall, at the aggregate level, the percentage quantity of selected cereal (rice) grain used as seed, animal feed and wastage was found to be 13.07 percent (table-1). At disaggregated level, the percentage quantity of selected cereal grain used as seed was estimated at 3.19 per cent. The proportion of selected cereal grain production used for animal feed was observed to be 2.15 percent whereas the percentage

Table-1

Crop-wise Percentage of Seed, Feed and Wastage Ratio in production of Cereal (Rice) in Midnapore (East) and in Production of Pulse (Lentil) in Murshidabad district.

District	Size of holding	Crop	Area (ha)	Production (kg)	Seed used		Seed kept		Used as feed		Wastage		Consumption as seed, feed and wastage (kg)		Available quantity for human consumption	
					Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%	Qty. (Kg.)	%
Midnapore (East)	Marginal	Rice	68.82	175370.86	5587.80	3.18	6861.11	3.91	1512.00	0.86	11761.34	6.71	18861.14	10.75	156509.72	89.25
	Small		169.67	446397.84	14492.58	3.25	19286.91	4.32	8081.36	1.81	33175.20	7.43	55749.14	12.49	390648.70	87.51
	Medium		268.07	679972.01	21483.89	3.16	36548.95	5.37	18407.82	2.71	55622.03	8.18	95513.74	14.05	584458.27	85.95
	All		501.55	1301240.71	41564.27	3.19	62696.97	4.82	28001.18	2.15	100558.58	7.73	170124.03	13.07	1131116.68	86.93
Murshidabad	Marginal	Lentil	8.30	8905.40	224.10	2.52	261.70	2.94	127.28	1.43	389.06	4.37	740.44	8.32	8164.96	91.68
	Small		36.34	36653.55	1009.68	2.75	1096.60	2.99	1712.64	4.67	1957.66	5.34	4679.98	12.76	31973.57	87.24
	Medium		78.05	80935.45	2124.25	2.62	2384.50	2.95	2594.63	3.21	4836.81	5.98	9555.69	11.81	71379.76	88.19
	All		122.69	126494.40	3358.04	2.65	3742.80	2.96	4434.56	3.50	7183.50	5.68	14976.10	11.84	111518.30	88.16

quantity of wastage was found to be quite significant which stood at 7.73 percent. Thus, an aggregate 13.07 per cent of selected cereal (rice) grain production goes towards seed, feed and wastage. That is, about 86.93 percent of total cereal (rice) production was available for human consumption.

In the case of the selected pulse (lentil), the percentage of aggregate quantity of selected pulse (lentil) grain used for seed, animal feed and total wastages was estimated at 11.84 percent. At the disaggregated level, the proportions of selected pulse grain used for seed, animal feed and wastages were of the order of 2.65 percent, 3.51 percent and 5.68 percent respectively. The percentage quantity of selected pulse grain (lentil) available for human consumption thus arrived at 88.16 percent of total production.

Overall, for the selected foodgrain crops, the quantity available for human consumption was largely reflected in the percentage quantity of total wastage of grains. A significant percentage of produce is lost during different operations at farmers' level stretching from harvesting to the market for sale. Thus having obtained the estimates of the percentage of aggregate quantity of wastage of selected grains, it is intended to examine the factors that influence post-harvest losses in grains. In the following section, attempts has been made to identify the factors affecting post-harvest losses in the selected foodgrain crops through undertaking regression exercises.

Factors Affecting Post-harvest Losses in Foodgrains: Functional Analysis

Usually Indian farmers do attach much importance on seed requirement of a particular crop to be used in an agricultural year and usually, it is observed that farmers keep seeds from their produce just after harvest more than the actual requirement. Besides a sizeable quantity of production goes towards animal feeding. A significant quantity of produce is also lost during the process of handling of produce by the farmers in the post-harvest system viz. harvesting, transportation, threshing, storage, processing, marketing etc. However, although the use of foodgrains for seed and animal/poultry feed are essential requirement of the farmers, wastages of foodgrains at different stages are major concern in arriving at the actual estimates of foodgrains and thus in ascertaining net availability of foodgrains for human consumption. Hence, there is need to identify the factors that influence the post-harvest losses in foodgrains which would help develop corrective measures to reduce these losses. The present section thus intends to examine the factors affecting post-harvest losses in foodgrains at farmers' level.

The magnitude of post harvest losses at different stages are estimated for two selected foodgrain crops viz. rice and pulse. While tabular analysis has been used to estimate the magnitude of post harvest losses of foodgrains, functional analysis has been done to assess the influence of different socio-economic factors on post harvest losses using the survey data collected from 300 farmers for each selected crop. The following multiple linear regression equation was fitted to the survey data separately for each crop selected under the study.

$$Y = a_0 + a_1X_1 + a_2 X_2 + a_3 X_3 + a_4 X_4 + a_5 X_5 + a_6 X_6 + a_7 X_7 + a_8 X_8 + u_i$$

Where Y = post harvest losses of rice/pulse at the farm level in quintals

X_1 = age of the farmer respondents in years

X_2 = level of literacy of the farmer respondents

X_3 = total production of rice/pulse in quintals

X_4 = area under rice/pulse in ha.

X_5 = irrigated area under rice/pulse

X_6 = area under commercial crops (in ha.)

X_7 = storage dummy which takes the value "0" if the storage facility was available and value "1" otherwise

X_8 = threshing machine dummy which takes the value "0" if threshing machine is available during harvesting and value "1" otherwise

u_i = random error term.

As follows from the results of regression exercises, variables included in the regression equation for selected cereal (rice) crop explained 94.16 per cent the variation in the total post-harvest losses in rice. The regression coefficients of all the variables except age and threshing machine dummy were positive. However, the post harvest losses were positively and significantly associated with area under rice and storage dummy. Other positive coefficients were not statistically significant. Thus the post harvest losses in rice was found to have increased with the increase in area under rice and non-availability of storage facility. A negative association with age and threshing machine dummy were observed but none of them turned out be statistically significant.

In case of selected pulse crop, the explanatory variables used are the same as that of rice except the threshing machine dummy. In all seven variables are considered in the estimated equation for pulse. Similar to rice, the variables included in the regression equation explained a large part of the variation (94.26 per cent) in post harvest losses of

pulses. In four, out of seven variables positive association was observed. Variables having positive relation are level of literacy, total production of pulse, pulse area under irrigation, area under commercial crops. Of them, total production of pulse is the only variable which turned out to be statistically significant. Thus post harvest losses in pulses increased with the increase in volume of production of pulses. Variables having negative association are age of the farmer respondents, area under pulse and storage dummy. Out of the variables exerting a negative influence on the dependant variable, the coefficient of area under pulse were found to be statistically significant, which is however contrary to the usual expectation.

The functional analysis has thus revealed that post harvest losses of rice are significantly influenced by area under rice and availability of storage facility. This implies that while losses would increase with the increase in area under rice, the establishment of storage and warehousing units would help reduce the post harvest losses in rice. In the case of pulses, contrary to the anticipation, the coefficient of area under pulses exerted negative influence on post harvest losses. However, a positive and significant relation with the volume of production of pulses clearly indicated that the post harvest losses in pulses increased with the increase in size of output.

Conclusions and Policy Implications

Based on the findings of the study it can be concluded that seed, feed and wastage ratios in case of cereals (rice) could be taken as 13.07 per cent whereas in terms of pulses (lentil) the ratio be taken as 11.84 per cent. However, while the use of foodgrains for seed and animal/poultry feed are essential requirement of the farmers, wastage of foodgrains at different stages are major concern in pushing up the availability of foodgrains for human consumption. Thus, in an attempt to identify the factors affecting post harvest losses in the selected foodgrain crops through undertaking regression exercises it is clearly revealed that the post harvest losses of cereal crop (rice) increased with the non-availability of storage facility. This implicates that there is need for developing proper storage facilities both at the farm level and in the state. Storage facilities should be such that every grain produced could be preserved and be made available to the consumer without affecting its quality and quantity. Safe storage of foodgrains is as important as production of foodgrains. Sample farmers are found to have poor storage structure for storage of their foodgrains and the percentage of wastages of selected foodgrain crops were found to be highest in storage. So far, facilities available in the state are also far

from satisfactory. Thus, easing of infra-structural bottlenecks in the form of promoting godowns and accordingly creating more storage facilities are called for in order to minimize post harvest losses in foodgrains. The establishment of small sized warehouses/godowns in remote villages would greatly help reduce the storage losses. This calls for stepping up public investment in developing storage facility in West Bengal (**Attn: West Bengal State Warehousing Corporation**). The involvement of private sector should also be encouraged in promoting storage facilities through construction of godowns in rural areas. On the side of farmers, there is need for adopting scientific storage practices and for the purpose, farmers need to be encouraged to construct separate storage structures. Moreover, educating and training the farmers on proper methods of post harvest management would help avoid wastage of foodgrains at harvest and post harvest operations (**Attn: Directorate of Agriculture, Government of West Bengal**).

Further, as evidenced by the estimated regression coefficient of threshing machine dummy in case of rice, threshing losses were higher when the produce is threshed by threshing machine as compared to manual threshing. In general, however farmers preferred to use threshing machine for threshing activity due to their time and cost advantage. What is therefore needed is to make available quality threshers in the market and also to train the farmers for proper handling of threshers (**Attn: Directorate of Agriculture, Government of West Bengal**).