Study No. 156

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

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PREFACE

The present study was undertaken at the instance of Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, Krishi Bhavan, New Delhi as a coordinated study, the act of coordination being vested upon the Agricultural Development and Rural Transformation Unit, Institute for Social and Economic Change (ISEC), Bangalore. Initially, the proposal as well as schedules was sent by Indian Agricultural Statistics Research Institute, New Delhi. The coordinating centre, ADRT Bangalore modified the schedules according to the requirement of the study and took the final shape for undertaking the study in the participating states. The study was designed to estimate the availability of foodgrains for human consumption after making allowance for Seed, Feed and Wastages in the total production of major foodgrains.

While foodgrains production is estimated with the help of crop-cutting surveys, so far enough attention has not been given for estimating seed, feed and wastages ratios for foodgrains. 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 Ministry of Agriculture, Government of India had asked Agro-Economic Research Centres in the country to undertake a common study on "Estimation of seed, feed and wastage ratios for major foodgrains". The Agro-Economic Research Centre, Visva-Bharati has taken up the study in West Bengal.

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.

At the aggregate level, it is noticed that the percentage quantity of selected cereal (rice) grain used as seed, animal feed and wastage was 13.07 percent. 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 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 and the percentage quantity of selected cereal (rice) grain available for human consumption was worked out at 86.93 percent.

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. The study observes that a significant percentage of produce is lost during different operations at farmers' level stretching from harvesting to the market for sale. 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. So far, facilities available in the state are 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.

The study team associated with the project consisted of Prof. Kazi MB Rahim, Dr. Jiban Kumar Ghosh, Mr. Debanshu Majumder and Mr. Ashok Sinha. The undersigned has provided consultative inputs in carrying out the study. Dr. Jiban Kumar Ghosh took all the pains for drafting of the report. The field investigation and tabulation works were jointly done by Mr. Debanshu Majumder and Mr. Ashok Sinha. At the stage of field investigation, Mr. Ramesh Chandra Mondal keenly assisted the study team. Besides Sri Vivekananda Datta assisted at the stage of collection of secondary data from various official publications of the Government of West Bengal. Munshi Abdul Khaleque and Sri Nityananda Maji painstakingly performed the tedious job of typing who also helped in compilation of data at the computer. The secretarial

assistance was received from Sarbasri D. Mondal, H. Roy, P. Das, A. R. Patra and P. Hazra. I offer my thanks to all of them.

On behalf of the centre, the undersigned takes the opportunity to thank the officials of the Government of West Bengal for their kind help and cooperation in carrying out the study. I am especially thankful to the officials of the Bureau of Applied Economics and Statistics, Food and Supplies Department, Government of West Bengal who extended whole-hearted support to the study team and spared time to give us the necessary information. I also take this opportunity to thank the sample respondents in the study area of the state of West Bengal for their cooperation at the time of collecting primary data. Finally, my thanks are due to Dr. R.S. Deshpande, Professor and Head, ADRT Unit, Institute for Social and Economic Change, Bangalore for his excellent coordination in conducting the study.

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Chapter-I

Introduction

1.1: Introduction

In India about 70 percent of the population live in rural areas and the overwhelming majority of them depend upon agriculture as their primary source of income. The agriculture sector contributes close to a quarter of India's National Income and work force engaged in agriculture is about 60 per cent. Thus, agriculture continues to be the engine of economic growth. For the estimate of agricultural income, income from food crops, cash crops, oil seeds, fibre and other important crops contribute significantly. However, of all the food articles, foodgrains constitute the major. 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 chronic shortage of foodgrains, India has made considerable strides towards achieving self-sufficiency in foodgrains, due to the green revolution in the 1970s beginning with wheat and then expanding to rice. Foodgrains production has increased manifold from 50.82million tonnes during 1950-51 to 213.46million tonnes during 2003-04 (Table-1.2.1). The performance of agriculture in India has thus its three distinct phases. The first phase is characterized by the shortage of food supply in relation to demand during the period beginning the plan period to the mid-1960s. The second phase during the period from about the mid-1960s to the close of the 1980s witnessed self-sufficiency in the availability of food and experienced significant reduction in the incidence of poverty particularly in the 1980s and thus ensured effective food security. The third phase represented by the post-economic reform period of the 1990s experienced decline in growth of foodgrains output. Keeping in view the rapidly increasing food requirement with ever-increasing population, it is suggestive that the important problems concerning food management is to overcome food insecurity by ensuring food availability to the whole population on a sustainable basis. 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.

Agricultural crops produced at the farm level undergo various operations such as harvesting, threshing, transportation, storage, processing and marketing before they

reach the consumer and there are appreciable losses in crop output at all the stages of handling of produce by the farmers. Further, apart from the requirement of food for domestic consumption, farmers used to keep a part of their produce for the purpose of seed and animal feed. While the use of foodgrains for seed and animal feed are essential requirement of the farmers, minimizing losses of foodgrains at harvest and post-harvest stages is as important as raising production of foodgrains in pushing up the availability of foodgrains for human consumption. Every effort is therefore needed to push up the availability of foodgrains not only through increasing the level of production but also minimizing the losses at different harvest and post harvest stages. Although India achieved self-sufficiency in foodgrains production, it is necessary to have reliable and objective estimates of seed, feed and wastage ratios for foodgrains crops to ascertain the availability of food grains for human consumption after making allowances for seed, feed and wastages in the total production.

1.2: Foodgrains situation at the all India level

Foodgrains constitute the most significant part of Indian diet. The experience of food shortages in the pre-independence era and also after independence during the period beginning the plan period to the mid 1960s, achieving self-sufficiency in foodgrains has been the corner stone of development policy in India. Due to concerted efforts made by the government, foodgrains production has increased fourfold from 50.82million tonnes in 1950-51 to 213.46million tonnes in 2003-04 (table-1.2.1).

In terms of growth of foodgrains production, it has registered an average growth rate of 4.25 per cent per annum during the period of fifties (table-1.2.2), which subsequently declined during the decade of sixties accompanying a growth rate of 1.85 per cent. The decade of seventies however witnessed the increase in the rate of growth by 2.05 per cent followed by 2.73 and 2.09 during the decade of eighties and nineties respectively. Very recently, during the period between 2000 and 2004, production of foodgrains further declined registering a growth rate of 0.47 per cent per annum.

Due to increase in the volume of foodgrains production, the net per capita availability of foodgrains increased from 394.90gms per day in 1951 to 494.10gms per day in 2002 (Table-1.2.3). In the case of cereals net per capita availability increased from 334.20gms per day in 1951 to 458.70gms per day in 2002. The net per capita availability of pulses declined from 60.70gms per day in 1951 to 35.40gms per day in 2002.

Table-1.2.1
All-India area, production and yield of foodgrains from 1950-51 to 2003-04

Year	Area (in million hectares)	Production (in million tones)	Yield (kg/ha)
1950-51	97.32	50.82	522
1951-52	96.96	51.99	536
1952-53	102.09	59.2	580
1953-54	109.07	69.82	640
1954-55	107.86	68.03	631
1955-56	110.56	66.85	605
1956-57	111.14	69.85	629
1957-58	109.48	64.31	587
1958-59	114.76	77.14	672
1959-60	115.82	76.67	662
1960-61	115.58	82.02	710
1961-62	117.23	82.71	706
1962-63	117.84	80.15	680
1963-64	117.42	80.64	687
1964-65	118.11	89.36	757
1965-66	115.1	72.36	629
1966-67	115.3	74.23	644
1967-68	121.42	95.05	783
1968-69	120.43	94.01	781
1969-70	123.57	99.5	805
1970-71	124.32	108.42	872
1971-72	112.62	105.71	858
1972-73	119.28	97.03	813
1973-74	126.54	104.67	827
1974-75	121.08	99.83	824
1975-76	128.18	121.03	944
1976-77	124.36	111.17	894
1977-78	127.52	126.41	991
1978-79	129.01	131.9	1022
1979-80	125.21	109.7	876
1980-81	126.67	129.59	1023
1981-82	129.14	133.3	1032
1982-83	125.1	129.52	1035
1983-84	131.16	152.37	1162
1984-85	126.67	145.54	1149
1985-86	128.02	150.44	1175
1986-87	127.2	143.42	1128
1987-88	119.69	140.35	1173
1988-89	12767	169.92	1331
1989-90	126.77	171.04	1349
1990-91	127.84	176.39	1380
1991-92	121.87	168.38	1382
1992-93	123.15	179.48	1457
1993-94	122.75	184.26	1501
1994-95	123.86	191.5	1546
1995-96	121.01	180.42	1491
1996-97	123.58	199.44	1614
1997-98	123.85	192.26	1552
1998-99	125.17	203.61	1627
1999-2000	123.1	209.8	1704
2000-01	121.05	196.81	1626
2001-02	122.78	212.85	1734
2002-03	113.86	174.77	1535
2003-04	123.32	213.46	1731

Source: Agriculture Statistics at a Glance 2005, Directorate of Economics & Statistics, Department of Agriculture & Cooperation Ministry of Agriculture, Government of India

Table – 1.2.2

All-India compound growth rates of food-grains (percent per annum)

Period	Area	Production	Yield
1950-1960	1.94	4.25	2.26
1960-1970	0.52	1.85	1.32
1970-1980	0.82	2.05	1.60
1980-1990	-0.23	2.73	2.97
1990-2000	-0.08	2.09	2.17
2000-2004	-0.20	0.47	0.66

Data Source: Figures are estimated.

Table-1.2.3

Net availability of foodgrains (per day) in India from 1951 to 2004(grams per capita per day)

Year	Cereals	Pulses	Foodgrains
1951	334.20	60.70	394.90
1952	325.40	59.10	384.50
1953	349.90	62.70	412.60
1954	358.10	69.70	427.80
1955	372.90	71.10	444.00
1956	360.40	70.30	430.70
1957	375.30	71.80	447.10
1958	350.30	58.50	408.80
1959	393.40	74.90	468.30
1960	384.10	65.50	449.60
1961	399.70	69.00	468.70
1962	398.90	62.00	460.90
1963	384.00	59.80	443.80
1964	401.00	51.00	452.00
1965	418.50	61.60	480.10
1966	359.90	48.20	408.10
1967	351.80	39.60	391.40
1968	404.10	56.10	460.20
1969	397.80	47.30	445.10
1970	403.10	51.90	455.00
1971	417.60	51.20	468.80
1972	419.10	47.00	466.10
1973	380.50	41.10	421.60
1974	410.40	40.80	451.20
1975	365.80	39.70	405.50
1976	373.80	50.50	424.30
1977	386.30	43.30	429.60
1978	422.50	45.50	468.00
1979	431.80	44.70	476.50
1980	379.50	30.90	410.40
1981	417.30	37.50	454.80
1982	415.90	39.20	455.10
1983	397.50	39.50	437.00
1984	437.60	41.90	479.50
1985	415.30	38.10	453.40
1986	433.70	43.80	477.50
1987	434.80	36.40	471.20
1988	411.20	36.40	447.60
1989	451.50	41.90	493.40
1990	431.50	41.10	472.60
1991	458.50	41.60	500.10
1992	434.50	34.30	468.80
1993	427.90	36.20	464.10
1994	434.00	37.20	471.20
1995	457.60	37.80	495.40
1996	442.50	32.70	475.20
1997	455.00	37.10	492.10
1998	414.20	32.80	447.00
1999	429.20	36.50	465.70
2000	422.70	31.80	454.50
2001	386.20	30.00	416.20
2002	458.70	35.40	494.10
2003(P)	407.10	29.10	436.20
2004(P)	427.60	35.60	463.20

Source: Agriculture Statistics at a Glance, Different Issues, Directorate of Economics & Statistics, Department of Agriculture & Cooperation Ministry of Agriculture, Government of India

1.3: Foodgrains situation in West Bengal

The volume of foodgrains production in West Bengal places it third after Uttar Pradesh and Punjab. The relationship between irrigation and agricultural productivity is well documented in the literature. However, despite low intensity of irrigation in West Bengal, the state has its third highest average yield of foodgrains in India. During the last decades significant progress and development in agriculture has taken place in West Bengal. Foodgrains production increased from 4423.8 thousand tonnes in 1950-51 to 16009.20 thousand tonnes in 2003-04, cereals being the major constituent of foodgrains production (Table - 1.3.1). Cereals production grew from 4077.70 thousand tonnes in 1950-51 to 15797.60 thousand tonnes in 2003-04. Pulses production however declined from 346.10 thousand tonnes in 1950-51 to 221.60 thousand tonnes in 2003-04.

In terms of growth of foodgrains production, the state of West Bengal has fared much better during the period of eighties as compared to nineties. It has registered an average growth of 6.32 per cent between 1980 and 1990 as opposed to an average annual growth of 2.52 per cent between 1990 and 2000 (table – 1.3.2). Beyond that the state of West Bengal managed to achieve a growth performance of 3.88 per cent between 2000 and 2004 which is higher than what it was in the nineties. Notably, growth in foodgrains production has largely been contributed by growth of yield.

Due to increased foodgrains production, the net per capita availability of foodgrains in West Bengal increased from about 395gms per day in 1952 to 456gms per day in 2004 (table-1.3.3). In the case of cereals, net per capita availability increased from about 357gms per day to about 450gms per day during the same period. This was mainly due to increased availability of superior cereals like rice and wheat. In contrast, the net per capita availability of pulses declined from about 38gms per day in 1952 to barely 6gms per day in 2004.

Table-1.3.1

Area, production and yield of cereals, pulses and food grains in West Bengal from 1950-51 to 2003-04

(area in '000 ha, production in '000 tonnes and yield in kgs. per ha.)

	Cereals			Pulses			Foodgrains		
Year	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1950-51	4106.20	4077.70	993	529.60	346.10	654	4635.8	4423.8	954
1951-52	3998.10	3651.40	913	585.00	391.30	669	4583.1	4042.7	882
1952-53	4266.90	4121.00	966	626.60	397.00	634	4893.50	4518.00	923
1953-54	4438.90	5432.30	1224	684.40	422.10	617	5123.40	5854.40	1143
1954-55	4146.30	3940.30	950	709.80	445.40	628	4856.10	4385.70	903
1955-56	4288.00	4335.80	1011	687.40	386.40	562	4975.40	4722.20	949
1956-57	4296.10	4511.60	1050	571.50	269.20	471	4867.60	4780.80	982
1957-58	4563.00	4462.80	978	582.50	259.20	445	5145.50	4722.00	918
1958-59	4419.40	4226.20	956	740.50	373.50	504	5159.90	4599.70	891
1959-60	4609.90	4356.70	945	738.10	333.80	452	5348.00	4690.50	877

Contd. Table – 1.3.1

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Area, production and yield of cereals, pulses and food grains in West Bengal from 1950-51 to 2003-04

	Cereals			Pulses			Foodgrains		
Year	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1960-61	4756.60	5545.30	1166	774.30	390.10	504	5530.90	5934.40	1073
1961-62	4599.30	4913.20	1068	764.50	341.80	447	5363.80	5255.00	980
1962-63	4616.30	4513.30	978	732.50	355.50	485	5348.80	4868.80	910
1963-64	4703.80	5436.80	1156	764.70	390.60	511	5468.50	5827.40	1066
1964-65	4818.90	5853.90	1215	787.00	405.30	515	5605.90	6259.20	1117
1965-66	4796.50	5009.90	1044	771.00	438.30	568	5567.50	5448.20	979
1966-67	4828.30	4956.60	1027	787.00	420.60	534	5615.30	5377.20	958
1967-68	4921.40	5374.90	1092	704.60	366.10	520	5626.00	5741.00	1020
1968-69	5098.60	6150.60	1206	747.60	447.80	599	5846.30	6598.40	1129
1969-70	5367.80	6646.70	1238	704.70	364.60	517	6072.50	7011.30	1155
1970-71	5454.30	7116.30	1305	669.50	377.30	564	6123.80	7493.60	1224
1971-72	5555.60	7538.90	1357	597.10	317.00	531	6152.70	7855.90	1277
1972-73	5562.70	6487.50	1166	545.60	284.80	522	6108.30	6772.30	1109
1973-74	5678.30	6535.30	1151	659.70	348.60	528	6338.00	6883.90	1086
1974-75	5970.70	7490.50	1255	682.30	375.50	550	6653.00	7866.00	1182
1975-76	6128.10	8180.90	1335	727.20	410.70	565	6855.30	8591.60	1253
1976-77	5834.60	7102.30	1217	619.40	351.50	567	6454.00	7453.80	1155
1977-78	6012.90	8636.00	1436	564.40	334.20	592	6577.30	8970.20	1364
1978-79	5396.30	7775.90	1441	561.00	267.50	477	5957.30	8043.40	1350
1979-80	5514.70	6757.50	1225	559.40	304.50	544	6074.10	7062.00	1163
1980-81	5575.00	8043.20	1443	524.30	238.20	454	6099.30	8281.40	1358
1981-82	5535.70	6325.30	1143	437.70	232.70	532	5973.40	6558.00	1098
1982-83	5233.30	5654.50	1080	407.30	214.70	527	5640.60	5869.20	1041
1983-84	5809.70	8911.90	1534	397.20	258.20	650	6207.00	9170.10	1477
1984-85	5639.40	9035.30	1602	377.70	221.40	586	6017.10	9256.60	1538
1985-86	5481.30	8863.60	1617	421.00	264.30	628	5902.30	9127.90	1546
1986-87	5892.20	9411.30	1597	353.50	199.60	565	6245.70	9610.90	1539
1987-88	5944.00	10078.50	1696	362.80	227.00	626	6306.80	10305.50	1634
1988-89	6013.60	11306.70	1880	308.90	208.40	675	6322.50	11515.10	1821
1989-90	6034.90	11644.10	1929	338.90	212.40	627	6373.80	11856.50	1860
1990-91	6181.80	11076.70	1792	314.00	193.40	616	6495.80	11270.10	1735
1991-92	6044.10	12681.40	2098	269.90	175.00	648	6314.00	12856.40	2036
1992-93	6046.10	12190.20	2016	276.00	198.90	721	6322.90	12389.10	1959
1993-94	6262.40	12930.00	2065	269.00	170.80	635	6531.40	13108.00	2007
1994-95	6166.50	13144.00	2132	227.40	135.00	594	6393.90	13279.00	2077
1995-96	6362.50	12743.70	2003	212.70	142.50	670	6575.20	12886.20	1960
1996-97	6212.30	13584.80	2187	234.60	173.00	737	6446.90	13737.80	2131
1997-98	6336.10	14199.20	2241	221.90	152.70	688	6558.00	14354.30	2189
1998-99	6335.00	14241.00	2248	203.70	126.50	621	6538.70	14367.50	2197
1999-00	6573.80	14704.00	2237	214.10	141.60	661	6787.90	14845.60	2187
2000-01	5918.40	13595.70	2297	274.50	219.50	800	6192.90	13815.20	2231
2001-02	6558.00	16326.10	2489	249.10	175.10	703	6807.10	16501.20	2424
2002-03	6297.30	15354.70	2438	241.80	167.90	694	6539.10	15522.60	2374
2003-04	6359.90	15797.60	2484	251.90	221.60	880	6611.80	16009.20	2421

Source: Various issues of Statistical Abstract, West Bengal, Bureau of Applied Economics & Statistics Government of West Bengal

Table – 1.3.2

Compound growth rates of cereals, pulses and food-grains in West Bengal

(per cent per annum)

Period	Cereals			Pulses			Foodgrains		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
1950-1960	1.23	0.95	-0.28	2.27	-2.62	-4.95	1.37	0.68	-0.68
1960-1970	1.37	2.23	0.88	-0.69	1.05	1.75	1.08	2.17	1.08
1970-1980	0.24	0.92	0.69	-1.23	-1.34	-0.18	0.09	0.83	0.74
1980-1990	1.18	6.53	5.28	-4.45	-1.29	3.12	0.82	6.32	5.45
1990-2000	0.68	2.60	1.91	-4.32	-3.90	0.41	0.49	2.52	2.02
2000-2004	1.77	3.97	2.16	-2.92	-0.13	2.78	1.57	3.88	2.27

Data Source: Figures are estimated.

Table-1.3.3

Per capita net availability of foodgrains in West Bengal from 1952 to 2004

Year	Population	Production of Cereals ('000tonnes)		Production of Pulses ('000tonnes)		Net Foodgrains production	Per capita net availability *(gms. per day)*		
	(in lakhs)	Gross	Net	Gross	Net		Cereals	Pulses	Foodgrains
1952	245	3651.4	3195.0	391.3	342.4	3537.4	357.28	38.29	395.57
1953	254	4121.0	3605.9	397.0	347.4	3953.3	388.94	37.47	426.42
1954	258	5432.3	4753.3	422.1	369.4	5122.66	504.75	39.23	543.98
1955	262	3940.3	3447.8	445.4	389.7	3837.5	360.54	40.75	401.29
1956	267	4335.8	3793.8	386.5	338.2	4132.0	389.29	34.70	423.99
1957	286	4511.8	3947.8	269.1	235.5	4183.3	378.18	22.56	400.74
1958	289	4462.9	3905.0	259.3	226.9	4131.9	370.20	21.51	391.71
1959	335	4226.1	3697.8	373.5	326.8	4024.7	302.42	26.73	329.15
1960	344	4356.8	3812.2	333.9	292.2	4104.4	303.62	23.27	326.88
1961	352	5545.0	4851.9	391.0	342.1	5194.0	377.64	26.63	404.27
1962	361	4913.1	4299.0	342.0	299.3	4598.2	326.26	22.71	348.97
1963	370	4513.3	3949.1	355.4	311.0	4260.1	292.42	23.03	315.45
1964	379	5436.5	4756.9	390.5	341.7	5098.6	343.87	24.70	368.57
1965	387	5853.8	5122.1	405.3	354.6	5476.7	362.61	25.11	387.72
1966	395	5010.0	4383.8	438.3	383.5	4767.3	304.06	26.60	330.66
1967	404	4956.6	4337.0	420.6	368.0	4705.1	294.12	24.96	319.07
1968	412	5374.9	4703.0	366.1	320.3	5023.4	312.74	21.30	334.05
1969	421	6149.6	5380.9	447.8	391.8	5772.7	350.17	25.50	375.67
1970	436	6646.7	5815.9	364.6	319.0	6134.9	365.46	20.05	385.50
1971	445	7116.4	6226.9	377.3	330.1	6557.0	383.37	20.33	403.69
1972	455	7538.9	6596.5	317.0	277.4	6873.9	397.20	16.70	413.90
1973	464	6487.5	5676.6	284.8	249.2	5925.8	335.18	14.71	349.89
1974	473	6535.3	5718.4	349.6	305.9	6024.3	331.22	17.72	348.94
1975	483	7490.5	6554.2	375.5	328.6	6882.8	371.77	18.64	390.41
1976	492	8182.0	7159.3	410.7	359.4	7518.6	398.67	20.01	418.68
1977	501	7102.3	6214.5	351.5	307.6	6522.1	339.84	16.82	356.66
1978	511	8636.0	7556.5	334.2	292.4	7848.9	405.14	15.68	420.82
1979	520	7777.1	6805.0	267.4	234.0	7038.9	358.53	12.33	370.86
1980	529	6757.6	5912.9	304.5	266.4	6179.3	306.23	13.80	320.03
1981	553	8043.2	7037.8	238.8	208.9	7246.7	348.67	10.35	359.02
1982	564	6325.2	5534.6	234.0	204.8	5739.3	268.85	9.95	278.80
1983	576	5654.5	4947.7	214.7	187.9	5135.6	235.34	8.94	244.27
1984	589	8911.9	7797.9	258.2	225.9	8023.8	362.72	10.51	373.23
1985	602	9035.2	7905.8	221.4	193.7	8099.5	359.80	8.82	368.61
1986	615	8863.6	7755.6	263.0	231.3	7986.9	345.50	10.30	355.80
1987	629	9411.3	8234.9	199.6	174.7	8409.5	358.69	7.61	366.29
1988	644	10078.5	8818.7	227.0	198.6	9017.3	375.17	8.45	383.62
1989	659	11306.7	9893.4	208.4	182.4	10075.7	411.31	7.58	418.89
1990	674	11644.1	10188.6	212.4	185.9	10374.4	414.15	7.55	421.71
1991	681	11076.7	9692.1	193.4	169.23	9861.3	389.92	6.81	396.73
1992	703	12681.4	11096.2	175.0	153.1	11249.4	432.44	5.97	438.41
1993	716	12190.2	10666.4	198.9	174.0	10840.5	408.14	6.66	414.80
1994	730	12930.0	11313.7	171.0	149.6	11463.3	424.61	5.61	430.22
1995	743	13144.0	11501.0	135.0	118.1	11619.1	424.09	4.35	428.44
1996	755	12743.6	11150.6	142.5	124.8	11275.4	404.63	4.53	409.16
1997	767	13584.8	11886.7	173.0	151.4	12038.1	424.59	5.41	430.00
1998	778	6336.1	5544.1	152.7	133.6	5677.7	195.23	4.71	199.94
1999	789	14241.0	12460.9	126.5	110.7	12571.6	432.69	3.84	436.54
2000	799	14764.0	12866.0	141.6	123.9	12989.9	441.17	4.25	445.42
2001	802	13595.7	11896.2	219.5	192.1	12088.3	406.39	6.56	412.95
2002	820	16326.1	14285.3	175.1	153.21	14438.5	477.29	5.12	482.41
2003	831	15354.7	13435.4	167.9	146.9	13582.3	442.95	4.84	447.80
2004	842	15797.6	13822.9	211.6	185.1	14008.0	449.77	6.02	455.80

Data Source: Various issues of Statistical Abstract, West Bengal, Bureau of Applied Economics & Statistics, Government of West Bengal.

Note : Net availability figures are based on net production which are estimated by deducting 12.5 per cent of gross production towards seed, feed requirement and wastages.

1.4: History of methods of estimation followed in the state income accounting process

The Primary concern of the planners and policy makers is to ensure growth with stability, attainment of desirable distribution of income and above all eradication of poverty. To formulate the policies for the attainment of these goals, the government is required to understand the process of economic behavior. The aspect of economics which helps one understand these problems is known as economics which uses overall aggregates as variables viz. national product, labour force, population, consumption, capital formulation and similar other relevant variables.

National income gives a single measure of the extent of goods and services produced in a country, thus providing a figure to indicate its affluence or poverty. Frequently this measure is divided by the population giving what is known as per capita income. The unit of measurement of income is both in gross terms and in net terms (net of depreciation). National accounts help one to pose the problem of the material aspect of growth. By national accounts is meant national income and certain other related aggregates. The simplest form of national accounts may be depicted by familiar equation, Y=C+I, indicating that the income produced (Y) is used up during the accounting period partly as current consumption (C) and partly for acquisition of assets (I).

Like national income estimates the state income represents total income originated in the state during a particular period. The estimate of State Domestic Product (i.e., state income) is one of the important indicators to reflect the changes in the level of economic performance of the State's economy. It measures an unduplicated aggregate value of all goods and services produced (whether marketed or not) during a given period of time within the geographical boundaries of the State and used for final consumption and capital formation.

The importance of national income estimates crucially hinges upon the reliability of data obtained from different sources. The first official estimates of national income for the Indian Union was prepared by the Ministry of Commerce, Government of India, and referred to the year 1948-49 though this organisation had earlier estimated national income for the Union Province for the years 1945-46 and 1946-47. The importance of the work, however, received official recognition with the setting up of the National Income Committee in 1949 with Prof. P. C. Mahalanobis as Chairman and Prof. D. R. Gadgil and Prof. V. K. R. V. Rao as members. The Committee published its *First and Final Reports* in 1951 and 1954 respectively.

Since the publication of the *Reports of the National Income Committee*, the work on the estimation of national income has been continued at the official level on a

regular basis and not only have the estimates been extended to cover a large number of macro-aggregates but also have improved in quality by using recent basic data as well as by introducing methodological changes. Thereafter, the committee entrusted the work to the National Accounts Division of the Central Statistical Organisation (CSO), Government of India. The official statistics of national income and related aggregates for India cover all the different aspects, viz. domestic product, final expenditure and factor incomes and the details are brought out annually by the Central Statistical Organisation (CSO) in the form of a publication entitled *National Accounts Statistics*. The states have been following the standard methodology adopted by the *National Accounts Division* of the CSO for estimation of their state income.

The Bureau of Applied Economics and Statistics, Government of West Bengal has been preparing the estimate of state domestic product (i.e. state income) of West Bengal since 1951-52 following the usual methods, i.e. product method in regard to as many sectors of the State's economy as possible and income method for the remaining sectors. The estimates by industry of origin both at current and constant prices are obtained by product method for the commodity producing sectors like Agriculture, Forestry, Fishery, Mining etc., and by income approach for the remaining sectors of the economy. The estimates are based on standard methodology suggested by the Central Statistical Organization, Government of India from time to time to make the estimates of state domestic product of different states and union territories comparable.

The estimates of SDP are prepared at both current and constant prices. The estimates at current prices are arrived at by evaluating all the goods and services at current prices prevailing in the market during the year while the same at constant prices are prepared by evaluating the goods and services of the current year at the base year prices thereby eliminating the effect of changes in prices to measure the real growth of the State's economy. The state provides the estimates of gross domestic product along with net domestic product at current as well as constant prices. The estimates are revised by shifting the base year from time to time as per recommendation of the National Accounts Division of CSO and no significant methodological changes are made in the estimation of state domestic product. Chronologically, the base year has been shifted from 1970-71 to 1980-81 and further to 1993-94 in accordance with the recommendation of the Central Statistical Organisation, Government of India.

In the past, the base year changed to a year synchronizing with the year of the decennial population census. Accordingly, GDP estimates have been revised decennially corresponding to the year of population census. As a sequel to this

sequence, the previous series of GDP estimates should have been with the base year 1990-91 instead of 1993-94. However, it was observed that the data on Worker Participation Rate (WPR) captured by the NSSO was better than that estimated through the population census. This is because the working force as thrown up by population census 1991 for service sector did not put adequate importance on female workers and also workers in rural segment. The required information were available in the quinquennial survey on employment and unemployment of NSSO, conducted in 1993-94 (50^{th} round 1993-94). Accordingly, the CSO used the workforce estimates based on National Sample Survey (NSS) workforce participation rates from the NSS 1993-94 (50^{th} round) survey results and revised the base year of national accounts to 1993-94. In accordance with the methodological guidance of the National Accounts Division of the Central Statistical Organisation, the new series of the estimates of State Domestic Product (SDP) with 1993-94 as base year have been prepared in the state, thereby making some improvements in the estimation of SDP from the service sector. Recently, CSO has further revised the base year of national accounts statements to 1999-2000 as it has used the data on WPR from the NSS 55^{th} round quinquennial survey on employment and unemployment conducted in 1999-2000. Accordingly, in the state, new series of the state domestic product estimates with base year 1999-2000 has been introduced in 2005-06.

For the purpose of estimation of SDP, the economy of the State is divided into the following sectors in conformity with the procedure followed at the national level to estimate the national income:

I. Primary sector:

1) Agriculture (including livestock and horticulture).
2) Forestry and Logging.
3) Fishing.
4) Mining and Quarrying.

II. Secondary sector:

5) Manufacturing:- (a) Registered (b) Unregistered
6) Construction
7) Electricity, Gas and Water Supply

III. Tertiary sector:

8) Transport, Storage and Communication
    a) Railways

b) Transport by other means and Storage
c) Communication

9) Trade, Hotels and Restaurants
10) Banking and Insurance
11) Real Estate, Ownership of Dwellings and Business Services
12) Public Administration
13) Other Services

The estimates of SDP in West Bengal are obtained by the production approach for commodity producing sectors like agriculture, forestry, fishery, mining and manufacturing (registered) and by income approach for the remaining sectors of the economy. In product approach, the sum of the values of all goods and services produced within the state during a year after deducting the value of raw materials and other material inputs and also the value of intermediate products is considered. In Income Approach Method, the total income is considered to be distributed among the factors of production, namely, land, labour, capital and the entrepreneur in the form of rent, salary/wages and money value of other benefits, interest and profit, respectively. For the purpose of estimation of value of goods and services produced in the State, market prices are considered. The market prices include two components, namely, indirect taxes like sales tax, excise duties etc. and subsidies given by the government. So adjustments are made to arrive at the value of output at factor cost.

Sector-wise estimates of GSDP are prepared at both current and constant prices and on addition over sectors the estimates of total GSDP are obtained. Then consumption of fixed capital (CFC) for each sector is deducted from the estimate of GSDP of a particular sector to get the estimate of NSDP of that sector. The aggregate of the estimates of sector-wise NSDP yields total NSDP of a particular year. Per capita income is obtained by dividing the estimate of total NSDP for that year by the estimated mid-year population of the year.

1.5: Contribution of different sectors to state domestic product

The state domestic product estimates assume much significance in the decision making process and formulation of strategies of development. Such decision requires disaggregated data for making acquainted with the relative contributions of different sectors of the economy. As noted earlier, while calculating state domestic product, the economy of the state is divided into three prime sectors viz primary sector, secondary sector and tertiary sector. Primary sector included “agriculture, forestry, fishery, mining and quarrying”. In the secondary sector, “manufacturing, constriction, electricity, gas and water supply” are included. Tertiary sector consists of “transport,

storage & communication, trade, hotel & restaurant, banking & insurance, real estate, ownership of dwelling and business service, public administration and other services" are included.

Data on gross domestic product (GDP) and net state domestic product (NSDP) at the aggregate and sectoral levels from 1993-94 onwards upto 2002-03 are reported in tables- 1.5.1 and 1.5.2. The figures contained in table-1.5.1 are at current prices and the figures reported in table-1.5.2 are at constant (1993-94) prices. The aggregate GDP and NDP are decomposed into the contribution of constituent sectors namely primary, secondary and tertiary sectors. The results of the exercise reported in tables-1.5.1 and 1.5.2 find that the contribution by the tertiary sector overwhelms the contribution by the other sectors. Notably, the contribution by tertiary sector exceeds that of primary sector comprising of agriculture, forestry, fishery, mining and quarrying. Table-1.5.1 clearly brings out that at current prices, the contribution of income from agriculture towards the SDP has been declining. The contribution of agriculture (crop activity) to the total net state domestic product declined to 23.61 per cent in 2002-03 which was 30.08 per cent in 1993-94 (table-1.5.1). On the other, the share of tertiary sector increased from 42.79 per cent in 1993-94 to 52.86 percent in 2002-03. Disaggregating the tertiary sector into "transport, storage and communication", "trade, hotels and restaurants", "banking, insurance and real estate", and "community and personal services" it is found that all the groups show an acceleration during the five year period from 1993-94 to 2002-03, the extent of acceleration being varied from mild in the case of "transport, storage and communication" to dramatic in case of "banking and insurance" and "trade, hotels and restaurant". The share of secondary sector where manufacturing is the major constituent, has declined from 21.31 per cent of the state net domestic product (at current prices) in 1993-94 to 18.00 per cent of the state net domestic product in 2002-03. The conclusion thus can only be that the acceleration of GDP over the reference period was not led by manufacturing. Structurally, the state of West Bengal witnessed the trend of transition from the primary to the tertiary sector. The similar trend of sectroal distribution is observed when compared the contribution of different industrial sectors at constant (1993-94) prices (table-1.5.2).

Table – 1.5.1

Estimates of gross and net state domestic product of West Bengal by industry of origin at current prices ***(Rs. Crores)***

Industry	1993-94		1999-00		2000-01		2001-02		2002-03	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
1. Agriculture	14826.00	14558.75	34854.87	34339.98	34965.31	34471.84	37518.73	36942.74	36360.33	35802.12
	(27.75)	(30.08)	(27.48)	(29.38)	(25.00)	(26.73)	(24.38)	(26.13)	(21.98)	(23.61)
2. Forestry	463.08	453.97	1014.01	996.87	1072.40	1054.48	1028.74	1009.96	1057.18	1037.88
	(0.87)	(0.94)	(0.80)	(0.85)	(0.77)	(0.82)	(0.67)	(0.71)	(0.64)	(0.68)
3. Fishery	2001.37	1779.16	4518.39	3980.67	5245.13	4587.08	5815.37	5054.87	6351.72	5552.16
	(3.75)	(3.68)	(3.56)	(3.41)	(3.75)	(3.56)	(3.78)	(3.58)	(3.84)	(3.66)
4. Mining & Quarrying	789.88	581.25	1330.52	944.76	1956.95	1541.84	2376.24	1875.23	2279.74	1799.08
	(1.48)	(1.20)	(1.05)	(0.81)	(1.40)	(1.20)	(1.54)	(1.33)	(1.38)	(1.19)
Primary Sector	**18080.33**	**17373.13**	**41717.79**	**40262.28**	**43239.79**	**41655.24**	**46739.08**	**44882.80**	**46048.97**	**44191.24**
5. Manufacturing	(33.84)	(35.90)	(32.89)	(34.44)	(30.92)	(32.30)	(30.38)	(31.75)	(27.84)	(29.14)
5.1 Registered	4714.07	3550.40	6862.82	5123.28	6905.58	5154.55	7527.26	5252.90	8520.02	5945.70
	(8.82)	(7.34)	(5.41)	(4.38)	(4.94)	(4.00)	(4.89)	(3.72)	(5.15)	(3.92)
5.2 Un-registered	4282.92	4011.13	10091.60	9444.55	10838.71	10120.53	12120.25	11342.95	11456.83	10722.08
	(8.02)	(8.29)	(7.96)	(8.08)	(7.75)	(7.85)	(7.88)	(8.02)	(6.93)	(7.07)
6. Construction	2333.52	2228.08	5271.29	5055.28	7121.92	6891.51	7740.06	7476.22	9255.76	8940.25
	(4.37)	(4.60)	(4.16)	(4.32)	(5.09)	(5.34)	(5.03)	(5.29)	(5.60)	(5.90)
7. Electricity, Gas & Water Supply	967.20	523.23	2210.81	1300.18	2592.03	1614.74	2578.35	1508.54	2879.72	1684.86
	(1.81)	(1.08)	(1.74)	(1.11)	(1.85)	(1.25)	(1.68)	(1.07)	(1.74)	(1.11)
Secondary Sector	**12297.71**	**10312.84**	**24436.52**	**20923.29**	**27458.24**	**23781.33**	**29965.92**	**25580.61**	**32112.33**	**27292.89**
8. Transport, Storage & Communication	(23.02)	(21.31)	(19.27)	(17.90)	(19.63)	(18.44)	(19.48)	(18.10)	(19.41)	(18.00)
8.1 Railways	737.02	490.90	1168.41	711.19	1232.70	753.32	1408.16	936.89	1551.79	1032.45
	(1.38)	(1.01)	(0.92)	(0.61)	(0.88)	(0.58)	(0.92)	(0.66)	(0.94)	(0.68)
8.2 Transport by other Means and Storage	2561.37	1979.45	5357.84	4238.72	5981.46	4738.49	6906.12	5651.03	7230.47	5918.76
	(4.79)	(4.09)	(4.22)	(3.63)	(4.28)	(3.67)	(4.49)	(4.00)	(4.37)	(3.90)
8.3 Communication	596.98	488.73	1585.15	1322.61	1853.05	1554.38	2073.13	1738.99	2371.51	1989.28
	(1.12)	(1.01)	(1.25)	(1.13)	(1.32)	(1.21)	(1.35)	(1.23)	(1.43)	(1.31)
9. Trade, Hotel & Restaurant	6035.44	5866.82	13775.69	13434.81	15090.14	14714.64	17460.42	17050.36	19210.97	18759.80
	(11.30)	(12.12)	(10.86)	(11.49)	(10.79)	(11.41)	(11.35)	(12.06)	(11.61)	(12.37)
10. Banking & Insurance	3006.29	2805.16	12768.65	12115.01	15442.72	14538.01	17022.50	15883.66	20491.03	19120.12
	(5.63)	(5.80)	(10.07)	(10.36)	(11.04)	(11.27)	(11.06)	(11.24)	(12.39)	(12.61)
11. Real Estate, Ownership of Dwelling	3552.61	3041.58	8585.31	7545.97	10654.98	9503.49	12071.28	10752.50	14792.87	13176.76
and Business Service	(6.65)	(6.28)	(6.77)	(6.46)	(7.62)	(7.37)	(7.85)	(7.61)	(8.94)	(8.69)
12. Public Administration	2717.57	2333.45	7195.65	6394.10	7776.19	6922.37	8159.20	7243.68	8812.08	7801.79
	(5.09)	(4.82)	(5.67)	(5.47)	(5.56)	(5.37)	(5.30)	(5.12)	(5.33)	(5.15)
13. Other Services	3838.82	3705.57	10242.88	9950.64	11134.10	10813.56	12059.04	11636.93	12796.56	12348.63
	(7.19)	(7.66)	(8.08)	(8.51)	(7.96)	(8.38)	(7.84)	(8.23)	(7.74)	(8.14)
Tertiary Sector	**23046.10**	**20711.66**	**60679.58**	**55713.05**	**69165.34**	**63538.26**	**77159.85**	**70894.04**	**87257.28**	**80147.59**
	(43.14)	(42.79)	(47.84)	(47.66)	(49.45)	(49.26)	(50.15)	(50.15)	(52.75)	(52.86)
Total G.S.D.P	53424.14		126833.89		139863.37		153864.85		165418.58	
Total N.S.D.P		**48397.63**		**116898.62**		**128974.83**		**141357.45**		**151631.72**
Per Capita G.S.D.P (Rupees)	7457.62		16076.29		17508.97		19047.87			
Per Capita Income (Rupees)		**6755.95**		**14816.99**		**16145.87**		**17499.5**		**18494.15**

Data Source : Statistical Abstract, Bureau of Applied Economics & Statistics, Government of West Bengal, 2005.

Table – 1.5.2

Estimates of gross and net state domestic product of West Bengal by industry of origin at constant (1993-94) prices (Rs. Crores)

Industry	1993-94		1999-00		2000-01		2001-02		2002-03	
	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
1. Agriculture	14826.00	14558.75	18844.26	18520.48	19332.40	19028.46	21315.22	20978.75	20253.48	19933.77
	(27.75)	(30.08)	(23.36)	(25.19)	(22.52)	(24.32)	(23.21)	(25.02)	(20.51)	(22.13)
2. Forestry	463.08	453.97	521.95	512.44	512.62	502.75	544.02	534.15	541.74	531.91
	(0.87)	(0.94)	(0.65)	(0.70)	(0.60)	(0.64)	(0.59)	(0.64)	(0.55)	(0.59)
3. Fishery	2001.37	1779.16	2548.18	2180.58	2592.81	2170.22	2955.21	2485.38	3006.23	2546.76
	(3.75)	(3.68)	(3.16)	(2.97)	(3.02)	(2.77)	(3.22)	(2.96)	(3.04)	(2.83)
4. Mining & Quarrying	789.88	581.25	919.11	660.03	1052.19	782.63	1142.90	837.13	1093.50	800.95
	(1.48)	(1.20)	(1.14)	(0.90)	(1.23)	(1.00)	(1.24)	(1.00)	(1.11)	(0.89)
Primary Sector	**18080.33**	**17373.13**	**22833.50**	**21873.53**	**23490.02**	**22484.06**	**25957.35**	**24835.41**	**24894.95**	**23813.39**
5. Manufacturing	(33.84)	(35.90)	(28.30)	(29.75)	(27.37)	(28.73)	(28.26)	(29.62)	(25.21)	(26.44)
5.1 Registered	4714.07	3550.40	6637.30	5105.37	6689.42	5089.27	6831.73	5139.91	7362.88	5539.53
	(8.82)	(7.34)	(8.23)	(6.94)	(7.79)	(6.50)	(7.44)	(6.13)	(7.46)	(6.15)
5.2 Un-registered	4282.92	4011.13	7052.50	6597.93	6985.64	6501.08	7308.22	6814.05	7605.61	7091.33
	(8.02)	(8.29)	(8.74)	(8.97)	(8.14)	(8.31)	(7.96)	(8.13)	(7.70)	(7.87)
6. Construction	2333.52	2228.08	3398.06	3214.63	3755.65	3582.70	4035.28	3844.36	4205.99	4012.30
	(4.37)	(4.60)	(4.21)	(4.37)	(4.38)	(4.58)	(4.39)	(4.58)	(4.26)	(4.45)
7. Electricity, Gas & Water Supply	967.20	523.23	1340.17	738.43	1506.20	878.25	1625.47	972.47	1769.59	1058.69
	(1.81)	(1.08)	(1.66)	(1.00)	(1.75)	(1.12)	(1.77)	(1.16)	(1.79)	(1.18)
Secondary Sector	**12297.71**	**10312.84**	**18428.03**	**15656.36**	**18936.91**	**16051.30**	**19800.70**	**16770.79**	**20944.07**	**17701.85**
8. Transport, Storage & Communication	(23.02)	(21.31)	(22.84)	(21.29)	(22.06)	(20.51)	(21.56)	(20.00)	(21.21)	(19.65)
8.1 Railways	737.02	490.90	866.20	529.42	910.96	569.38	959.28	629.74	1017.80	668.16
	(1.38)	(1.01)	(1.07)	(0.72)	(1.06)	(0.73)	(1.04)	(0.75)	(1.03)	(0.74)
8.2 Transport by other Means and Storage	2561.37	1979.45	3614.69	2798.72	3804.22	2944.44	4249.11	3395.99	4511.95	3605.48
	(4.79)	(4.09)	(4.48)	(3.81)	(4.43)	(3.76)	(4.63)	(4.05)	(4.57)	(4.00)
8.3 Communication	596.98	488.73	1329.07	1158.81	1578.72	1390.42	1766.21	1555.55	2218.36	1953.77
	(1.12)	(1.01)	(1.65)	(1.58)	(1.84)	(1.78)	(1.92)	(1.86)	(2.25)	(2.17)
9. Trade, Hotel & Restaurant	6035.44	5866.82	10061.10	9796.91	10902.94	10626.76	12080.56	11791.34	13029.22	12717.29
	(11.30)	(12.12)	(12.47)	(13.32)	(12.70)	(13.58)	(13.15)	(14.06)	(13.19)	(14.12)
10. Banking & Insurance	3006.29	2805.16	8384.53	7925.52	9678.23	9114.35	9808.86	9237.37	13380.89	12601.28
	(5.63)	(5.80)	(10.39)	(10.78)	(11.28)	(11.65)	(10.68)	(11.02)	(13.55)	(13.99)
11. Real Estate, Ownership of Dwelling	3552.61	3041.58	5519.47	4844.09	6387.63	5658.25	6878.61	6093.12	7886.34	6985.77
and Business Service	(6.65)	(6.28)	(6.84)	(6.59)	(7.44)	(7.23)	(7.49)	(7.27)	(7.99)	(7.76)
12. Public Administration	2717.57	2333.45	4528.41	4037.57	4792.43	4281.25	4714.67	4190.39	4953.66	4402.80
	(5.09)	(4.82)	(5.61)	(5.49)	(5.58)	(5.47)	(5.13)	(5.00)	(5.02)	(4.89)
13. Other Services	3838.82	3705.57	5111.30	4906.88	5349.78	5133.82	5621.13	5349.49	5913.46	5627.69
	(7.19)	(7.66)	(6.34)	(6.67)	(6.23)	(6.56)	(6.12)	(6.38)	(5.99)	(6.25)
Tertiary Sector	**23046.10**	**20711.66**	**39414.77**	**35997.92**	**43404.91**	**39718.67**	**46078.43**	**42242.99**	**52911.68**	**48562.24**
	(43.14)	(42.79)	(48.86)	(48.96)	(50.57)	(50.76)	(50.17)	(50.38)	(53.58)	(53.91)
Total G.S.D.P	53424.14		80676.30		85831.84		91836.48		98750.70	
Total N.S.D.P		**48397.63**		**73527.81**		**78254.03**		**83849.19**		**90077.48**
Per Capita G.S.D.P (Rupees)	7457.62		10225.78		10744.96		11369.00		12044.38	
Per Capita Income (Rupees)		**6755.95**		**9319.70**		**9796.33**		**10380.20**		**10986.53**

Data Source : Statistical Abstract, Bureau of Applied Economics & Statistics, Government of West Bengal, 2005.

1.6: Trends in seed, feed and wastage ratios based on available studies

India is known for her tremendous achievement in reaching self-sufficiency in foodgrains. However, on account of growing demand for food commensurate with continuous rise in population, there arises the need for growing more foodgrains in the country. Obviously this calls for enhancing crop production by means of increasing the frequency of cropping as also adopting improved methods of production in the production process. Side by side, losses on account of wastages of foodgrains at different stages of handlings need to be minimized. Furthermore, a part of the produce of foodgrains are used as seed and animal feed apart from the use of foodgrains for consumption purpose. Thus, in order to arrive at an estimate of the actual quantity of foodgrains available for human consumption, it is necessary to have information on the percentage quantity of foodgrains used for seed and animal feed and also the percentage quantity of foodgrains lost at different stages of handling by the farmers.

As a first step towards the estimates of seed, feed and wastage ratios, it was only in 1986, Government of India constituted a Committee of experts comprising of members from different organizations such as D.E.S., N.S.S.O., C.S.O., 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 foodgrains crops was used as seed, feed and quantity of foodgrains wasted. The committee stressed the need for a fresh study for getting reliable estimates of the net quantity of foodgrains available for human consumption. Accordingly, the Techno-Economic Research Institute undertook a pilot study on seed, feed and wastage ratios in foodgrains on behalf of Planning Commission in some of the districts of Punjab, Haryana and Western Uttar Pradesh in 1986-87. As per the results of the study 10.32 per cent of the total production of foodgrains was used as seed, feed and waste in these areas. The corresponding figures for Western Uttar Pradesh, Punjab and Haryana were 12.01 per cent, 8.22 per cent and 10.84 per cent, respectively.

Besides, a number of studies have been conducted to assess the post-harvest losses of foodgrains. Singh and Khosla (1978) reviewed the work done relating to the post-harvest foodgrains losses in India. Tomar et al.(1978) conducted crop profitability and marketable surplus in Himachal Pradesh and reported that in small category the retention of Paddy for home consumption was 90.84per cent, for seed 2.2per cent, for payment of wages in kind 3.66 per cent and marketable surplus stood at 3.3per cent. In case of medium category, the marketable surplus was reported to be 4.61per cent while for large category it was reported nil. Gill, et al.(1988) reported

storage losses to the tune of 1.78per cent for paddy stored for consumption and 1.48per cent for the paddy stored for seed purposes. According to a study conducted by World Bank in 1999, post-harvest losses of foodgrains in India are 7 to 10 percent of the total production from farm to market level (source: Basavaraja et.al. 2007). A.A. Reddy (2005) finds that post harvest operations storage is responsible for maximum loss (7.5 per cent), processing, threshing and transport cause 1 per cent, 0.5 per cent and 0.5 per cent losses respectively aggregating 9.5 per cent of total loss of production. Basavaraja et. al, (2007) estimated post-harvest loses at different stages in two major foodgrains viz. rice and wheat using survey data collected from 100 farmers, 20 wholesalers, 20 processors, and 20 retailers in each crop in Karnataka for the year 2003-04. The post harvest losses at the farm level have been estimated to be 3.82 kg/q for rice and 3.28kg/q for wheat. The losses have been highest during storage in both the crops.

The estimates of losses given above are mostly based on objective methods on limited field experiments. From the available studies it can easily be understood that there is need to have a comprehensive study based on farm-level data, which would provide the reliable and objective estimate of the seed, feed and wastage ratios across crops. This would help assess the extent and magnitude of losses suffered by the farmers in handling the agricultural commodities. This in turn would help in arriving at correct estimate of the marketable surplus and to ascertain net availability of foodgrains for human consumption. This would also help develop corrective measures to minimize the losses of foodgrains at different stages of handling.

1.7: Probable impact on the state income accounting

State income accounting, its principles and the estimates, furnishes a unified system for studying the economic condition of the state concerned and its change over time. Such a study is essential for pinpointing the deficiencies in performance and planning for development. It is therefore almost obligatory for economists, technologists, scientist and policymakers to have a fairly detailed grasp of State Income Accounting. Of course, the merit of State Income statistics depends on the methodology used in obtaining State Income information.

State Income gives a single measure of the extent of goods and services produced in the State and thus provide a figure to describe its affluence or poverty. Frequently this measure is divided by the population of the State giving what is known as per capita state domestic product. State Income Accounts help one to pose the problem of the material aspect of growth and also assists in solving the problem. Since the material basis of development is indispensable for socio-political, economic

and cultural advancement, state income accounts afford a starting point for attacking the multi-faceted problem of development.

The estimate of State Domestic Product (State Income) is one of the important indicators to reflect the changes in the level of economic performance of the State's economy. It measures an unduplicated aggregate value of all goods and services produced (whether marketed or not) during a given period of time within the geographical boundaries of the State and used for final consumption and capital formation. The estimates of SDP are prepared at both current and constant prices with sifting of base year from time to time. The re-basing of the state data is particularly important given the major difference between the old and the new estimates of agricultural production which is important for the state. Such re-basing is appropriate to take into account the state economy's changed structure. The state accounts are thus updated and re-based following the standard methodology adopted by the National Accounts Division of CSO. The estimates at current prices are arrived at by evaluating all the goods and services at current prices prevailing in the market during the year while the same at constant prices are prepared by evaluating the goods and services of the current year at the base year prices thereby eliminating the effect of changes in prices to measure the real growth of the State's economy. The base year, which was previously 1970-71, has been shifted to 1980-81 and subsequently to 1993-94.

The estimate of Net State Domestic Product (SDP) of West Bengal by industry of origin are obtained by product method for the commodity producing sectors like Agriculture, Forestry, Fishery, Mining etc. and by income approach for the remaining sectors of the economy. The estimates are prepared according to the standard methodology adopted by the National Accounts Division of C.S.O. In estimating Net State Domestic Product (NSDP), consumption of fixed capital (CFC) for each sector is deducted from the estimate of GSDP of a particular sector. The aggregate of the sector-wise estimates of NSDP yields total NSDP of a particular year. Of the various methodological improvements in estimating state domestic product, mention may be made of the revised procedure of estimation of consumption of fixed capital. Earlier, estimates of consumption of fixed capital were based on the provision for depreciation in the books of accounts of enterprises. Such method of estimation has been subject of criticism on the ground that the depreciation included in the books of accounts did not provide the replacement cost of fixed assets. In the absence of such estimates the result was an under-estimation of the consumption of fixed capital and thus resulting in the over estimation of net domestic product. The estimates of consumption of fixed capital are now based on the estimates of fixed capital stock and the estimated life of each type of assets.

The estimates of seed, feed and wastages are applied to gross production of foodgrains to get the estimate of net production while arriving at net availability of foodgrains. In West Bengal, 10 percent of gross production is provided for seeds requirement and wastages uniformly for cereals and pulses production in the state. The procedure however has its limitation in that it does not incorporate the animal feed requirement. Moreover, allowances for seed-feed-wastage ratios are not made at the disaggregated level across crops. As these ratios differ across crops, the single ratio employed will result in over estimation of net availability of foodgrains Thus the study of comprehensive nature designing to estimate seed-feed-wastages ratios at the individual crop level would be of much help in arriving at the estimate of actual availability of foodgrains for human consumption.

1.8: Need for the present study

Agricultural development is a pre-requisite for economic growth of an economy like ours, which is still predominantly agricultural. Further, development of agriculture sector is necessary not only to meet the ever-growing demand for food by the increasing millions of people but also for forage for animals and supply of raw materials for industrial sector.

Agriculture contributes significantly to the aggregate economy through growing food crops and non-food crops. True that India witnessed remarkable growth in foodgrains production and the country has become self-sufficient in food. Despite this, the country has been unable to achieve food security in the sense of sustainability of well being of population at all times. The growth rate of food grain production decelerated and the position remained lower than the annual growth of population. Population growth has altered land-man ratio, which is further exacerbated by the subdivision of holdings leaving the country with a large number of small and marginal farmers whose cost of cultivation exceeds yield and returns. Degradation of natural resources, particularly forests and privatization of traditional common property resources have led not only to erosion of soil and water bodies but has also increased the reliance of the poor on these natural resources, which is precarious. It is within these broader economy-wide changes, while there is need for raising the quantum of production through improvement in productivity of foodgrains, every effort is needed to reduce the losses of foodgrains at different stages of handling. Moreover, farmers used to keep seeds from the harvest for meeting their seed requirement and also use a part of the foodgrains production as feed of the animal. There is therefore need to know how much of foodgrains are available for human consumption after making allowances for seed, feed and wastage ratios. Evolving correct policies for ensuring the availability of foodgrains to the masses would crucially depend on reliable and

objective estimates of seed, feed and wastage ratios. This in turn would help develop proper measures to reduce post-harvest losses in foodgrains. The present study is thus undertaken with the aim of providing the estimates of seed, feed and wastage ratios for major food grain crops in the state of West Bengal.

1.9: Objectives of the study

Keeping in view the need for fresh estimates of seed, feed and wastage ratios of foodgrains, the Agro-Economic Research Centre, Visva-Bharati, has taken up the study in West Bengal with the following two broad 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.

1.10: Organizations responsible for the study

The study was proposed by the Institute of Indian Agricultural Statistics Research, New Delhi and was allotted to Agro-Economic Research Centre, Visva-Bharati, for undertaking the study in West Bengal by the Ministry of Agriculture, Government of India. As a coordinated study, the study has been conducted under the able leadership of ADRT Unit, Institute for Social and Economic Change, Bangalore.

Chapter – II

Description of the Survey

Efforts are being made to produce more foodgrains so as to meet the requirements of the ever-growing population of the country. However, before they reach the consumer there are losses in output at different stages during harvesting and after the crop harvest. Moreover, a portion of output is used for seed and animal feed. The present study is undertaken in order to arrive at an estimate of the availability of foodgrains for human consumption after making allowance for seed, feed and wastage ratios of foodgrains. This chapter provides detailed description of the study including the sampling design adopted for estimating seed, feed and wastage ratios for major foodgrains.

2.1: Sampling Design

The Study is confined to two crops (one cereal and one pulse) based on the area predomination in the state. The selected cereal crop is rice and the chosen crop among pulses is lentil. Two districts are chosen having larger density of these crops. After the selection of the district a total number of 4 strata is formed by suitably combining the adjoining blocks. From among the list of villages of these blocks, five villages are selected from each stratum randomly. After that, a complete enumeration of all the farmers growing the selected crops is done in the selected villages. Five cultivators each from marginal, small and medium holdings are selected randomly from the three enumerated lists. As per standard categorization of holdings, large holdings were not found in the selected districts of West Bengal and sample farmers were selected from the existing size categories of landholdings viz. Marginal, Small and Medium. The sample size of 300 cultivators from each district spreading over all the four strata and thus a total sample of 600 (300 + 300) sample cultivators in the state is covered. The reference period for the study is 2004-05. The sample households are contacted twice in order to collect data for kharif and rabi seasons.

2.2: Profile of the Regions Selected for the Study

2.2.1: About the State

This section presents a brief background of the state of West Bengal depending on available secondary data relating to the state.

First of all we spell out the broad demographical characteristics of the state.

Demographic Features

According to 2001 census, the state has a population of 801.76 lakhs with an area of 88752 sq. km. A total of 577.49 lakhs (72.03 percent) are found to live in rural areas and the rest are urban population, which accounted for 27.97 percent. As per 2001 census the proportion of scheduled caste and scheduled tribe population were of the order of 23.02 and 5.50 percent respectively. The sex ratio of the state stood at 1000 males for every 934 females. The total workforce of the state constituted 36.78 percent in relation to the total population. The proportion of cultivators among total workers accounted for 19.18 percent and the corresponding share of agricultural labourers in total working population stood at 24.97 percent. The state is inhabited by 15715915 households of which rural households make up 71.02 percent of total households and the rest belongs to urban.

Overall, the level of literacy in the state as captured by the percent of literate persons among total population works out at 69.2 percent. Urban population is relatively more educated (81.6 percent) as compared to rural (64.1 percent). Across sexes, the percentage of literate persons among males is relatively higher which shows the proportion of 77.6 percent as against the comparable figure as 60.2 percent for females (table - 2.2.1).

Pattern of land holdings

The marginal (below 1ha) and small (1.00 –2.00ha) sized land holdings form the bulk of the farm holdings in the state. These two size classes together accounted for 95.30 per cent of the total holdings. The average size of holdings in respect of all size classes hardly works out to 0.82 ha for the state (table - 2.2.1).

Irrigation

As recorded in 1995-96 agriculture census, the state of West Bengal has 55.24 per cent of the net sown area as irrigated area. Tube-wells play major role as a source of irrigation where 55.80 per cent of total irrigated area is catered to by this source. The next important source is canal, which serves 23.50 per cent of total irrigated area in the state. Area irrigated by tanks constituted 10.50 percent occupies the position after canal (table - 2.2.1).

Agriculture, Land Use and Productivity

The economy of the state is mainly based on agriculture. There is not much uncultivated land left which could be conveniently utilized for agricultural purpose. In the year 2003-04, total cultivable area constitutes 67.69 percent of which 92.30 percent are brought under cultivation. About 62.48 percent of the total area of the state falls under net sown area. On an average 18.83 percent of the area is not available for

cultivation. About 14 percent of the area of the state is covered by forests. Density of cultivating population as measured by the number of cultivators per 100 ha of cultivated land works out at 103. The comparable estimates for agricultural labourers stood at 134. In the year 2000-01, net sown area per agricultural worker works out at 0.42 ha. whereas cultivable area per agricultural worker stood at 0.53 ha. As recorded in the year 2003-04, the index of multiple cropping as measured by the level of crop use intensity is estimated to be 178 percent. Rice is the predominant crop of the state and productivity level of rice is estimated at 2504 kgs per ha. Productivity of cereals works out at 2484 kgs per ha while the corresponding figure of pulses stood at 840 kg and combining these two crops together, productivity level of food grains is estimated at 2421 kg per ha (table - 2.2.1).

Livestock and poultry

The rural economy of West Bengal is mostly a mixed economy of agriculture and animal husbandry. As an allied component of agriculture, animal husbandry provides supplementary income to rural households. According to Livestock Census 2003, the total livestock population in the state was 345.43 lakhs of which bovine population comprising of cattle and buffaloes accounted for 54.60 per cent. Ovine population covering sheep and goats formed 38.12 per cent in total livestock population. In the total livestock population of the state, the cattle population accounted for 52.06 per cent while those of buffalos constituted 2.53 per cent. The state's cattle population comprised of 36.52 percent females, 20.12 percent males and 43.36 per cent young-stock. According to 2003 livestock census, there were 551.14 lakhs poultry birds in the state (table - 2.2.1).

Agricultural Machinery

Use of machineries play on important role in agricultural development of a region. Among the agricultural machineries, tractors, power-tillers and pump-sets used for irrigation purpose are important ones. According to the livestock census, 2003, density of tractor use as measured by the number of tractors per '000 ha of net sown area stood at 5.54 in number. The use of power-tiller is also prevalent in the state to make agricultural operations cost effective. The number of power-tillers per '000 ha of net sown area was estimated at 4.47. There were about 102 diesel pump-sets and 10 electric pump-sets per '000 ha of net sown area, which were using for irrigation purpose (table - 2.2.1).

Table – 2.2.1
A Profile of West Bengal

Description		Year	Unit	Particulars
I. Area and Population				
Area	a) Total	2001	Sq. Kilometre	88752
	b) Rural	2001	Sq. Kilometre	85444
	c) Urban	2001	Sq. Kilometre	3308
Total Population		2001	In Lakhs	801.76
Male Population		2001	In Lakhs	414.66
Female Population		2001	In Lakhs	387.10
Density of Population		2001	No. per sq. km	903
Urban Population	a) Total	2001	In Lakhs	224.27
	b) Male	2001	In Lakhs	-
	c) Female	2001	In Lakhs	-
Rural Population	a) Total	2001	In Lakhs	577.49
	b) Male	2001	In Lakhs	-
	c) Female	2001	In Lakhs	-
Urban Population in relation to total		2001	Percent	27.97
S.C Population		2001	In Lakhs	184.53
S.T. Population		2001	In Lakhs	44.07
Percentage of S.C. Population to Total		2001	Percent	23.02
Percentage of S.T. Population to Total		2001	Percent	5.50
Sex Ratio (Female per 1000 Males)		2001	Number	934
Number of main Workers	Total	2001	In Lakhs	230.64
	Rural	2001	In Lakhs	161.15
	Urban	2001	In Lakhs	69.49
Number of Marginal Workers	Total	2001	In Lakhs	64.39
	Rural	2001	In Lakhs	57.82
	Urban	2001	In Lakhs	6.57
Number of Non-Workers	Total	2001	In Lakhs	50.72
	Rural	2001	In Lakhs	35.84
	Urban	2001	In Lakhs	14.88
Work force (Main & Marginal) in relation to total Population		2001	Percentage	36.78
Proportion of agricultural labourers to total workers		2001	Percent	24.97
Proportion of cultivators to total workers		2001	Percent	19.18
Number of cultivators per 100 ha of cultivated land		2001	Number	103
No. of Households	Total	2001	Number	15715915
	Rural	2001	Number	11161870
	Urban	2001	Number	4554045

Contd. Table-2.2.1

Contd. Table-2.2.1

Description		Year	Unit	Particulars
II. Education				
Percentage of Literates	a) Male	2001	Percent	77.6
	b) Female	2001	Percent	60.2
	c) Total	2001	Percent	69.2
	d) Rural	2001	Percent	64.1
	e) Urban	2001	Percent	81.6
III. Classification of Holdings				
Per cent of Marginal Holdings (below 1ha.)		2000-01	Percent	80.44
Per cent of Small Holdings (1-2ha.)		2000-01	Percent	14.86
Per cent of Semi- medium Holdings (2-4ha.)		2000-01	Percent	4.17
Per cent of Medium Holdings (4-10ha.)		2000-01	Percent	0.51
Per cent of Large Holdings (10ha. and above)		2000-01	Percent	0.01
Average Size of Holdings		2000-01	ha	0.82
IV. Irrigation				
Per cent of Net Sown Area Irrigated		1995-96	Per cent	55.24
Per cent of Net Irrigated Area under Canals		1995-96	Per cent	23.50
Per cent of Net Irrigated area under Tanks		1995-96	Per cent	10.50
Per cent of Net Irrigated area under Wells		1995-96	Per cent	1.80
Per cent of Net Irrigated area under Tube wells		1995-96	Per cent	55.80
Per cent of Net Irrigated area served by Other Sources		1995-96	Per cent	8.40
V. Agriculture Land Use & Productivity				
Area Under Forest		2003-04	Percent	13.48
Area not available for cultivation		2003-04	Percent	18.83
Other uncultivated land excluding current fallows		2003-04	Percent	0.71
Current fallows		2003-04	Percent	3.84
Net area sown		2003-04	Percent	62.48
Ratio of cultivable area to total area		2003-04	Percent	67.69
Ratio of Net area sown to cultivable area		2003-04	Percent	92.30
No. of Cultivators per 100 hectares of cultivated land		2001	Number	103
No. of Agricultural Labourers per 100 hectares of cultivated land		2001	Number	134
Cultivable area		2000-01	Per Agricultural Worker in ha.	0.53
Net area sown		2000-01	Per Agricultural Worker in ha.	0.42
Gross Cropped Area		2003-04	'000 ha	9661.32
Net Cropped Area		2003-04	'000 ha	5427.67
Cropping Intensity		2003-04	Percent	178
Productivity of Rice		2003-04	Kgs Per ha	2504

Contd. Table-2.2.1

Contd. Table-2.2.1

Description	Year	Unit	Particulars
Productivity of Cereals	2003-04	Kgs Per ha	2484
Productivity of Pulses	2003-04	Kgs Per ha	840
Productivity of Foodgrains	2003-04	Kgs Per ha	2421
VI. Livestock and Poultry			
Cattle: Cows	2003	Number	6568239 (19.01)
Bulls and Bullocks	2003	Number	3618078 (10.47)
Youngstock	2003	Number	7797763 (22.57)
Total	2003	Number	17984080 (52.06)
Buffaloes: Cows	2003	Number	205881 (0.60)
Bulls and Bullocks	2003	Number	505813 (1.46)
Yongstock	2003	Number	163812 (0.47)
Total	2003	Number	875506 (2.53)
Total Bovine Population			18859586 (54.60)
Sheep	2003	Number	1411049 (4.08)
Goats	2003	Number	11756690 (34.04)
Total Ovine Population			13167739 (38.12)
Horses & Poines	2003	Number	10575 (0.03)
Pig	2003	Number	898831 (2.60)
Other Livestock	2003	Number	1605918 (4.65)
Total Livestock	2003	Number	34542649 (100.00)
Poultry: Fowls	2003	Number	37685574 (73.73)
Ducks	2003	Number	13024453 (25.48)
Others	2003	Number	404524 (0.79)
Total	2003	Number	51114551 (100.00)

Contd. Table-2.2.1

Contd. Table-2.2.1

Description	Year	Unit	Particulars
VII. Use of Agricultural Machineries			
Number of Agricultural Tractors per '000ha of Net Sown Area	2003	Number	5.54
Number of Agricultural Power Tillers per '000ha of Net Sown Area	2003	Number	4.47
Number of Diesel Pump Sets per '000ha of Net Sown Area	2003	Number	101.93
Number of Electric Pump Sets per '000ha of Net Sown Area	2003	Number	9.80
Number of Total Pump Sets per '000ha of Net Sown Area	2003	Number	111.73
VIII. Infrastructure			
Proportion of Villages electrified	As on 31.03.03	Percentage	82.66
Road length			
1. Public Works and P.W.D Roads			
a) Total	31.3.2003	Km.	18091
b) Surfaced	31.3.2003	Km.	17892
c) Un-surfaced	31.3.2003	Km.	199
2. Zilla Parishad Roads			
a) Total	31.3.2001	Km.	42478.42
b) Surfaced	31.3.2001	Km.	12774.85
c) Un-surfaced	31.3.2001	Km.	29703.57
3. Municipalities Roads			
a) Total	31.3.2002	Km.	20587.91
b) Surfaced	31.3.2002	Km.	13431.66
c) Un-surfaced	31.3.2002	Km.	7156.25
Scheduled Commercial Banks			
1. Number of Offices	Dec'2004	Number	4500
2. Population per Bank Office	Dec'2004	'000 Number	18
3. Per Capita Bank Deposits	Dec'2004	Rs.	13055
4. Per Capita Bank Advances	Dec'2004	Rs.	6824
5. Credit-Deposit Ratio	Dec'2004	Percent	52.27

Data Source:1. Statistical Abstract, Bureau of Applied Economics & Statistics, Government of West Bengal
2. Statistical Hand Book, Bureau of Applied Economics & Statistics, Government. of West Bengal, Relevant Issues.

Note : Figures in brackets indicate percentages.

Infra-structure

Infra-structure plays the key role in promoting agricultural development which in turn exert influence on the growth of agricultural activities. Good infra-structural facility not only ensures smooth flow of inputs and outputs but also facilitates higher accessibilities to knowledge. Again within the group of infra-structures, road transport is crucial.

The road network in the state is maintained by public works and public works (Roads) departments of the State Government, Zilla Parishad and Municipalities. The state has a total of 18091 km. road length maintained by the P.W.D. The area served by rural road system amounts to 42478 km in the state. Such roads are maintained by Zilla Parishad. Those apart, road maintained by the municipality amounts to 20588 km. Thus the total area served by the road system amounts to 81157 km. of which rural roads alone accounted for 52.34 percent in the state. In fact priority is given on improving the connectivity of villages through providing all weather roads to the unconnected villages. The other infra-structure called electrification has focused on extending the grid supply to villages and remote areas and covers 82.66 percentage of total villages in West Bengal. With regard to the access of credit, India has a wide network of rural financial institutions but the moneylenders still are important financial agencies especially in rural areas. West Bengal is not the exception to this. Banking facilities are available in West Bengal and there are 4500 scheduled bank offices and this translates to about 18000 people served by each of bank office. In per capita terms bank advances amounted Rs. 6824 as against the total amount of deposit of Rs. 13055 (table - 2.2.1).

2.2.2 : Profile of the Selected Districts

The two districts namely Midnapore (East) and Murshidabad were selected to represent the selected cereal (rice) and pulse (lentil) crops respectively. This section presents a brief account of the sample districts. First of all, it provides background information of the districts and then presents the rural profile of the selected districts covering the aspects of demography, agricultural prosperity, infrastructure and urbanization.

General

The District of **Purba Medinipur** was created on January 1st 2002 by bifurcating the erewhile Midnapur district. It has four Administrative Sub-Divisions namely Tamluk, Haldia, Kanthi, Egra. There are 25 Development Blocks, 21 Police Stations & 5 Municipalities. There are 3035 Mouzas in the district grouped into 21 Police Stations.

The district is geographically located between $21^0 36'$ and $22^0 57'$ North Latitudes and between $86^0 33'$ and $88^0 12'$ East Longitudes. The district is surrounded by Bay of Bengal in its South & Balosore district of Orrisa, Paschim Medinipur in West & North, Howrah & South 24-Paraganas districts in East. The important rivers i.e. Rupnarayan, Haldi, Kansabati, Hooghly, Keleghai flow through the district.

As per 2001 Census, the district has a total area of 4295 sq km and a total population of 4417377 persons. The density of population per sq km for the district works out at 1028 as against the state average of 903. The ratio between rural and urban populations is 92 : 08. It can thus be deduced from the foregoing statistics that the district is predominantly rural one (table-2.2.2.1).

The district of **Murshidabad** can be designated as a "Crop Museum" district from the agricultural point of view as the soil, weather and climate allow multi-crop cultivation. Besides, having its historical importance the district occupies a distinct position in the agricultural map of the state. The district of Murshidabad lies between 23°43′ and 24°52′ north latitude and 87°49′ and 88°44′ east longitude. It is so called after Murshidabad, a town on the left bank of the Bhagirathi, which was the last of the Muhammadan capitals of Bengal. The headquarters, however, are not at Murshidabad, but at Berhampore. It is bounded along its whole eastern frontier, from the extreme north to the south-eastern extremity, by the Padma or main channel of the Ganges, which separates it from the districts of Malda and Rajshahi. On the south it is bounded by the districts of Burdwan and Nadia, the river Jalangi on the south-east forming the boundary between it and Nadia for a considerable distance. To the west lie the districts of Birbhum and the Santhal Parganas.

The district of Murshidabad has an area of 5324 sq km and contains, according to the census of 2001, a population of 5866569 persons. In the district, there are 2210 Mouzas as per 2001 census. The district consists of 26 Police Stations and equal number of Development Blocks. As per 2001 census, the density of population per sq. km. stood at 1102 as against the state average of 903. According to 2001 census, 12.49 per cent of the population live in urban areas. Thus the ratio between rural and urban population is 88 : 12. Characteristically, the district of Murshidabad is thus basically rural (table-2.2.2.1).

Demographic characteristics of the selected districts

As between the two sample districts, the district of Murshidabad is densely populated. In respect of the total population living rural areas, Midnapore (East) district occupies the position ahead of Murshidabad. In terms of the proportion of scheduled caste and scheduled tribe population, Midnapore (undivided) ranks ahead of

Murshidabad as recorded in the year 2001. The level of literacy as captured by the percentage of literate persons among total population was estimated to be significantly higher in Midnapore (undivided) as compared to Murshidabad. The work force participation rate is relatively higher in Murshidabad (28.51 percent) as compared to undivided Midnapore (26.33 percent). The proportion of cultivators among total workers constituted 41.69 percent in undivided Midnapore as against the figure of 22.43 percent in Murshidabad. The corresponding share of agricultural labourers in total working population stood at 47.13 percent in undivided Midnapore which was 33.60 percent in Murshidabad (table 2.2.2.1).

Table – 2.2.2.1

Important demographic features of the selected districts

Sl. No.	Item	Particulars	
		Midnapore (East)	Murshidabad
1.	Area (2001) in sq.km.	4295	5324
2.	Population(2001) in nos.	4417377	5866569
3.	Density of Population (2001) per sq.km.	1028	1102
4.	Per cent of Urban Population to total population (2001)	8.29	12.49
5.	Per cent of SC Population to total population (2001)	16.40 (undivided midnapore)	12.00
6.	Per cent of ST Population to total population (2001)	8.31 (undivided midnapore)	1.29
7.	Level of Literacy (2001):		
	a) Per cent of literate persons among males	89.10	60.70
	b) Per cent of literate persons among females	70.70	47.60
	c) per cent of total literate persons	80.20	54.30
8.	Total main workers as per cent of total population (2001)	26.33 (undivided midnapore)	28.51
9.	Per cent of cultivators to total main workers (2001)	41.69 (undivided midnapore)	22.43
10.	Per cent of agricultural labourers to total main workers (2001)	47.13 (undivided midnapore)	33.60

Data Source: Statistical Abstract, Bureau of Applied Economics & Statistics, Government of West Bengal, 2005

Land use and Agriculture

Agriculture is the chief occupation of the people living in the selected districts. About 74.96 per cent of the total area of Midnapore (East) district falls under the net cropped area and the culturable wastes aggregate to 0.02 per cent. In Murshidabad, net sown area forms 75.83 per cent of total reporting area where the culturable wastes accounted for 0.15 per cent. Thus in both the selected districts, there is not much un-cultivated land left which could be used for agricultural purpose. On an average 0.44 per cent and 0.38 per cent of the area is not available for use and falls under the head of barren and unculurable waste in Midnapore (East) and Murshidabad districts respectively. Current fallow and fallow lands other than current fallow in the selected districts do not form large blocks. Area under forest accounted for 0.23 per cent in Midnapore (East) and 0.14 per cent in Murshidabad (table – 2.2.2.2).

Table – 2.2.2.2
Land Use Classification in the Selected Districts of West Bengal (2003-2004)

(Area in ' 000 ha.)

Use Classification	**Midnapore (East)**		**Murshidabad**	
	Area	**Per cent**	**Area**	**Per cent**
1. Reporting Area	396.59		532.5	
2. Forest	0.9	0.23	0.77	0.14
3. Land put to non-agricultural uses	91.7	23.12	120.8	22.69
4. Barren and Unculturable Waste	1.74	0.44	2.03	0.38
5. Area not available for Cultivation (3+4)	**93.44**	**23.56**	**122.83**	**23.07**
6. Permanent pasture and other grazing land	0.07	0.02	0.04	0.01
7. Misc. tree crops and groves	3.9	0.98	2	0.38
8. Culturable waste	0.06	0.02	0.82	0.15
9. Fallow land other than current fallow	0.15	0.04	0.4	0.08
10. Current fallow	0.78	0.20	1.82	0.34
11. Net Area Sown	297.29	74.96	403.82	75.83

Data Source: Statistical Abstract, Bureau of Applied Economics & Statistics, Government of West Bengal, 2005

Rainfall situation in the selected districts

Farming technology has so advanced that it is possible to increase crop yields even under rainfed conditions but the choice of the crops would have to depend on the amount and distribution of the prevailing rainfall. Accordingly, rainfall pattern as well as total rainfall for the seasons, July to September, October to December, January to March and April to June separately are shown in table – 2.2.2.3. It is seen that the south-west monsoon months viz. July to September form the principal rainy season and constitute the dominant rainfall period. In the selected districts total rainfall concentrated in the south-west monsoon months July to September accounted for 51.90 percent of total annual rainfall in Midnapore (East) while the same is 40.04 percent in Murshidabad. To the right of south-west monsoon months is the distribution of post-monsoon months October to December and to the left that for the pre-monsoon months January to June. The rainfall occurring in the post-monsoon months of October to December amounted to 19.90 percent of total annual rainfall in Midnapore (East) against the figure of 26.44 percent in Murshidabsad. The period of pre-monsoon months is divided into two periods of three months each starting from January. The rainfall distribution for the pre-monsoon months depicted that very scanty rainfall occurs during the period of January to March in both the districts while the period April to June get 27.00 percent and 32.43 percent of total annual rainfall in Midnapore (East) and Murshidabad respectively.

Table – 2.2.2.3

Rainfall situation in selected districts – 2004

(in m.m.)

Districts	Rainfall concentrated in the month of January to March	Rainfall concentrated in the month of April to June	Rainfall concentrated in the month of July to September	Rainfall concentrated in the month of October to December	Annual Rainfall (Total)
Midnapore (East)	19	406	781	299	1505
	(1.30)	(27.00)	(51.90)	(19.90)	(100.00)
Murshidabad	16	477	589	389	1471
	(1.09)	(32.43)	(40.04)	(26.44)	(100.00)

Data Source: District Statistical Handbook of the respective districts, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Level of irrigation in the selected districts

Irrigation leads to the transformation in cropping pattern by shifting cropping pattern in favour of high-value crops and by promoting crop specialization which eventually enhance agricultural output leading to increase in income of rural farmers. The level of irrigation and its distribution by source across the selected districts are shown in table – 2.2.2.4. It is observed that the district of Midnapore (East) enjoys

better irrigation facility in terms of both quantitative and qualitative coverage of irrigation. The extent of irrigation as measured by the percent of net sown area irrigated accounted for 62.08 percent in Midnapore (East) whereas the corresponding figure for the district of Murshidabad is 52.37 percent. In term of qualitative coverage of irrigation the district of Midnapore (East) enjoys 40.97 percent of net irrigated area from ground water sources as against the comparable figure of 7.17 percent for Murshidabad district. Canal irrigation accounted for 22.36 percent of net irrigated area in Midnapore (East). In Murshidabad about 21.50 percent of net irrigated area is irrigated by canal. Tank irrigation accounted for 14.22 percent in Midnapore (East) while the corresponding figure stood at 4.05 percent in Murshidabad. About 5.47 percent of net irrigated area is under river lift irrigation in Murshidabad as against the figure of 1.43 percent in Midnapore (East). A feature of significance is that in Murshidabad district, area served by other sources of irrigation accounted for the major, the percentage being 61.81 percent while it was 21.02 percent in Midnapore (East).

Table – 2.2.2.4

Sources of irrigation in the selected districts: 2003-2004

District/ State	Area irrigated by different sources ('000 ha)							Irrigated area as per cent of net sown area
	Government Canal	Tank	Deep Tubewell	Shallow Tubewell	River Lift	Other Sources	Total	
Midnapore (East)	41.27	26.25	26.7	48.91	2.64	38.8	184.57	62.08
	(22.36)	(14.22)	(14.47)	(26.50)	(1.43)	(21.02)	(100.00)	
Murshidabad	45.47	8.56	13.32	1.85	11.6	130.72	211.49	52.37
	(21.50)	(4.05)	(6.30)	(0.87)	(5.47)	(61.81)	(100.00)	

Data Source: District Statistical Handbook of the respective districts, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Average size of holding in the selected districts

It is quit plausible that with inadequate land base, farm workers resort to no-agriculture activities in order to supplement their household income. The compulsion to move out from agriculture due to decline in the average size of holding is also expected. In respect of the size of farm (table-2.2.2.5), the comparison of the selected districts revealed that the average size of holding is lower (0.53ha) in Midnapore (East) as compared to its counterpart district Murshidabad (0.75ha). As for the percentage distribution of the number and area of the holdings in respect of different size classes, it was noticed that the holdings up to 2.00 hectares accounted for 95.07 per cent of the total holdings in Murshidabad district, which was around 99.18 per cent in Midnapore (East) district. Similarly, in terms of total area operated, the holdings upto 2.00 hectares have 81.15 per cent of the total operated area in

Murshidabad and 95.80 per cent in Midnapore (East). Thus the bulk of the holdings fall within 2.00 hectares in the selected districts being characterized by the preponderance of small and marginal holdings.

Table – 2.2.2.5

Distribution of operational holdings in the selected districts: 2000-2001

Size Classes of Holdings	Murshidabad		Midnapore(E)	
	No. of Holdings	Area of Holdings	No. of Holdings	Area of Holdings
Marginal (Below 1ha.)	460025 (78.39)	212183 (48.32)	550168 (94.61)	256843 (82.59)
Small (1-2ha)	97910 (16.68)	144139 (32.83)	26591 (4.57)	41085 (13.21)
Semi-medium (2-4ha)	25556 (4.36)	67032 (15.27)	4410 (0.76)	11426 (3.67)
Medium (4-10ha.)	3310 (0.56)	15575 (3.55)	301 (0.05)	1427 (0.46)
Large (10ha. And above)	15 (0.003)	158 (0.04)	14 (0.002)	195 (0.06)
All Size	586816 (100.00)	439087 (100.00)	581484 (100.00)	310977 (100.00)
Average Size of Holding (ha.)	0.75		0.53	

Data Source: District Statistical Handbook, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Agricultural Mechanization in the selected districts

Agricultural transformation attendant upon the mechanization of agriculture leads to the creation of newer job opportunities leading to the emergence of diversified occupational structure. In this study, the index of mechanization is captured by tractorisation and pump sets used in agriculture. It can be seen that in respect of tractorisation and the use of pump sets (table-2.2.2.6) the district of Murshidabad occupied the position ahead of undivided Midnapore, while in terms of the use of power tillers the latter district ranked ahead of the former.

Table – 2.2.2.6

Agricultural Mechanization in the selected districts: 2003

Districts	Number of Agricultural Tractors per '000ha of Net Sown Area	Number of Agricultural Power Tillers per '000ha of Net Sown Area	Number of Diesel Pump Sets per '000ha of Net Sown Area	Number of Electric Pump Sets per '000ha of Net Sown Area	Number of Total Pump Sets per '000ha of Net Sown Area
Midnapore (undivided)	1.81	10.71	142.48	8.91	151.40
Murshidabad	4.08	0.83	141.77	16.61	158.38

Data Source: District Statistical Handbook 2005,
Bureau of Applied Economics & Statistics, Government of West Bengal

Livestock and Poultry

Livestock and poultry population together numbered 84.95 lakhs in Murshidabad and 105.56 lakhs in Midnapore (East). Poultry population tops the list in both the selected districts (table - 2.2.2.7). The total livestock population in Murshidabad and Midnapore (East) districts are 30.24 lakhs and 44.91 lakhs respectively. Disaggregating livestock into bovine and ovine, it was found that bovine population constituted 44.75 per cent in Murshidabad district while it was 58.46 per cent in Midnapore (East). Correspondingly, ovine population (sheep and goats) accounted for 55.25 per cent of total livestock population in Murshidabad district as against the figure of 41.54 per cent in Midnapore (East). Cattle constitute the major in total bovine population, which was 92.38 percent in Murshidabad and 96.98 percent in Midnapore (East). Within the group of the ovine population, sheep constitute 7.72 percent in Murshidabad and others are goats (92.29 percent). In the counterpart district of Midnapore (East), the percentage of sheep population in total ovine population accounted for 7.38 percent and the corresponding figure of goats stood at 92.62 percent. It is thus revealing that goat population assumes importance in both the selected districts out of the total poultry, chickens constituted the major followed ducks in both the districts

Fisheries in the selected districts

Among the allied agricultural activities, fisheries are important in the state. In the selected districts, fishery resources as captured by the net area available for pisciculture as percent of total reporting area of the district accounted for 8.74 percent in Murshidabad and 6.87 percent in Midnapore (East). With regard to use of fishery resources, area under effective pisciculture constituted 8.33 percent in Murshidabad as against that of 5.31 percent in Midnapore (East). As per the available statistics annual production of fish was 35227.7 tonnes in Midnapore (East) followed by 155.0 tonnes in Murshidabad district (table – 2.2.2.8).

Infra-structural facilities in the selected districts

Infra-structure is the crucial determinant of agricultural development. Again within the group of infra-structure, road transport and electrification are important ones. As follows from table – 2.2.2.9, the extent of road transport network linking rural with urban areas appears to be better in the district of Midnapore (East) than that of Murshidabad. In terms of road length (maintained by P.W.D) per thousand sq. km of geographical area, the district of Midnapore (East) displays the figure of 424.11 km. as against figure of 229.06 km. in Murshidabad district. In respect of other rural infra-structure viz. village electrification rate, the district of Murshidabad ranks ahead of Midnapore (East). As revealed from table – 2.2.2.9, the number of revenue mouzas electrified accounted for 85.20 percent in

Table – 2.2.2.7
Livestock and poultry in the selected districts: 2003(P)

Type	Murshidabad		Midnapore (E)	
	Nos.	Per cent	Nos.	Per cent
1. Cattle: Cows	444684	5.23	334295	3.17
Bulls and Bullocks	196812	2.32	5852241	55.44
Yongstock	608867	7.17	1627271	15.41
Total	1250353	14.72	2546807	24.12
2. Buffaloes: Cows	21183	0.25	17563	0.17
Bulls and Bullocks	56647	0.67	45282	0.43
Yongstock	25311	0.30	16435	0.16
Total	103141	1.21	79280	0.75
Total Bovine Population	**1353494**	**15.93**	**2626087**	**24.88**
3. Sheep	118290	1.39	116267	1.10
4. Goats	1414791	16.65	1458333	13.81
Total Ovine Population	**1533081**	**18.05**	**1574600**	**14.92**
5. Horses & Poines	3096	0.04	109	0.001033
6. Pig	21894	0.26	99519	0.94
7. Other Livestock	112735	1.33	191581	1.81
Total Livestock Population	**3024300**	**35.60**	**4491896**	**42.55**
8. Poultry: Fowls	4014901	47.26	4813100	45.59
Ducks	1451188	17.08	1094535	10.37
Others	4924	0.06	157246	1.49
Total Poultry	**5471013**	**64.40**	**6064881**	**57.45**
Grand Total	**8495313**	**100.00**	**10556777**	**100.00**

Data Source: District Statistical Handbook of the respective districts, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Table – 2.2.2.8
Status of fisheries in the selected districts: 2004-05

Districts	Net area available for pisciculture as per cent of total reporting area	Net area under effective pisciculture as per cent of total reporting area	Annual production of fish (tonnes)
Midnapore (East)	6.87	5.31	35227.70
Murshidabad	8.74	8.33	155.00

Data Source: District Statistical Handbook of the respective districts, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Table – 2.2.2.9

Infrastructure facilities available in the selected districts

Item	Murshidabad	Midnapore(E)
1. Proportion of Mouzas Electrified (2004)	85.20	65.50
2. Population served per bank office (in '000) 2005	29	21 (Undivided Midnapore)
3. No. of Post offices per lakh of population (as on 31.03.2005)	10	16 (Undivided Midnapore)
4. Road length maintained by PWD per '000sq.km. of geographical area (2003-04) in km.	229.06	424.11

Data Source: District Statistical Handbook of the respective districts, 2005
Bureau of Applied Economics & Statistics, Government of West Bengal

Murshidabad as against the corresponding figure of 65.50 percent in Midnapore (East). With regard to the access of credit, the selected districts have a network of scheduled bank offices where population served per bank office numbered more in Murshidabad as compared to Midnapore (East). In Murshidabad district about 29000 people were served by each of bank office while the figure translated to about 21000 in Midnapore (East).

2.3: Cropping Pattern of the State, Districts and Selected Villages

2.3.1: Cropping Pattern of the State

This section intends to look into the behavior of crop pattern at the state level using time series data for the 5-year period ending 2003-04. For the purpose of analyzing crop pattern, based on the share of each crop to the total gross cropped area, percentages were worked out for period 1999-00 to 2003-04 and are presented in table 2.3.1. A perusal of the table – 2.3.1 indicated that rice, wheat, rape & mustard, jute and potato are dominant crops in order of importance in the state. These crops together covered 90.68 per cent of the gross cropped area. However during the period under review i.e. 1999-2000 to 2003-2004, aggregate share of these crops in the total gross cropped area decreased from 92.28 per cent in 1999-2000 to 90.68 per cent in 2003-2004. It can be noticed that there has been decline in the area share of foodgrains during the period under review. Foodgrains crops as a whole shared 78.23 per cent of gross cropped area in 2003-2004, which was 80.42 per cent in 1999-2000. However despite decline in the proportion of area under foodgrains, it still accounted for the major in the cropping pattern remaining almost stable at about 78 per cent during the period after 1999-00. Within foodgrains crops, cereals constituted the major in West Bengal where about 75.25 per cent of the gross cropped area was covered by cereals as recorded in 2003-04. The corresponding figure was 77.88 per cent in 1999-2000 and thus

Table – 2.3.1
Cropping pattern in West Bengal during last five years ending 2003-04

(Percent of Gross Cropped Area)

Crops	1999-2000	2000-01	2001-02	2002-03	2003-04
Winter Rice	50.34	45.91	49.04	48.74	48.83
Autumn Rice	5.06	4.97	4.69	4.63	4.02
Summer Rice	17.47	17.68	16.94	16.92	16.45
Total Rice	72.86	68.56	70.66	70.29	69.30
Wheat	4.31	5.37	5.05	4.88	5.04
Barley	0.06	0.04	0.03	0.03	0.04
Maize	0.42	0.45	0.39	0.33	0.66
Jower	0.01	0.01	0.01	0.02	0.02
Bajra	0.00	0.00	0.00	0.00	0.00
Ragi	0.15	0.16	0.15	0.16	0.16
Small Millets	0.06	0.05	0.05	0.05	0.04
Total Cereals	77.88	74.65	76.35	75.77	75.25
Gram	0.32	0.69	0.59	0.57	0.55
Arhar(Tur)	0.04	0.11	0.05	0.04	0.04
Mung	--	0.14	0.13	0.12	0.13
Musur	--	0.96	0.83	0.83	0.82
Khesari	--	0.51	0.40	0.39	0.42
Other Pulses	2.19	1.05	0.90	0.96	1.02
Total Pulses	2.54	3.46	2.90	2.91	2.98
Total Foodgrains	80.42	78.11	79.25	78.68	78.23
Oil Seeds :Rape & Mustard	4.10	5.50	5.12	4.91	5.35
Linseed	0.12	0.15	0.13	0.11	0.07
Til	1.25	1.35	1.26	1.33	1.93
Others	0.49	0.55	0.52	0.48	0.75
Total Oil Seeds	5.95	7.55	7.03	6.84	8.11
Jute	7.27	7.73	7.59	7.65	7.34
Mesta	0.11	0.14	0.12	0.10	0.11
Cotton	0.01	0.02	0.02	0.01	0.02
Sunhemp(Fibre)	0.02	0.02	0.02	0.02	0.02
Total Fibre	7.41	7.90	7.75	7.78	7.49
Tea	1.22	1.36	1.27	1.32	1.35
Sugarcane	0.27	0.27	0.27	0.23	0.20
Tobacco	0.14	0.13	0.11	0.09	0.15
Potato	3.74	3.78	3.49	4.20	3.65
Dry Chillies	0.75	0.78	0.71	0.74	0.72
Ginger(Dry)	0.11	0.12	0.11	0.11	0.11
Gross Cropped Area(GCA) in '000 ha	8440.90	7928.20	8588.90	8311.10	8451.50

Data Source : Figures are estimated from the data obtained from Statistical Abstract, Bureau of Applied Economics and Statistics, Government of West Bengal, Different issues.

cereals suffered loss in acreage during the period. Within the cereal crops, rice and wheat are the major ones and jointly occupied 74.34 per cent of the gross cropped area as in 2003-04, which was 77.17 per cent in 1999-2000. Rice and wheat being principal components of foodgrains jointly demonstrated decline in their area share over the same reference period viz. 1999-2000 to 2003-04. Within the foodgrains crops, the share of pulses in total cropped area increased marginally from 2.54 per cent to 2.98 per cent in the above-mentioned period. Rape and mustard is the major oilseed crop in

West Bengal. While the share of total oilseeds accounted for 8.10 per cent in 2003-04, the corresponding share of rape and mustard was 5.35 per cent during the same period. The percentage of area under oilseeds showed increasing trend, area share being increased from 5.95 per cent to 8.10 per cent in the same reference period. As against this area proportion under rape and mustard increased from 4.10 per cent in 1999-2000 to 5.35 per cent in 2003-04. Jute requiring a large amount of human labour per acre, the share of area under the crop increased marginally from 7.27 per cent to 7.34 per cent. Potato, again a crop absorbing a significant amount of human labour and of bullock labour but bringing in higher gross revenue per acre occupied an area of 3.65 per cent of gross cropped area in 2003-04 which was 3.74 per cent in 1999-2000.

The overall changing scenario of the cropping pattern in West Bengal reveals that cropping pattern of the state is still predominated by foodgrains crops, the principal component being cereal crops. One of the striking features of cropping pattern of the state is the decline in the area share of foodgrains accompanying its principal component cereals. The decline in area proportion of foodgrains was associated with increase in the area share of commercial crops like oilseeds and jute.

2.3.2 : Cropping Pattern of the Selected Districts

In order to have a clear picture of the crop economy of the selected districts, cropping pattern of the selected districts are presented in tables 2.3.2.1 & 2.3.2.2 for Midnapore (East) and Murshidabad respectively. The cropping pattern of Midnapore(East) presented in table 2.3.2.1 shows that rice is the single dominating crop in the cropping pattern of the district accounting for about 92.79 per cent of the gross cropped area. The cropping pattern of the district clearly brings out that the district is predominantly foodgrains producing region which covered 94.04 per cent of the cropped area of the district. During the period 1999-2000 to 2003-04, gross cropped area in the district has shown steady decline from 558.9 thousand hectare in 1999-2000 to 455.1 thousand hectare in 2003-04. The overall percentage area under foodgrains increased from 89.89 per cent of gross cropped area to 94.04 per cent during the same reference period. Rice being the dominant component of foodgrains, improved it's share from 88.92 per cent in 1999-2000 to 92.79 per cent in 2003-04. Though oilseed is the next important crop in the district, it experienced decline in its share from 4.06 per cent to 3.91per cent during1999-2000 to2003-04.

The details of cropping pattern of Murshidabad district have been presented in table 2.3.2.2. It shows that rice, wheat, lentil, rape & mustard and jute are dominant crops in the cropping pattern of the district which altogether accounted

Table – 2.3.2.1
Cropping pattern in Midnapore (East) of West Bengal

(Per cent of Gross Cropped Area)

Crops	1999-2000	2000-01	2001-02	2002-03	2003-04
Winter Rice	57.02	57.71	58.16	62.21	59.66
Autumn Rice	3.01	2.74	4.49	3.09	2.90
Summer Rice	28.90	28.36	26.28	28.88	30.24
Total Rice	**88.92**	**88.80**	**88.94**	**94.18**	**92.79**
Wheat	0.11	0.12	0.10	0.00	0.02
Barley	0.00	0.00	0.00	0.00	0.00
Maize	0.00	0.00	0.00	0.00	0.00
Jower	0.00	0.00	0.00	0.00	0.00
Bajra	0.00	0.00	0.00	0.00	0.00
Ragi	0.00	0.00	0.00	0.00	0.00
Small Millets	0.00	0.00	0.00	0.00	0.00
Total Cereals	**89.03**	**88.92**	**89.04**	**94.18**	**92.81**
Gram	0.00	0.00	0.40	0.07	0.00
Arhar(Tur)	0.00	0.00	0.00	0.00	0.00
Mung	0.14	0.10	0.14	0.05	0.04
Musur	0.00	0.00	0.02	0.00	0.00
Khesari	0.68	1.29	1.13	0.61	1.16
Other Pulses	0.04	0.10	0.02	0.02	0.02
Rabi Pulses	0.00	0.00	0.00	0.00	0.00
Khrif Pulses	0.00	0.00	0.00	0.00	0.00
Total Pulses	**0.86**	**1.56**	**1.31**	**0.68**	**1.23**
Total Foodgrains	**89.89**	**90.49**	**90.35**	**94.86**	**94.05**
Oil Seeds					
Rape & Mustard	0.84	1.04	0.75	0.21	0.92
Linseed	0.00	0.00	0.00	0.00	0.00
Til	1.59	1.55	1.57	0.05	0.13
Others	1.63	1.60	1.52	2.32	2.86
Total Oil Seeds	**4.06**	**4.19**	**3.83**	**2.57**	**3.91**
Jute	0.97	0.81	0.94	0.42	0.46
Mesta	0.00	0.00	0.00	0.00	0.00
Cotton	0.00	0.00	0.00	0.00	0.00
Sunhemp(Fibre)	0.04	0.03	0.03	0.05	0.04
Total Fibre	**1.00**	**0.84**	**0.98**	**0.47**	**0.51**
Tea	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.00	0.00	0.00	0.00	0.00
Tobacco	0.00	0.00	0.00	0.00	0.00
Potato	4.08	3.46	3.85	1.08	0.62
Dry Chillies	0.77	0.81	0.77	0.77	0.68
Ginger(Dry)	0.20	0.22	0.23	0.26	0.24
Gross Cropped Area (GCA) '000 ha	**558.90**	**594.90**	**574.10**	**427.60**	**455.10**

Data Source : Figures are estimated from the data obtained from Statistical Abstract, Bureau of Applied Economics and Statistics, Government of West Bengal, Different issues.

Table - 2.3.2.2
Cropping pattern in Murshidabad district of West Bengal

(Per cent of Gross Cropped Area)

Crops	1999-2000	2000-01	2001-02	2002-03	2003-04
Winter Rice	30.26	10.23	28.69	28.80	26.64
Autumn Rice	6.59	7.44	5.94	6.44	4.61
Summer Rice	12.81	16.59	13.79	13.93	15.01
Total Rice	49.65	34.26	48.43	49.17	46.26
Wheat	15.93	20.71	16.88	16.20	15.46
Barley	0.20	0.15	0.07	0.08	0.08
Maize	0.06	0.08	0.01	0.01	0.23
Jower	0.08	0.09	0.09	0.13	0.14
Bajra	0.00	0.00	0.00	0.00	0.00
Ragi	0.00	0.00	0.00	0.00	0.00
Small Millets	0.00	0.00	0.00	0.01	0.00
Total Cereals	65.93	55.29	65.47	65.61	62.16
Gram	0.86	1.59	1.21	1.21	1.44
Arhar(Tur)	0.08	0.20	0.13	0.17	0.06
Mung	0.04	0.03	0.01	0.00	0.01
Musur	2.15	4.33	3.40	3.40	2.82
Khesari	0.93	1.38	1.02	1.09	1.53
Other Pulses	1.39	1.54	0.54	0.53	1.59
Rabi Pulses	0.00	0.00	0.00	0.00	0.00
Khrif Pulses	0.00	0.00	0.00	0.00	0.00
Total Pulses	**5.45**	**9.06**	**6.31**	**6.40**	**7.45**
Total Foodgrains	**71.38**	**64.35**	**71.79**	**72.00**	**69.61**
Oil Seeds					
Rape & Mustard	7.18	9.94	7.72	7.50	8.89
Linseed	0.13	0.17	0.12	0.07	0.07
Til	0.54	0.72	0.50	0.56	1.63
Others	0.04	0.05	0.10	0.04	0.03
Total Oil Seeds	**7.88**	**10.87**	**8.44**	**8.16**	**10.62**
Jute	18.12	21.55	17.53	17.40	17.66
Mesta	0.05	0.17	0.01	0.01	0.01
Cotton	0.00	0.00	0.00	0.00	0.00
Sunhemp(Fibre)	0.00	0.00	0.00	0.00	0.00
Total Fibre	18.17	21.72	17.54	17.41	17.67
Tea	0.00	0.00	0.00	0.00	0.00
Sugarcane	0.87	0.99	0.77	0.79	0.67
Tobacco	0.00	0.00	0.00	0.00	0.00
Potato	1.11	1.36	0.93	1.06	0.85
Dry Chillies	0.56	0.66	0.49	0.56	0.55
Ginger(Dry)	0.03	0.05	0.04	0.02	0.03
Gross Cropped Area (GCA) '000 ha	**781.60**	**654.20**	**815.90**	**827.20**	**872.10**

Data Source : Figures are estimated from the data obtained from Statistical Abstract, Bureau of Applied Economics and Statistics, Government of West Bengal, Different issues.

for 91.07 per cent of the gross cropped area in the year 2003-04. Considering the overall cropping pattern during the five year period ending 2003-04, it is noticeable that area under foodgrains has been on the decline with its share being decreased from 71.38 per cent in 1999-2000 to 69.61 per cent in 2003-04. Evidently, the downward trend in the area share of foodgrains is clearly explained by the declining share of cereals, the major component of foodgrains. The share of pulses, which accounted for 5.45 per cent in 1999-2000 increased to 7.45 per cent in 2003-04. Among pulses, lentil (musur) is the dominant one. Among other crops jute and oilseed are important ones. The share proportion of area under jute remained steady with only a slight decrease from 18.12 per cent in 1999-2000 to 17.66 per cent in 2003-04. Area under oilseed crop on the other hand, increased from 7.88 per cent of gross cropped area to 10.62 per cent during the same reference period.

2.3.3 : Cropping Pattern of the Selected Villages

The cropping pattern of the state and the selected districts are also reflected in the selected villages. The table 2.3.3.1 shows the percentages of areas under the principal crops on gross cropped area of the selected villages in Midnapore (East) district. From the table 2.3.3.1 it is apparent that the staple crop in the selected villages is rice. The principal harvest of the crop is that of the winter crop called Haimantik or Aman. Practically the only other cereal grown in the sample villages is wheat which are raised in very small quantities in a small area. Other crops grown in the sample villages are pulses, mustard, potato and jute in order of importance. Strata-wise we find no variation in the relative importance of the crops except in strata III where fibre crop like jute is not grown at all and accordingly, area allocation under winter rice is found to be comparatively high. In strata I, II and IV winter rice (Aman), the principal crop of the district is raised on an area ranging from 38 to 56 per cent of the gross cropped area across the selected villages. In strata III land given up to winter paddy comprised of 62 per cent of gross cropped area. Cereal other than rice comprised only wheat which are cultivated in a very negligible area, the share proportion of the crop being less than 1 per cent in all the strata of the district. Other crops included potato, mustard and pulses which are found to be cultivated by the farmers in all the selected villages belonging to different strata.

In Murshidabad district (table – 2.3.3.2), rice is by far the most important crop being raised on 42 to 52 per cent of cropped area across the selected villages. Rice crop is divided into three classes known as Aus, Aman and Boro. Aman or Haimantik is the principal crop of the district and constitutes the bulk of the rice. Murshidabad is one of the few districts in West Bengal in which wheat is grown to a considerable extent. In the selected villages, the proportion of area devoted to wheat accounted for

16 to 19 per cent of the gross cropped area as against the figure of about 5 per cent for the state as a whole. Other important crop is jute followed by rape and mustard, pulses and potato, in order of importance. Jute absorbs a large amount of human labour per acre and the proportion of area allocated to jute accounted for around 10 to 17 per cent of the gross cropped area across the selected villages. Pulses requiring much less labour input per acre occupies about 4 to 5 per cent of the gross cropped area which stand higher than the state average of about 2.98 per cent. The pulses cultivated are of various sorts grouped as kharif and rabi pulses of which the latter group is dominant among total pulses. Sugarcane planted requires a high amount of labour and of bullock labour input and thus this crop is cultivated to a small extent occupying less than 1 per cent of the gross cropped area across the selected villages. Potatoes again a very labour intensive crop requiring also a very high bullock labour input but bringing in large gross revenue per acre are grown on a very small proportion of area varying from 1.86 per cent to 2.41 per cent across the selected villages.

2.5: Methods of Data Collection

The study is mainly based on primary data collected from the sample farmers. In collecting primary data, survey method was employed. Data were collected through structured schedule prepared for the purpose. The study is confined to two crops i.e. one cereal crop and one pulse crop. Crops covered are rice in case of cereal crop and lentil for pulse crop. Based on the area predomination of these crops, two districts were selected. Three sets of schedule were canvassed for collecting primary information. In schedule-I, stratum-wise list of selected villages along with the names of development blocks for each crop covered the study were collected. For the purpose, the district was divided into four strata and five villages from each stratum were selected randomly. The complete enumeration of respondents of the selected villages was collected in schedule-II. In this schedule, name of the cultivator, Father's/Husband's name, area owned, cultivated area, holding-size code were collected for each household

Table – 2.3.3.1

Cropping pattern of the selected villages in the district of Midnapore (East) for three years ending 2003-04

		Rice						Pulses					Gross Cropped
Village /Stratum	Year	Autumn	Winter	Summer	Total Rice	Jute	Wheat	Kharif	Rabi	Total Pulses	Mustard	Potato	Area (ha)
STRATUM-I													
Nayaput	2003-04	6.74	74.97	6.76	88.47	0.33	0.33	2.27	4.29	6.56	1.61	2.7	196.53
	2002-03	6.74	74.99	6.74	88.47	0.34	0.34	2.26	4.28	6.54	1.63	2.68	196.5
	2001-02	6.74	74.98	6.76	88.48	0.33	0.34	2.26	4.27	6.53	1.62	2.69	196.5
Baliapur	2003-04	6.73	75	6.76	88.49	0.33	0.33	2.26	4.27	6.53	1.63	2.69	116.57
	2002-03	6.73	75.04	6.74	88.51	0.34	0.32	2.27	4.28	6.55	1.6	2.68	116.54
	2001-02	6.74	75.04	6.76	88.54	0.33	0.3	2.25	4.3	6.55	1.62	2.66	116.53
Fatepur	2003-04	6.77	74.96	6.75	88.48	0.31	0.36	2.25	4.26	6.51	1.64	2.69	58.63
	2002-03	6.78	74.95	6.77	88.50	0.32	0.32	2.28	4.29	6.57	1.6	2.68	58.68
	2001-02	6.79	75.07	6.79	88.65	0.29	0.29	2.3	4.27	6.57	1.57	2.63	58.6
Balabhadrapur	2003-04	6.76	74.91	6.76	88.43	0.35	0.35	2.28	4.29	6.57	1.61	2.69	111.55
	2002-03	6.78	74.92	6.77	88.47	0.33	0.34	2.27	4.28	6.55	1.6	2.71	111.5
	2001-02	6.77	75.01	6.75	88.53	0.31	0.32	2.28	4.26	6.54	1.58	2.72	111.44
Amartalya	2003-04	6.77	74.9	6.75	88.42	0.34	0.34	2.28	4.29	6.57	1.62	2.71	122.57
	2002-03	6.78	74.98	6.74	88.50	0.32	0.33	2.26	4.25	6.51	1.63	2.69	122.48
	2001-02	6.75	75.01	6.74	88.50	0.33	0.31	2.27	4.29	6.56	1.6	2.7	122.42

Contd.Table-2.3.3.1

Contd. Table-2.3.3.1

		Rice						Pulses					Gross
Village /Stratum	Year	Autumn	Winter	Summer	Total Rice	Jute	Wheat	Kharif	Rabi	Total Pulses	Mustard	Potato	Cropped Area(ha)
STRATUM-II													
Haridaspur	2003-04	20.39	38.09	32.87	91.35	0.65	0.32	2.24	1.72	3.96	2.43	1.29	127
	2002-03	20.4	38.06	32.85	91.31	0.64	0.31	2.25	1.73	3.98	2.44	1.31	127.05
	2001-02	20.41	38.14	32.86	91.41	0.62	0.33	2.25	1.7	3.95	2.42	1.28	126.89
Mamudpur	2003-04	20.35	38.08	32.83	91.26	0.67	0.33	2.26	1.72	3.98	2.44	1.31	161.64
	2002-03	20.38	38.1	32.82	91.30	0.66	0.32	2.25	1.73	3.98	2.43	1.31	161.56
	2001-02	20.38	38.12	32.82	91.32	0.65	0.33	2.24	1.73	3.97	2.44	1.29	161.51
Sanmajigaon	2003-04	20.36	38.09	32.83	91.28	0.66	0.33	2.26	1.71	3.97	2.44	1.32	188.78
	2002-03	20.37	38.11	32.82	91.30	0.65	0.32	2.26	1.72	3.98	2.43	1.32	188.73
	2001-02	20.37	38.12	32.84	91.33	0.67	0.32	2.25	1.7	3.95	2.42	1.3	188.62
Baruibarh	2003-04	20.38	38.07	32.84	91.29	0.67	0.3	2.26	1.71	3.97	2.46	1.32	76.56
	2002-03	20.41	38.12	32.92	91.45	0.64	0.29	2.21	1.7	3.91	2.42	1.3	76.4
	2001-02	20.42	38.13	32.86	91.41	0.65	0.31	2.22	1.73	3.95	2.39	1.27	76.44
Naria	2003-04	20.37	38.1	32.83	91.30	0.65	0.34	2.24	1.72	3.96	2.43	1.31	126.98
	2002-03	20.38	38.11	32.85	91.34	0.64	0.32	2.26	1.73	3.99	2.42	1.29	126.99
	2001-02	20.4	38.08	32.84	91.32	0.66	0.32	2.24	1.74	3.98	2.4	1.32	126.97

Contd.Table-2.3.3.1

Contd. Table-2.3.3.1

		Rice						Pulses					Gross
Village /Stratum	Year	Autumn	Winter	Summer	Total Rice	Jute	Wheat	Kharif	Rabi	Total Pulses	Mustard	Potato	Cropped Area(ha)
STRATUM-III													
Bongopalpur	2003-04	9.05	62.39	18.1	89.54	0	0.28	3.71	2.94	6.65	1.72	1.81	146.13
	2002-03	9.04	62.43	18.12	89.59	0	0.27	3.7	2.94	6.64	1.71	1.79	146.05
	2001-02	9.03	62.44	18.11	89.58	0	0.26	3.71	2.95	6.66	1.71	1.79	145.99
Finga	2003-04	9.05	62.4	18.08	89.53	0	0.26	3.72	2.96	6.68	1.7	1.82	72.35
	2002-03	9.03	62.45	18.07	89.55	0	0.28	3.69	2.95	6.64	1.69	1.84	72.31
	2001-02	9.05	62.48	18.15	89.68	0	0.25	3.67	2.94	6.61	1.66	1.8	72.23
Babupur	2003-04	9.05	62.39	18.09	89.53	0	0.28	3.71	2.95	6.66	1.73	1.81	210.15
	2002-03	9.05	62.4	18.1	89.55	0	0.27	3.7	2.94	6.64	1.72	1.81	210.17
	2001-02	9.04	62.44	18.1	89.58	0	0.26	3.7	2.93	6.63	1.72	1.81	210.11
Anarpur	2003-04	9.09	62.43	18.08	89.60	0	0.27	3.66	2.93	6.59	1.76	1.78	40.94
	2002-03	9.05	62.53	18.07	89.65	0	0.24	3.69	2.91	6.6	1.74	1.76	40.89
	2001-02	9.06	62.48	18.15	89.69	0	0.27	3.64	2.96	6.6	1.69	1.76	40.94
Urdhammal	2003-04	9.04	62.4	18.09	89.53	0	0.27	3.71	2.94	6.65	1.72	1.81	346.28
	2002-03	9.04	62.42	18.09	89.55	0	0.27	3.71	2.95	6.66	1.72	1.81	346.15
	2001-02	9.05	62.42	18.09	89.56	0	0.27	3.7	2.94	6.64	1.72	1.81	346.1

Contd.Table-2.3.3.1

Contd. Table-2.3.3.1

		Rice						Pulses					Gross
Village /Stratum	Year	Autumn	Winter	Summer	Total Rice	Jute	Wheat	Kharif	Rabi	Total Pulses	Mustard	Potato	Cropped Area(ha)
STRATUM-IV													
Naikuri - Jagannath Chak	2003-04	0.59	56.46	30.95	88.00	0.78	0.39	4.72	2.7	7.42	1.87	1.54	150.83
	2002-03	0.58	56.46	30.96	88.00	0.8	0.38	4.71	2.71	7.42	1.86	1.55	150.82
	2001-02	0.58	56.5	30.95	88.03	0.79	0.37	4.73	2.69	7.42	1.85	1.53	150.76
Lahanda	2003-04	0.57	56.45	30.95	87.97	0.79	0.39	4.72	2.72	7.44	1.85	1.56	179.4
	2002-03	0.59	56.46	30.95	88.00	0.78	0.38	4.72	2.72	7.44	1.86	1.55	179.36
	2001-02	0.57	56.49	30.97	88.03	0.78	0.38	4.71	2.72	7.43	1.85	1.54	179.31
Chapbasan	2003-04	0.58	56.45	30.95	87.98	0.79	0.38	4.73	2.71	7.44	1.85	1.56	143.67
	2002-03	0.59	56.45	30.94	87.98	0.8	0.4	4.71	2.72	7.43	1.87	1.53	143.64
	2001-02	0.58	56.51	30.94	88.03	0.77	0.4	4.72	2.7	7.42	1.85	1.53	143.53
Jairambati	2003-04	0.57	56.48	30.96	88.01	0.77	0.39	4.72	2.71	7.43	1.85	1.55	161.13
	2002-03	0.58	56.48	30.97	88.03	0.76	0.38	4.72	2.7	7.42	1.86	1.55	161.08
	2001-02	0.57	56.52	30.97	88.06	0.78	0.37	4.71	2.7	7.41	1.85	1.53	160.96
Ajangechia	2003-04	0.58	56.48	30.96	88.02	0.79	0.39	4.71	2.71	7.42	1.85	1.53	142.46
	2002-03	0.59	56.47	30.97	88.03	0.77	0.38	4.72	2.72	7.44	1.86	1.52	142.52
	2001-02	0.58	56.53	30.97	88.08	0.78	0.39	4.71	2.7	7.41	1.85	1.51	142.39

Data Source: Village level data collected in course of the survey.

Table – 2.3.3.2

Cropping pattern of the selected villages in Murshidabad district for three years ending 2003-04

(Percentages of Gross cropped area)

Village /Stratum	Rice				Jute	Wheat	Pulses			Mustard	Sugarcane	Potato	Gross Cropped Area (ha)
STRATUM -I JADUPUR	Autumn	Winter	Summer	TotalRice			Kharif	Rabi	Total Pulses				
2003-04	5.51	20.75	15.85	42.11	17.73	17.92	1.22	3.61	4.83	14.22	0.94	2.25	473.30
2002-03	5.44	20.85	15.96	42.25	17.30	18.09	1.22	3.63	4.85	14.31	0.94	2.27	470.04
2001-02	5.69	20.72	15.81	42.22	17.61	17.98	1.22	3.59	4.81	14.18	0.94	2.26	474.14
PRATAPUR-CHANDPARA													
2003-04	5.54	20.80	15.87	42.21	17.62	17.92	1.23	3.61	4.84	14.23	0.92	2.26	146.18
2002-03	5.71	21.42	16.35	43.47	14.97	18.53	1.23	3.72	4.95	14.63	0.98	2.47	141.93
2001-02	5.46	20.57	15.97	42.00	17.51	18.08	1.23	3.57	4.80	14.20	0.93	2.47	145.60
BASABARI													
2003-04	5.49	20.80	15.85	42.14	17.69	17.93	1.24	3.60	4.84	14.23	0.94	2.23	255.23
2002-03	6.04	21.11	16.10	43.25	15.96	18.23	1.26	3.63	4.88	14.48	0.96	2.24	250.91
2001-02	5.70	20.76	15.83	42.29	17.59	18.03	1.19	3.54	4.73	14.18	0.94	2.24	255.30
SUNGAI													
2003-04	5.80	20.71	15.81	42.31	17.67	17.86	1.21	3.59	4.80	14.18	0.94	2.24	362.23
2002-03	5.78	20.99	16.03	42.80	16.59	18.11	1.26	3.64	4.90	14.39	0.95	2.27	357.25
2001-02	5.63	20.73	15.83	42.20	17.59	18.05	1.21	3.57	4.78	14.20	0.94	2.24	361.24
BANINATHPUR													
2003-04	5.59	20.79	15.86	42.24	17.75	17.93	1.23	3.59	4.82	14.08	0.93	2.25	333.81
2002-03	5.71	21.15	16.15	43.01	16.08	18.31	1.24	3.68	4.91	14.45	0.95	2.29	327.68
2001-02	5.55	20.81	15.87	42.23	17.70	17.91	1.22	3.59	4.82	14.17	0.95	2.23	333.30

Contd.Table-2.3.3.2

Contd. Table-2.3.3.2

Village /Stratum	Rice				Jute	Wheat	Pulses			Mustard	Sugarcane	Potato	Gross Cropped Area (ha)
STRATUM – II	Autumn	Winter	Summer	TotalRice			Kharif	Rabi	Total Pulses				
DEBIPUR													
2003-04	5.23	20.88	15.95	42.07	17.83	17.78	1.23	3.61	4.84	14.28	0.94	2.26	98.41
2002-03	5.55	21.90	16.77	44.23	13.46	18.91	1.28	3.74	5.02	15.04	0.99	2.35	93.61
2001-02	5.23	21.01	16.07	42.31	17.40	17.98	1.25	3.52	4.77	14.33	0.95	2.25	97.68
LAKSHMIPUR													
2003-04	5.19	20.90	15.98	42.07	17.83	17.91	1.19	3.58	4.77	14.21	0.95	2.27	73.21
2002-03	5.63	22.07	16.81	44.51	13.00	19.04	1.23	3.75	4.98	15.09	1.01	2.38	69.32
2001-02	5.29	20.80	15.79	41.88	17.85	18.14	1.21	3.62	4.83	14.22	0.93	2.14	72.83
MANIKPUR													
2003-04	5.24	20.83	15.89	41.96	17.79	18.00	1.25	3.61	4.85	14.24	0.92	2.24	163.02
2002-03	5.35	21.38	16.27	42.99	15.73	18.43	1.30	3.71	5.00	14.62	0.94	2.28	158.91
2001-02	5.33	20.94	15.95	42.22	17.47	18.06	1.29	3.57	4.86	14.18	0.92	2.28	162.25
MAHISAIL													
2003-04	5.28	20.83	15.89	42.00	17.74	17.96	1.23	3.61	4.83	14.26	0.95	2.25	1234.39
2002-03	5.43	21.14	16.13	42.71	16.48	18.18	1.24	3.66	4.90	14.49	0.96	2.29	1215.69
2001-02	5.29	20.89	15.94	42.11	17.53	18.03	1.23	3.62	4.85	14.29	0.94	2.25	1230.36
HAPANIA													
2003-04	5.19	20.82	15.93	41.93	17.82	17.96	1.22	3.62	4.85	14.25	0.93	2.26	150.37
2002-03	5.42	21.80	16.62	43.83	14.15	18.78	1.25	3.75	5.01	14.88	0.99	2.36	143.84
2001-02	5.28	20.91	15.97	42.16	17.45	18.01	1.21	3.61	4.82	14.34	0.94	2.29	149.66

Contd. Table-2.3.3.2

Contd. Table-2.3.3.2

Village /Stratum	Rice				Jute	Wheat	Pulses			Mustard	Sugarcane	Potato	Gross Cropped Area (ha)
STRATUM – III	Autumn	Winter	Summer	TotalRice			Kharif	Rabi	Total Pulses				
BHARTA													
2003-04	4.46	20.99	16.02	41.47	17.94	18.15	1.25	3.63	4.88	14.35	0.97	2.25	160.30
2002-03	4.62	22.19	16.94	43.75	13.38	19.18	1.31	3.83	5.14	15.25	1.02	2.28	151.44
2001-02	4.53	21.10	16.11	41.75	17.56	18.21	1.20	3.65	4.85	14.49	0.94	2.20	159.32
ISHANPUR													
2003-04	4.46	21.00	16.03	41.50	17.91	18.12	1.22	3.65	4.87	14.39	0.94	2.27	195.97
2002-03	4.54	21.47	16.39	42.39	16.20	18.49	1.26	3.71	4.97	14.70	0.94	2.30	191.69
2001-02	4.46	21.13	16.13	41.72	18.05	17.69	1.23	3.65	4.88	14.46	0.96	2.24	194.51
ATGHARIA													
2003-04	4.48	21.00	16.02	41.50	17.94	18.14	1.23	3.60	4.83	14.37	0.94	2.27	249.74
2002-03	4.58	21.54	16.43	42.55	15.84	18.59	1.24	3.72	4.96	14.76	0.98	2.33	243.47
2001-02	4.43	21.10	16.11	41.64	17.62	18.20	1.24	3.63	4.87	14.47	0.93	2.27	248.42
AUGRAM													
2003-04	4.49	21.03	16.05	41.57	17.78	18.14	1.23	3.65	4.88	14.40	0.95	2.28	562.36
2002-03	4.52	21.40	16.33	42.26	16.37	18.47	1.26	3.70	4.96	14.66	0.97	2.32	552.58
2001-02	4.48	21.09	16.08	41.65	17.59	18.19	1.24	3.65	4.89	14.45	0.96	2.27	560.74
EROALI													
2003-04	4.48	20.98	16.02	41.49	17.92	18.11	1.24	3.64	4.87	14.38	0.95	2.27	1281.03
2002-03	4.56	21.34	16.28	42.18	16.56	18.41	1.26	3.70	4.95	14.62	0.97	2.31	1260.20
2001-02	4.49	21.02	16.03	41.54	17.81	18.15	1.24	3.65	4.88	14.41	0.94	2.27	1278.66

Contd. Table-2.3.3.2

Contd. Table-2.3.3.2

Village /Stratum	Rice				Jute	Wheat	Pulses			Mustard	Sugarcane	Potato	Gross Cropped Area (ha)
STRATUM - IV	Autumn	Winter	Summer	TotalRice			Kharif	Rabi	Total Pulses				
KALYANPUR													
2003-04	15.60	18.54	14.15	48.30	15.84	16.01	1.10	3.21	4.31	12.71	0.83	2.00	292.87
2002-03	15.92	18.94	14.45	49.31	14.06	16.34	1.12	3.28	4.40	12.98	0.86	2.05	286.76
2001-02	15.63	18.59	14.18	48.40	15.72	16.01	1.09	3.20	4.29	12.75	0.82	2.02	292.05
SITANAGAR													
2003-04	15.59	18.55	14.13	48.26	15.85	16.00	1.10	3.20	4.30	12.71	0.86	2.01	165.65
2002-03	16.35	19.45	14.84	50.64	11.76	16.76	1.14	3.36	4.50	13.34	0.89	2.11	157.83
2001-02	15.66	18.67	14.19	48.51	15.47	16.09	1.10	3.20	4.31	12.74	0.85	2.02	164.80
SITANAGAR-CHAINPARA													
2003-04	15.54	18.57	14.17	48.28	15.90	15.96	1.07	3.16	4.24	12.71	0.85	2.06	36.35
2002-03	16.86	20.10	15.19	52.14	9.38	17.42	1.07	3.28	4.35	13.70	0.77	2.23	33.58
2001-02	15.67	18.69	14.38	48.74	15.39	16.26	0.95	2.80	3.75	13.05	0.86	1.96	35.74
KOMNAGAR													
2003-04	15.60	18.56	14.13	48.29	15.85	16.01	1.09	3.21	4.30	12.71	0.83	2.01	330.36
2002-03	15.94	18.96	14.44	49.34	14.10	16.34	1.10	3.25	4.35	13.00	0.84	2.03	323.08
2001-02	15.63	18.59	14.18	48.41	15.79	16.02	1.09	3.21	4.30	12.72	0.84	1.92	329.29
RAIPUR													
2003-04	15.60	18.56	14.16	48.32	15.86	16.01	1.08	3.21	4.30	12.71	0.84	1.96	407.61
2002-03	15.89	18.91	14.42	49.22	14.30	16.32	1.11	3.27	4.38	12.93	0.85	2.00	400.11
2001-02	15.65	18.57	14.17	48.39	15.73	16.03	1.10	3.21	4.31	12.69	0.84	2.01	406.79

Data Source: Village level data collected in course of the survey.

in the village. Data on cropping pattern in the selected villages are based on village level enumeration of area under different crops. In Schedule-III, detailed information from the selected farmers was obtained. In this schedule, name of the farmer, Father's/Husband's name, age and caste particulars, crop-wise distribution of agricultural land, production and disposal of crops, consumption of feed by animals, wastages at harvest and post-harvest stages including wastages in storage at cultivator's level for each selected crop were collected. Apart from these, wastage during home consumption and wastage during animal/poultry feeding were collected.

Field data were collected both during kharif and rabi seasons. Data were collected through enquiry and physical observations in the field. For collection of field-data, three experienced investigators were used.

Apart from the primary data, secondary data were collected from various publications of the state government like Statistical Abstract, Government of West Bengal; Statistical Handbook, Government of West Bengal; Economy Review, Government of West Bengal; and Annual Action Plan on Agriculture of the selected districts.

Chapter-III

Methodology

This chapter is devoted to analyze the methodology adopted for estimation of seed, feed and wastage ratios of major foodgrains. The study is based on both primary and secondary data. The primary data was collected through field survey from the sample farmers in two selected districts of the state. For secondary data, the study draws upon various state government publications and official sources, particularly office of the Economic and Statistical Adviser and Director of Statistics, Food and Supplies Department, Government of West Bengal and office of the Director, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Kolkata, India.

3.1: Sampling Design

3.1.1: Selection of Crops and Districts

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 rice and Murshidabad for lentil have been selected purposively for the study (Tables-3.1.1 & 3.1.2).

3.1.2: Selection of Farmers

After the selection of the district, a total number of four strata were formed by suitably combining the adjoining blocks. In selecting villages, a complete list of all the villages for each block was prepared. 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. (Tables-3.1.1& 3.1.2).

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.

Table-3.1.1

Stratum-wise list of selected villages and total number of farmers in the village in Midnapore (East) district selected for Cereal (Rice) crop.

Stratum No.	Name of Taluka/Blocks	Name of the Selected Villages	Total numbers of Farmers in the Village	Total number of rice growing farmers	Total number of sample farmers selected for the study
Stratum-I					
CONTAI	CONTAI - I	1. NAYAPUT	241	241	15
		2. BALIAPUR	90	90	15
		3. FATEPUR	50	50	15
		4. BALABHADRAPUR	102	102	15
		5. AMARTALYA	68	68	15
TOTAL			551	551	75
Stratum-II					
EGRA	PATASPUR – I	1. HARIDASPUR	48	48	15
		2. MAMUDPUR	126	126	15
		3. SANMAJIGAON	92	92	15
		4. BARUIBARH	107	107	15
		5. NARIA	51	51	15
TOTAL			424	424	75
Stratum-III					
HALDIA	SUTAHATA	1. BANGOPALPUR	144	144	15
		2. FINGA	82	82	15
		3. BABUPUR	197	197	15
		4. ANARPUR	80	80	15
		5. URDHAMMAL	206	206	15
TOTAL			709	709	75
Stratum-IV					
TAMLUK	NAIKURI	1. NAIKURI JAGANNATH CHAK	228	228	15
		2. LAHANDA	193	193	15
		3. CHAPBASAN	235	235	15
		4. JAIRAMBATI	140	140	15
		5. AJANGECHIA	209	209	15
TOTAL			1005	1005	75
GRAND TOTAL			2689	2689	300

Data Source : Field Survey

Table – 3.1.2

Stratum-wise list of selected villages and total number of farmers in the village in Murshidabad district selected for Pulse (Lentil) crop.

Stratum No.	Name of Taluka/Blocks	Name of the Selected Villages	Total numbers of Farmers in the Village	Total number of pulse growing farmers	Total number of sample farmers selected for the study
Stratum-I					
BAHARAMPUR SADAR	BAHARAMPUR - I	1. JADUPUR	233	139	15
		2. PRATAPPUR CHANDPARA	70	53	15
		3. BASABARI	114	85	15
		4. SUNGAI	165	103	15
		5. BANINATHPUR	213	113	15
TOTAL			795	493	75
Stratum-II					
JANGIPUR	SUTI-II	1. DEBIPUR	545	283	15
		2. LAKSHMIPUR	147	102	15
		3. MANIKPUR	95	70	15
		4. MAHISAIL	870	435	15
		5. HAPANIA	473	221	15
TOTAL			2130	1111	75
Stratum-III					
KANDI	KHARGRAM	1. BHARTA	192	115	15
		2. ISHANPUR	221	110	15
		3. ATGHARIA	149	79	15
		4. AUGRAM	213	102	15
		5. EROALI	844	337	15
TOTAL			1619	743	75
Stratum-IV					
LALGOLA	RANINAGAR – II	1. KALYANPUR	134	91	15
		2. SITANAGAR	141	87	15
		3. SITANAGAR CHAINPARA	74	44	15
		4. KOMNAGAR	94	51	15
		5. RAIPUR	166	79	15
TOTAL			609	352	75
GRAND TOTAL			5153	2699	300

Data Source : Field Survey

3.2 : Tools used for analysis of data

In order to estimate seed, feed and wastage ratios of foodgrains, tabular analysis and simple analytical tools such as averages and percentages were used. Finally, attempt has been made to identify the factors affecting post-harvest losses of selected foodgrains crops. While the uses of foodgrains for seed and animal/poultry feed are essential requirement of the farmers, wastage of foodgrains at different stages are major concern in the estimates of foodgrains production and thus in pushing up the

availability of foodgrains for human consumption. There is therefore, need to identify the factors that influence the post-harvest losses in foodgrains which would help develop corrective measures to reduce these losses. Thus, 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.

3.3 : Reference Year

The reference year taken for the study is 2004-05 and the data is collected for kharif and rabi seasons.

3.4: Organization of the study

The study is organized into five chapters. In chapter-I, background information of the study, brief description about history of methods of estimation followed in the state income accounting process, contribution of different sectors to state domestic product (state income), trends in seed, feed and wastages ratios based on earlier studies, probable impact on the state income accounting, need for the present study and objectives of the study are presented. Chapter-II provides the description of the survey which contains the sampling design, profile of the state and selected districts, cropping pattern of the state, districts and selected villages and methods of data collection. In Chapter-III, methodology of the study is discussed. Chapter-IV deals with the utilization of grain for seed, feed and wastages. The chapter begins with the discussion of agro-economic characteristics of the study area and then in course of discussion, it describes process of utilization, methods and assumptions and finally presents farm size-wise as well as crop-wise estimates for seed, feed and wastages ratios of selected foodgrains crops. Besides, this chapter analyzes the results of functional analysis used to assess the factors that influenced the post-harvest losses of selected foodgrains. Finally, Chapter-V recapitulates overall findings of the study and provides the broad policy conclusions emerging from the study.

Chapter-IV

Results & Discussion

In this chapter, attempt has been made to provide the estimates of seed, feed and wastage ratios with net availability of selected foodgrain crops for human consumption on the basis of data collected through field survey canvassing well-structured schedules from two selected districts viz. Midnapore (East) and Murshidabad representative of selected cereal and pulse crops respectively. Before we go through the estimates of seed, feed and wastage ratios, information with regard to certain agro-economic characteristics of the study area has been provided. This includes distribution of farmers across size classes of land holdings, average size of operational holding, leased-in area as proportion to total operated area, leased-out area as proportion to total operated area, net cropped area and gross cropped area.

4.1 : Agro-Economic Characteristics of the Study Area

This section displays the agro-economic characteristics of the study area with regard to the distribution of number of farmers growing the selected crops, and their average size of operational holdings, proportion of leased-in and leased-out land, average size of net and gross cropped area. It is evident that, in the rice growing area [Midnapore (East)], the total number of farmers growing selected cereal (rice) crop in the sample villages was estimated to be 2689 (Table-4.1.1) of which marginal farmers are 1828 (67.98 per cent), small farmers are 538 (20.01 per cent) and medium farmers are 323 (12.01 per cent). The average size of operational holdings was 0.47 hectare for marginal, 1.54 hectares for small and 2.42 hectares for medium. Overall leased-in land accounted for 3.45 per cent of total operated land and it was higher for small (7.79 per cent) followed by marginal (4.26 per cent). Leased-out land was estimated at 5.52 per cent and was higher for medium farms (4.55 per cent). Thus the extent of tenancy as measured by the proportion of area leased out in Medinapore (East) is observed to be as low as 5.52 per cent. The overall per household average net-cropped area and gross cropped area stood at 1.48 hectares and 1.84 hectares respectively.

The distribution of number of farmers and other attributes in the study area selected for pulse crop i.e. Murshidabad are presented in Table-4.1.2. In the selected villages of Murshidabad district, there are 2699 (Table-4.1.2) pulse growing farmers and of them there are 1714 (63.51 per cent) marginal farmers, 607 (22.49 per cent) small farmers and 378 (14.00 per cent) medium farmers. In the selected villages of the district, the average size of holdings was 0.58 hectare for marginal, 1.52 hectares for

small and 2.58 hectares for medium farmers. The extent of leased-in land is estimated to be 2.61 per cent of total operated land and it was highest for marginal (5.17 per cent) followed by small (4.61 per cent) and medium (0.39 per cent). The proportion of overall leased-out land accounted for 5.52 per cent whereas it was 3.49 per cent for medium and 3.29 per cent for small farmers. The overall per household average net and gross cropped area were estimated at 1.52 hectares and 2.07 hectares respectively with relatively higher figures of 2.50 hectares and 3.56 hectares respectively for medium farmers.

Table – 4.1.1
Size-class wise Distribution of Farmers and Average size of holding for rice growing farmers in Midnapore (East) district

Size of land holdings	No. of rice growers	Average size of operational holding (ha)	Average leased in area (as % of total operated area)	Average leased out area (as % of total operated area)	Net croppe area (Average) per H. (ha.)	Gross cropped area (Average) per H. (ha.)	Sample farmers selected (Nos.)	Average size holding selected samp farmers (ha.)
Marginal	1828	0.47	0.02 (4.26)	-	0.45	0.67	100	0.44
Small	538	1.54	0.12 (7.79)	0.03 (1.95)	1.45	1.80	100	1.50
Medium	323	2.42	-	0.11 (4.55)	2.53	3.04	100	2.47
All	2689	1.45	0.05 (3.45)	0.08 (5.52)	1.48	1.84	300	1.47

Note: Figures in brackets indicate percentages.

Table – 4.1.2
Size-class wise Distribution of Farmers and Average size of holding for pulse growing farmers in Murshidabad district

Size of land holdings	No. of pulse growers	Average size of operational holding (ha)	Average leased in area (as % of total operated area)	Average leased out area (as % of total operated area)	Net cropped area (Average) per H.H (ha.)	Gross cropped area (Average) per H.H (ha.)	Sample farmers selected (Nos.)	Average size holding selected samp farmers (ha.)
Marginal	1714	0.58	0.03 (5.17)	-	0.55	0.65	100	0.57
Small	607	1.52	0.07 (4.61)	0.05 (3.29)	1.50	1.97	100	1.49
Medium	378	2.58	0.01 (0.39)	0.09 (3.49)	2.50	3.56	100	2.57
All	2699	1.53	0.04 (2.61)	0.06 (3.92)	1.52	2.07	300	1.54

Note: Figures in brackets indicate percentages.

4.2 : Agricultural Land Status of Sample Farmers

This section presents agricultural land status of sample farmers observed in the study areas selected for cereal and pulse crops. Out of 2689 cereal (rice) growing farmers in Midnapore (East) district, a total of 300 farmers i.e. 11.16 per cent forms the sample whereas in the pulse growing district viz. Murshidabad, among the total pulse growing farmers of 2699, the sample size of 300 farmers constitute 11.12 per cent. Average size of holding for the sample farmers works out at 1.47 hectares for the rice-growing district and 1.54 hectares for the pulse-growing district.

For the sample farmers in the selected villages of Midnapore (East) district, out of the total agricultural land of 400.95 hectares (Table-4.2.1), 301.88 hectares or 75.29 per cent of the area are under irrigated condition and the rest 99.07 hectares (24.71 per cent) are under un-irrigated condition. The proportion of irrigated land is higher among marginal farms (82.95 per cent) followed by small farms (77.65 per cent) and medium farms (72.51 per cent). In the pulse growing study area viz. Murshidabad district, pulse crops are raised under rainfed condition where total agricultural land of 122.69 hectares are found to be entirely un-irrigated (Table-4.2.2).

Table – 4.2.1
Size class-wise distribution of Agricultural Land for Sample Farmers in Midnapore (East) district (Rice)

Size of Holding	Area (Hectare)		
	Irrigated	Un-Irrigated	Total
Marginal	33.80 (82.95)	6.95 (17.05)	40.75 (100.00)
Small	104.24 (77.65)	30.01 (22.35)	134.25 (100.00)
Medium	163.84 (72.51)	62.11 (27.49)	225.95 (100.00)
All	301.88 (75.29)	99.07 (24.71)	400.95 (100.00)

Note: Figures in brackets indicate percentages.

Table – 4.2.2

Size class-wise distribution of Agricultural Land for Sample Farmers in Murshidabad district (Lentil)

Size of Holding	Area (Hectare)		
	Irrigated	Un-Irrigated	Total
Marginal	0.00	8.30 (100.00)	8.30
Small	0.00	36.34 (100.00)	36.34
Medium	0.00	78.05 (100.00)	78.05

All	0.00	122.69 (100.00)	122.69

Note: Figures in brackets indicate percentages.

4.3: Cropping Pattern of Sample Farmers

In this section, cropping pattern of the sample cultivators in the study area selected for cereal and pulse crops is studied. Needless to say, farming technology needs to be so advanced that it is possible to increase crop yields even under rainfed conditions. The cropping pattern depends primarily on soils and climatic factors particularly rainfall. Besides, there are a host of factors including technological, institutional and infra-structural which affect the crop preferences of the cultivators. However, not only in rainfed farming but even under irrigated conditions, we are to formulate plans for the most economic and efficient use of water to derive maximum possible benefit in the form of increasing agricultural production from the available arable land. This necessitates a close study of the existing cropping pattern in the selected regions.

Table – 4.3.1

Cropping pattern of the sample farmers of Midnapore (East) district

Size of Holding	Area share and the crop (proportion to GCA) per cent							GCA
Crops →	Winter Rice	Autum Rice	Summer Rice	Wheat	Must.	Potato	Lentil	
Marginal	40.70 (60.73)	- -	23.12 (34.50)	0.50 (0.75)	1.03 (1.54)	1.56 (2.33)	0.11 (0.16)	67.02
Small	121.59 (65.50)	6.28 (3.38)	41.80 (22.52)	4.07 (2.19)	4.87 (2.62)	6.66 (3.59)	0.42 (0.23)	185.63
Medium	204.00 (68.77)	12.10 (4.08)	51.97 (17.52)	7.26 (2.45)	9.02 (3.04)	11.82 (3.98)	0.49 (0.17)	296.66
All	366.28 (66.68)	18.38 (3.35)	116.89 (21.27)	11.83 (2.15)	14.92 (2.72)	20.05 (3.65)	1.02 (0.19)	549.32

Note: Figures in brackets indicate percentages.

The cropping pattern of the sample farmers in the study area selected for the cereal crop Midnapore (East) is presented in table 4.3.1. Notably, the district of Midnapore (East) has been selected for cereal crop (rice). From the above table it is observable that rice is the dominant crop in Midnapore (East) district covering 91.30 per cent (both kharif and rabi/summer seasons combined) of the gross cropped area followed by potato (3.65 per cent), mustard (2.72 per cent), wheat (2.15 per cent) and pulses (lentil) 0.19 per cent in order of importance. Across the landholding groups, area under rice ranged between 90.37 per cent for medium sized holdings and 95.23 per cent for marginal group of holdings. The area under

lentil is negligible occupying 0.19 per cent of the gross cropped area. Thus in the district, pulses are almost negligible.

Table – 4.3.2
Cropping pattern of the sample farmers of Murshidabad district

Size of Holding	Area share and the crop (proportion to GCA) per cent						GCA
Crops →	Winter Rice	Summer Rice	Wheat	Lentil	Gram	Jute	
Marginal	57.36 (85.19)	0.96 (1.43)	0.00	8.30 (12.33)	0.71 (1.05)	0.10 (0.05)	67.33
Small	148.67 (75.95)	8.07 (4.12)	0.66 (0.34)	36.34 (17.37)	0.66 (0.34)	1.31 (0.67)	195.74
Medium	256.92 (70.16)	25.64 (7.00)	1.60 (0.44)	78.05 (21.31)	0.80 (0.22)	3.20 (0.87)	366.22
All	462.95 (73.57)	34.67 (5.51)	2.26 (0.36)	122.69 (19.50)	2.17 (0.35)	4.52 (0.71)	629.29

Note: Figures in brackets indicate percentages.

Distribution of cropping pattern of sample farmers in the district selected for pulse crop is presented in Table-4.3.2. In the district, pulses are dominant after rice. The sample farm households in the district grow pulses in an area of 124.86 hectares which accounted for about 19.84 per cent in the total gross cropped area of the sample households and across the landholding groups it ranged between 13.38 per cent for marginal landholding group and 21.53 per cent for medium sized landholding group. Lentil is the major pulse crop and covered 19.50 per cent of the gross cropped area. Among pulses, gram is found to be another pulse crop in the district which occupy 0.35 per cent of the total gross cropped area of the sample farmers. During kharif, the sample farmers cultivated rice in an area of 73.57 per cent of the total cropped area. During rabi/summer, the sample cultivators grow rice with its share being 5.51 per cent in the total gross cropped area of sample cultivators. The other crops grown by the sample farmers are wheat and jute and covered 0.36 percent and 0.71 per cent of the total cropped area respectively.

4.4 : Production and Per Hectare Productivity of Crops of the Sample Farmers

This section presents the level of production of crops as well as per hectare gross value of output received by the sample farmers (Tables–4.4.1 & 4.4.2) in the study areas selected for the cereal and pulse crops. The estimates of production and productivity per hectare of the sample farmers in the area selected for cereal (rice) crop are shown in Table-4.4.1. Productivity of crops is one of the indicators of agriculture development and is largely influenced by the quantity of input use in the production process. In estimating productivity per hectare of crops, gross value of

production is calculated at farm harvest prices prevailing in the villages at the time of survey of the selected districts. In the sample farm households of Midnapore (East) district, total production was of the order of 8555.56 qtls. of winter (aman) rice, 439.09 qtls. of autum rice, 4017.76 qtls. of summer (boro) rice, 1625.62 qtls. of wheat, 1392.73 qtls. of mustard, 4714.55 qtls. of potato and 10.46 qtls. of lentil (Table–4.4.1). Gross value of production for all the farms together was thus estimated to be Rs.1,16,09,157.14 of which Rs.11,82,732.44 was for marginal farms, Rs.39,44,755.97 for small farms and Rs.64,81,668.73 for medium farms. Per hectare gross value of output i.e. per hectare productivity worked out to Rs.21,133.69 and across the landholding groups it ranged between Rs.17,647.46 among marginal land holders and Rs.21,848.81 among medium sized land holders.

Table – 4.4.1

Productivity per hectare of all crops for sample farmers of Midnapore (East) district

Size of Holding	Crop-wise production (Qtls.)							Total gross value of production at farm harvest price	Productivity per hectare of all crops Rs./Ha.
Crops →	Winter Rice	Autum Rice	Summer Rice	Wheat	Must.	Potato	Lentil		
Marginal	930.99	-	822.72	67.46	96.77	381.78	1.12	1182732.44	17647.46
Small	2882.17	150.83	143.98	568.22	458.08	1581.14	4.30	3944755.97	21250.64
Medium	4742.40	288.25	1764.07	989.93	837.88	2751.64	5.03	6481668.73	21848.81
All	8555.56	439.09	4017.76	1625.62	1392.73	4714.55	10.46	11609157.14	21133.69

Note: 1. Gross value of production of the crops is estimated at Farm Harvest Prices prevailing in the village at the time of survey.

2. Production figures are in terms of paddy.

The levels of production in physical units across crops and the estimates of per hectare gross value of output i.e. per hectare productivity of the sample farmers for the study area selected for pulse (lentil) crop is presented in Table-4.4.2. Total production in the sample farms of Murshidabad district represented for pulse crop was of the order of 10142.01 qtls of winter (aman) rice, 1028.66 qtls of summer (boro) rice, 300.52 qtls of wheat, 34.08 qtls of gram, 749.08 qtls of Jute and 122.69 qtls of Lentil (Table – 4.4.2). Gross value of production for all the sample farmers together was Rs. 6608289.13 and across the land holding groups, it was Rs. 751432.03 for marginal farms, Rs. 2645280.04 for small farms and Rs. 5211577.07 for medium farms. The gross value of output per hectare stood at Rs. 13679.37 which varied between Rs. 11160.43 for marginal landholding groups of farmers and Rs.14230.73 among medium sized land holders.

Table – 4.4.2

Productivity per hectare of all crops for sample farmers of Murshidabad district

Size of Holding	Crop-wise production (Qtls.)							Total gross value of production at farm harvest price	Productivity per hectare of all crops Rs./Ha.
Crops →	Winter Rice	Autum Rice	Summer Rice	Wheat	Gram	Jute	Lentil		
Marginal	1222.01	-	30.71	0.00	11.25	-	8.30	751432.03	11160.43
Small	3312.23	-	242.44	86.86	10.30	218.92	36.34	2645280.04	13514.25
Medium	5607.77	-	755.51	213.67	12.53	530.17	78.05	5211577.07	14230.73

All	10142.01	-	1028.66	300.52	34.08	749.08	122.69	6608289.13	13679.37

Note: 1. Gross value of production of the crops is estimated at Farm Harvest Prices prevailing in the village at the time of survey.

2. Production figures are in terms of paddy.

A comparison of the two districts selected for the study reveals that value productivity per hectare in Midnapore (East) district is considerably higher when compared to Murshidabad district. The reason for the differences however is that sample households of Midnapore (East) district raised high value crops like summer (boro) rice, wheat, mustard and potato which are more remunerative as compared to pulses grown by the sample farmers of Murshidabad district.

4.5 : Utilization of Grain for Seed

4.5.1: Process of Utilization

Seed is the key input for agricultural production. With the advent of green revolution farmers have realized the benefit of HYV seeds and in most cases, HYV seeds replaced traditional variety of seed. For cereal crops like rice and wheat, the replacement is prominently featured.

For cereal crop (rice) the principal source of seed is farmers themselves where seeds are retained from the previous year's produce for meeting the seed requirement of the farmers. As quality seed is crucial for realizing yield potentials of crops and for reaping better harvest, it is necessary that old seed have to be replaced with fresh seed at regular intervals. In the study area of Midnapore (East) district however it is found that majority of farmers used previous year's own seed in case of rice.

In using rice grain for seed, use of traditional method is found to be prevalent. Seeds are retained from the produce obtained from better quality of land where the quality of the harvested produce is comparatively good. The best grown crop among the produces of different plots of land is selected first and before retaining products for seed purpose, produces are cleaned and after that it is stored in gunny bags or granaries. Usually, seeds are retained more than the required quantity to be used in farmer's plots. This is because of avoiding the risk of poor germination or no germination in the event of erratic rainfall or no rainfall. While using seeds for crop production purpose, seeds are further cleaned and then farmers sow the seeds through the broadcasting method in the well-prepared farmer's crop field. This method of utilization of rice grain for seed is followed for transplanted rice in sowing seeds during dry season on dry land. For the wet season, however the cleaning process of seeds is different in that seeds are put in plain water and only sunken seeds are used and the floating ones are rejected. The sunk seeds selected are soaked for two days before sowing and after little germination, seeds are sown in nursery beds. However

the practice of seed treatment among the farmers is negligible. In order to get strong and healthy seedlings, the seedbed is well prepared.

Pulse grains (lentil) in the selected district Murshidabad are raised in rabi season mostly under rainfed conditions depending on the retained soil moisture and fertility in the fields. For pulse crop dry seeds are sown in the crop field after the land is vacated by the previous rice crop or any other crop and is prepared well through ploughing and harrowing. Many of the farmers replace seed in growing the crop. Usually they purchase seeds from the progressive fellow farmers and from the traders in the market. Those who are keeping seed from the previous harvest are following the traditional method of utilization of grain for seed inclusive of the activities such as cleaning and drying in the sunshine and then carefully keeping them in bags making free from the attack of pest and diseases to the crop.

4.5.2 : Methods and Assumptions

In the earlier paragraph it is mentioned that the traditional method of grain utilization for seed is mostly used by the sample farmers. In the traditional method, the usual assumption has been to use healthy seeds for proper germination and to obtain required seedlings for crop production. This assumption bears significance particularly for the broadcasting method followed for transplanted paddy in sowing seeds during the dry season on dry land where the risk of poor germination or no germination in the event of erratic rainfall or no rainfall is comparatively more as compared to wet season. Farmers generally use higher seed rate than the recommended rate considering the germination percentage having in the seed variety retained from the previous farm produce.

In case of pulse crop, many of the sample farmers in the selected district purchase seed from outsiders. Farmers those who have retained seed have adopted careful procedure for maintaining seed quality and to reduce the pest attack. Here again common assumption has been to use healthy seed so as to ensure proper germination and to reap better harvest.

4.5.3: Crop-wise Estimates 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. In this section, 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, which are presented in tables 4.5.3.1 and 4.5.3.2.

From the above mentioned tables it can be seen that rice growing sample farmers were keeping 4.82 per cent of production in Midnapore (East) district and 4.06 per cent in Murshidabad district. 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.

For carrying out the current year's production, the seed kept from the previous year's production were used which 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.

4.5.4: Farm Size-wise Estimates for Seed

The farm size-wise seed requirements of the sample farmers for the selected crops are documented in the same tables 4.5.3.1 and 4.5.3.2. Across the landholding groups, the percentages of production retained as seed increased consistently with the increase in farm size for the selected cereal (rice) crop in Midnapore (East) district. The proportions of seed kept for different farm sizes were 3.91 per cent for marginal farmers, 4.32 per cent for small farmers and 5.37 per cent for larger ones (Medium farmers). In case of pulse crop, the proportion of seed kept varied inversely with the increase in the size of farm in the district. In Midnapore (East), the proportion of pulse grain (lentil) kept as seed found to be 6.70 per cent for marginal farmers, 3.94 per cent for small farmers and 3.48 per cent for medium farmers, against an average of 4.01 per cent for all sample farmers together. However, the percentage quantity of the selected cereal and pulse grains kept for seed in Murshidabad district did not vary much across the size of holdings.

In respect of the percentage of total quantity of selected grains used for the seed to its total production, variation is not visible across the farm-size of holdings in both the selected districts. In Midnapore (East), the percentage quantity of selected cereal crop (rice) used for seed stood at 3.19 per cent for all the sample farmers with negligible variation across the size classes of landholdings, ranging from 3.16 per cent for medium farmers to 3.25 per cent for small farmers. The corresponding percentages of selected lentil grain ranged from 2.62 per cent for marginal farmers to 2.63 per cent for medium farmers. In Murshidabad district, the percentage quantity of selected cereal crop (rice) used for seed found to have varied from 3.41 per cent for medium farmers to 3.94 per cent for marginal farmers. For the selected pulse grain (lentil), the proportions ranged from 2.52 to 2.62 per cent across the farm-size holdings.

Table-4.5.3.1

Seed requirement for Cereal(Rice) of Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Area (ha.)	Production (kg.)	Quantity of seed (kg.)		Percentage qty. of seed with production	
					Used	Kept	Used	Kept
Midnapore (East)	Rice (crop-1)	Marginal	68.82	175370.86	5587.80	6861.11	3.19	3.91
		Small	169.67	446397.84	14492.58	19286.91	3.25	4.32
		Medium	268.07	679972.01	21483.89	36548.95	3.16	5.37
		All	501.55	1301240.71	41564.27	62696.97	3.19	4.82
Murshidabad	Rice (crop-1)	Marginal	58.32	125272.66	4934.51	5642.07	3.94	4.50
		Small	156.74	355466.66	12590.31	14213.67	3.54	4.00
		Medium	282.56	636327.45	21725.63	25453.10	3.41	4.00
		All	497.62	1117066.76	39250.46	45313.83	3.51	4.06

Table-4.5.3.2

Seed requirement for Pulse(Lentil) of Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Area (ha.)	Production (kg.)	Quantity of seed (kg.)		Percentage qty. of seed with production	
					Used	Kept	Used	Kept
Midnapore (East)	Lentil (crop-2)	Marginal	0.11	112.00	2.93	7.50	2.62	6.70
		Small	0.42	430.86	11.34	17.00	2.63	3.94
		Medium	0.49	503.03	13.25	17.50	2.63	3.48
		All	1.02	1045.89	27.52	42.00	2.63	4.01
Murshidabad	Lentil (crop-2)	Marginal	8.30	8905.40	224.10	261.70	2.52	2.94
		Small	36.34	36653.55	1009.68	1096.60	2.75	2.99
		Medium	78.05	80935.45	2124.25	2384.50	2.62	2.95
		All	122.69	126494.40	3358.04	3742.80	2.65	2.96

4.6 : Utilization of Grain for Feed

Livestock and poultry occupy a pivotal position in the rural life. Within livestock, the contribution of the cattle and buffalo to the rural economy is indeed vast. They are the main sources of drought power in agricultural operations and rural transportation. Livestock and poultry provide essential foods of animal origin like milk, meat and egg. Huge quantities of animal by-products such as hides bones etc and valuable organic manure are also provided by these animals. The bullocks and buffaloes continue to be the mainstay of agricultural operations particularly for the small and marginal farmers. Despite the impact of modernization, a large proportion of motive power for rural transportation is bullock–based. Livestock and poultry rearing offers very significant employment and income opportunities particularly to small and marginal farmers and agricultural labourers. As revealed from livestock census data, there has been a progressive increase in the livestock population. This increasing trend in livestock population may be attributed to increased agricultural requirements, demand for milk and milk products and other economic reasons. However, progressive increase in livestock population has not been matched by the corresponding increase in the feeds and fodder availability. There is thus a generally held belief that deterioration in the quality of livestock in general and of cattle in particular is the result of the presence of large number of animals compared to the available resources of feeds and fodder.

In the selected districts, the demand for fodder is met by different sources such as open grazing land ,fallow land, crop residue, paddy straw, concentrates, vegetable wastes, roughages etc. Hardly, fodder crops are raised in farmers' field to feed animals. Besides, owing to seasonal rainfall, availability of green grasses is restricted to only 3-4 months in a year. Moreover, due to increase in the density of population, the availability of green grasses is declining with the sharp decline in area under fallow land. Thus for a major part of the year, animals particularly cattle and buffaloes are fed coarse fodder mainly paddy straw supplemented with small quantity of concentrates. In case of poultry, feed consists of husk, broken rice, grains etc.

4.6.1 : Process of Utilization

Farmers in the selected districts use by products of the crop like paddy straw, rice bran, bran from pulses as feed for livestock. Besides farmers use chaff cutted green grass. Generally farmers, use by products of the paddy crop viz. straw mixed with concentrates and rice bran (bhusi) as the main items for animal feed. Sometimes feed is prepared by mixing green grasses or green fodder with paddy straw. Some sample farmers in the selected districts were reported to be using green fodder as feed

fed to bullocks and buffaloes keeping in view that it will provide balanced diet for bullocks/buffaloes and create extra energy for them. Feed is also prepared by boiling rice with wasted vegetables which is normally fed to milch animals. Milch animals alongwith youngstock are kept loose for open ground 4 to 5 hrs. a day and for the other part of the day they are stall fed.

4.6.2 : Methods and Assumptions

In the earlier sections, the items used to feed livestock and poultry is discussed. In this section methods and assumptions held during the utilization of grains to feed livestock and poultry is discussed. In feeding livestock, farmers attach relatively more weight to working bullocks/buffaloes and milch cattle. While the usual assumption of feeding animals is to maintain their good health to achieve higher productivity and net returns, providing extra feed to bullocks or buffaloes is to maintain the required draught power used for land preparation, transportation and other works related to crop cultivation. Milch animals are provided extra diet along with concentrates for fetching higher productivity and returns from milk production. In course of field investigation, it was assumed that the sampled farmers have complete knowledge of the grains and quantity of the items used to feed livestock and poultry, in order to maintain their health and nutrition.

4.6.3: Crop-wise Estimates of Grain for Feed

This section presents crop-wise estimates of the quantity of selected cereal and pulse crops used for feeding livestock and poultry birds. Livestock comprised of cows, bullocks, buffalos and calves. Other components of livestock viz goats, sheep etc. are not fed grains by the sample farmers in the selected districts. Data relating to annual consumption of selected cereal crop (rice) as feed by livestock is provided in table-4.6.3.1. From the table it is observed that no buffalo was fed the selected cereal grain in Midnapore (East) district selected to represent the cereal crop. In Midnapore (East) 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. It is seen that 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. The percentage quantity of rice grain fed to the livestock taken with respect to total rice production of the sample farmers constituted 0.74 per cent for cows, 1.13 percent for bullocks and 0.08 percent for calves.

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 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 (table–4.6.3.2). The sample farmers of Midnapore (East) were not found to be feeding pulse (lentil) grain to their live stock. But in the district of Murshidabad represented for pulse (lentil) crop, the sample farmers were found to be feeding pulse grain which was annually about 11.95 kg of pulse (lentil) 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. Sample farmers in Murshidabad district have fed higher percentage quantity of the selected pulse grain to their bullocks (1.36 percent of total production).

The annual quantity of selected cereal grain given as feed to poultry birds is produced in table – 4.6.3.3. The table shows significant variation in the quantity of cereals (rice) consumed by poultry birds 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. The sample farmers of Murshidabad district had less number of poultry birds than that of Midnapore (East). In Midnapore (East) district, the sample farmers have 702 birds comprising 285 hens and 417 duck and they consume 2564.96 kg of cereal (rice) feed per year whereas in Murshidabad district the sample farmers have 432 poultry birds of which 186 hens and 246 duck and they were fed about 913.43 kg of the rice grain per year. 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

Table – 4.6.3.1

Cereal (Rice) consumed as feed by live-stock in Midnapore (East) and Murshidabad districts

(Consumption per annum)

Sl. No.	Districts	Crop	Name of Animal	In Milk		Dry		Total Consumption (kg)	Consumption of crop/ animal (kg)	Proportion of consumption to total production (%)
				No.	Qty. (kg)	No.	Qty. (kg)			
1.	Midnapore (East)	Rice (Crop – I)	Cow	40	3706.86 (92.67)	80	5971.62 (74.65)	9678.48	80.65	0.74
2.			Buffaloes	-	-	-	-	-	-	-
3.			Bullock	-	-	182	-	14671.61	80.61	1.13
4.			Calves	-	-	27	-	1088.67	40.32	0.08
5.			Others	-	-	-	-	-	-	-
1.	Murshidabad	Rice (Crop – I)	Cow	31	1113.50 (35.92)	62	1595.74 (25.74)	2709.24	29.13	0.24
2.			He Buffaloes	-	-	30	-	1267.09	42.24	0.11
3.			Bullock	-	-	117	-	3932.98	33.62	0.35
4.			Calves	-	-	18	-	426.81	23.71	0.04
5.			Others	-	-	-	-	-	-	-

Note : Figures in brackets indicate per cow feed fed by the sample farmers.

Table – 4.6.3.2

Pulse (Lentil) consumed as feed by live-stock in Midnapore (East) and Murshidabad districts

(Consumption per annum)

Sl. No.	Districts	Crop	Name of Animal	In Milk		Dry		Total Consumption (kg)	Consumption of crop/ animal (kg)	Proportion of consumption to total production (%)
				No.	Qty. (kg)	No.	Qty. (kg)			
1.	Midnapore (East)	Lentil (Crop – 2)	Cow	40	-	80	-	-	-	-
2.			Buffaloes	-	-	-	-	-	-	-
3.			Bullock	-	-	182	-	-	-	-
4.			Calves	-	-	27	-	-	-	-
5.			Others	-	-	-	-	-	-	-
1.	Murshidabad	Lentil (Crop –2)	Cow	31	484.35 (15.62)	62	626.54 (10.11)	1110.89	11.95	0.88
2.			He Buffaloes	-	-	30	-	576.02	19.20	0.46
3.			Bullock	-	-	117	-	1721.26	14.71	1.36
4.			Calves	-	-	18	-	169.59	9.42	0.13
5.			Others	-	-	-	-	-	-	-

Note : Figures in brackets indicate per cow feed fed by the sample farmers.

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 is documented in table – 4.6.3.4. It is clearly observed 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 significant quantity of pulse grain to the poultry birds. The sample farmers selected for pulse (lentil) fed about 856.81 kg of selected pulse grain to 432 poultry birds and thus 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.

Table – 4.6.3.3

Consumption of Cereal (Rice) as feed by poultry in Midnapore (East) and Murshidabad districts

(Consumption per annum)

Sl. No.	District	Crop	Number of birds	Total Consumption of crop (kg.)	Consumption of per bird (kg)	Proportion of consumption to total production
1.	Midnapore (East)	Rice (Crop – I)	Hen - 285	979.82	3.44	0.08
2.			Duck - 417	1585.14	3.80	0.12
1.	Murshidabad	Rice (Crop – I)	Hen – 186	322.44	1.73	0.03
2.			Duck - 246	590.99	2.40	0.05

Table – 4.6.3.4

Consumption of Pulse (Lentil) as feed by poultry in Midnapore (East) and Murshidabad districts

(Consumption per annum)

Sl. No.	District	Crop	Number of birds	Total Consumption of crop (kg.)	Consumption of per bird (kg)	Proportion of consumption to total production
1.	Midnapore (East)	Lentil (Crop – 2)	Hen - 285	-	-	-
2.			Duck - 417	-	-	-
1.	Murshidabad	Lentil (Crop – 2)	Hen – 186	287.63	1.55	0.23
2.			Duck - 246	569.18	2.31	0.45

The quantity of selected pulse (lentil) grain fed to poultry birds taken with respect to the total production of the sample farmers formed 0.23 percent for hens and 0.45 percent of duck in Murshidabad district. In contrast, none of the birds were fed pulse grain in Midnapore (East) and hence the total quantity of consumption of the selected pulse grain in the district were found to be nil. Moreover, in the district where pulse grain 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.

4.6.4 : Farm Size-wise Estimates of Grain for Feed

We find no variation across the farm size of holdings in the percentage quantity of selected cereal and plus grain fed to animals and so farm size-wise estimates of the utilization of grain for feed fed to animals are not provided.

4.7 : Value of Crop Output of Selected Cereal and Pulse Crops

Value of crop output and productivity per hectare of the selected cereal crop (rice) and the selected pulse crop (lentil) are presented in table – 4.7.1 & 4.7.2 in Midnapore (East) and Murshidabad respectively. In Midnapore (East) district, the value of crop output from rice and lentil was Rs. 817574.51 in marginal farms, Rs. 2083828.60 in small farms, Rs. 3168976.65 in medium sized farms and for the farms of all sizes, it was Rs. 6070379.76. The per hectare value of total agricultural produce of the selected crops for the sample farms in Midanapore (East) was Rs. 12078.68 and across the farms size of holdings, it was Rs. 11860.94 for marginal farms, Rs. 12251.33 for small farms and Rs. 11799.88 for medium farms.

In Murshidabad district, total value of crop output from rice and lentil was of the order of Rs. 733660.21 in marginal farms, Rs. 2313237.30 in small farms and Rs. 4424412.08 in medium sized farms and thus for all the farms together it was Rs. 7471309.59. The per hectare value of total agricultural produce consisting of rice and lentil was Rs. 12044.48 and across the land holding groups, it ranged between Rs. 11012.61 among small land holding groups and Rs. 12269.24 among medium sized land holding groups.

The productivity of selected cereal crop (rice) was found to be higher in Midnapore (East) when compared to Murshidabad district. The value of average productivity of rice per hectare in Midnapore (East) was Rs. 12064.14 as compared to that of Rs. 10311.41 in Murshidabad district. In contrast, productivity per hectare of selected pulse crop (lentil) is lesser in Murshidabad district when compared to the same in Midnapore (East) district. The relatively low productivity in Murshidabad district is attributable to the cultivation of the selected pulse crop in a larger area

covering marginal and sub-marginal lands depending on retained soil moisture and fertilizer as against greater concentration of inputs in smaller area in Midnapore districts.

Table – 4.7.1
Value of crop output of selected crops (Rice + Lentil) in Midnapore (East) district

(Value in Rs. 0.00)

Size of holding	Value of crop output		Total gross value of crop output (Rice + Lentil)	Value of output per ha of selected crops		
	Rice (Crop – I)	Lentil (Crop – 2)		Rice (Crop – I)	Lentil (Crop - 2)	Both
Marginal	815474.51	2100.00	817574.51	11844.38	19090.91	11860.94
Small	2075749.97	8078.63	2083828.60	12234.04	19234.83	12251.33
Medium	3159544.84	9431.81	3168976.65	11786.27	19248.59	11799.88
All	6050769.32	19610.44	6070379.76	12064.14	19225.92	12078.68

Note: Gross value of production of the crops is estimated at farm harvest prices prevailing in the village at the time of survey. In case of rice, production is in terms of paddy and thus in estimating value of production, price of paddy is used.

Table – 4.7.2
Value of crop output of selected crops (Rice + Lentil) in Murshidabad district

(Value in Rs. 0.00)

Size of holding	Value of crop output		Total gross value of crop output (Rice + Lentil)	Value of output per ha of selected crops		
	Rice (Crop – I)	Lentil (Crop – 2)		Rice (Crop – I)	Lentil (Crop - 2)	Both
Marginal	568910.31	164749.90	733660.21	9754.98	19849.39	11012.61
Small	1635146.62	678090.68	2313237.30	10432.22	18659.62	11980.72
Medium	2927106.25	1497305.83	4424412.08	10359.24	19183.93	12269.24
All	5131163.19	2340146.40	7471309.59	10311.41	19073.65	12044.48

Note: Gross value of production of the crops is estimated at farm harvest prices prevailing in the village at the time of survey. In case of rice, production is in terms of paddy and thus in estimating value of production, price of paddy is used.

4.8 : Production and Disposal of the Selected Grains

In this section attempt has been made to highlight the proportion of production of the selected grains disposed across various types of disposal by the sample farmers. Usually farmers keep some portion of their produce as seed for the future use, for selling or exchanging seed, for home consumption, for animal feed, for meting expenses of kind wage payment to labourers and finally for marketing the surplus produces. Thus the estimates regarding disposal of selected grains includes the percentage quantity of selected grain kept as seed for the next year's production, exchange as seed, sold for seed, used for home consumption, payment to labour in the form of kind wage, quantity used for animal feed. Finally, we have worked out the quantity of marketed surplus of grains. The disposal of production of selected cereal and pulse crops are presented in tables – 4.8.1 and 4.8.2 respectively.

From table – 4.8.1 it is evident that the sample farmers of Midnapore (East) kept 4.82 percent of their total production as seed for next year production in case of selected cereal (rice) as against that of 4.06 percent in Murshidabad district. The percentage quantity of seed used obtained from the previous year's production is estimated at 3.19 percent in Midnapore (East) district and 3.51 percent in Murshidabad district.

The disposal pattern of selected cereal crop revealed that home consumption is the major component of disposal of the sample farmers. The sample farmers of Midnapore (East) district used 29.46 per cent of their production for home consumption as against the use of 27.25 per cent by the farmers in Murshidabad district. Interestingly, percentage quantity of selected cereal (rice) used for the kind wages to labour accounted for 5.92 per cent in Midnapore (East) followed by 5.21 per cent in Murshidabad district. The percentage quantity of selected cereal grain used for livestock and poultry feed was of the order of 1.95 per cent and 0.20 per cent respectively in Midanpore (East). The corresponding figures in Murshidabad district were found to be lower, which were estimated at 0.75 per cent and 0.08 per cent respectively. Out of the total production of rice, almost 50 per cent of the quantity was marketed by sample farmers of Midnapore (East) whereas the sample farmers of Murshidabad district marketed about 54.84 per cent of their total production.

Thus while looking at the pattern of disposal of selected cereal crop (rice), it was noticed that around 50 per cent the total selected cereal (rice) crop production was marketed by the sample farmers in the selected districts. The pattern of disposal of selected cereal did manifest that the quantity marketed by the sample farmers depended largely in the percentage quantity used for home consumption and payment made to labourers as kind wages.

In case of selected pulse crop (table – 4.8.2), the pattern of disposal clearly revealed that sample farmers of the selected districts used significant proportion of total production for home consumption. Out of total production of lentil, the sample farmers of Midnapore (East) district were found to have used 95.12 per cent for the home consumption whereas in Murshidabad district, the corresponding proportion worked out at 43.97 per cent. Thus in Murshidabad district, selected pulse (lentil) is grown commercially and largely for the market.

For the selected pulse (lentil), the next important component of disposal was the quantity kept as seed for further use by the sample farmers. The percentage quantity of selected pulse crop kept as seed for the future production was estimated to be 4.02 per cent for Midnapore (East) and 2.96 per cent for Murshidabad. The quantity of pulse grain was not at all used for kind wage payment to labourers in both

the selected districts. While in Murshidabad district, the quantity fed to livestock and poultry constituted 2.83 per cent and 0.68 per cent of total production respectively, the sample farmers in Midnapore (East) did not use the selected pulse crop as livestock and poultry feed. In case of selected pulse (lentil) crop, the percentage quantity marketed by the sample farmers showed quite significant variation across the selected districts. In Murshidabad district, the estimated percentage quantity of selected pulse crop (lentil) marketed was 44.26 per cent of total production while total production of selected pulse grain of sample farmers of Midnapore (East) left no surplus for sale in the market after meeting requirement for seed and home consumption and thus no marketed quantity of output is discernible in Midnapore (east) in case of selected pulse crop (lentil).

Overall, it was observed that the proportion of marketed quantity of selected pulse (lentil) is directly related to the volume of production. In the district of Murshidabad, selected for pulse (lentil) crop, the volume of marketed quantity was found to be higher where volume of production of the selected pulse grain was also higher. In the other district called Midnapore (East), the overall production of selected pulse grain was significantly low and the pulse crop was grown for meeting home consumption only leaving no surplus for the market.

4.9: Wastages in Foodgrains

4.9.1: Wastages at Different Production Stages

Efforts are being made to produce more foodgrains so as to meet growing demand for food matching with the growing population in the country. The problem is however not merely adopting scientific methods of production producing more food but to protect and preserve properly the harvest of the produce suffering from various kinds of losses at different stages. Foodgrains produced at the farm level undergo a series of operations such as harvesting, carrying, threshing, cleaning, transportation and storage before they become available for human consumption and there are losses in crop output at all these stages. Obviously, reduction in the losses of foodgrains in handlings has important implications on the availability of foodgrains for meeting the food requirements of ever-increasing population of the country. However, while concerted efforts are made to increase the yields of different crops through the use of high yielding variety of seeds and the package of inputs including chemical fertilizer, insecticides, controlled irrigation etc. not enough attention has been paid to reduce losses of foodgrains output at harvest and various post harvest stages.

Table-4.8.1

Production and Disposal for Cereal(Rice) of Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Total production (kg.)	Quantity (kg.) for								
				Previous year ‘s seed used	Kept for seed for next time	Exchange as seed	Sold for seed	Home consumption	Kind wage to labour	Used as animal feed	Used poultry feed	Market surplus
Midnapore (East)	Rice (crop-1)	Marginal	175370.86	5587.80 (3.19)	6861.11 (3.91)	365.00 (0.21)	0.00 (0.00)	85482.68 (48.74)	5155.68 (2.94)	1050.70 (0.06)	461.30 (0.26)	64799.52 (36.95)
		Small	446397.84	14492.58 (3.25)	19286.91 (4.32)	30.00 (0.01)	780.00 (0.17)	137428.90 (30.79)	25248.19 (5.66)	7160.39 (1.60)	920.97 (0.21)	224889.04 (50.38)
		Medium	679972.01	21483.89 (3.16)	36548.95 (5.38)	620.00 (0.09)	1625.00 (0.24)	160482.05 (23.62)	46643.19 (6.86)	17225.13 (2.54)	1182.69 (0.17)	365691.49 (53.82)
		All	1301240.71	41564.27 (3.19)	62696.97 (4.82)	915.00 (0.07)	2405.00 (0.18)	383393.64 (29.46)	77047.06 (5.92)	25436.22 (1.95)	2564.96 (0.20)	654880.05 (50.33)
Murshidabad	Rice (crop-1)	Marginal	125272.66	4934.51 (3.94)	5642.07 (4.50)	70.00 (0.06)	0.00 (0.00)	58530.70 (46.72)	3852.24 (3.08)	191.21 (0.15)	107.66 (0.09)	51123.65 (40.81)
		Small	355466.66	12590.31 (3.54)	14213.67 (4.00)	210.00 (0.06)	0.00 (0.00)	100501.30 (28.27)	18566.92 (5.22)	1926.57 (0.54)	325.07 (0.09)	194974.24 (54.85)
		Medium	636327.45	21725.63 (3.41)	25453.10 (4.00)	430.00 (0.07)	375.00 (0.06)	145359.29 (22.84)	35757.13 (5.62)	6218.33 (0.98)	480.70 (0.08)	366468.65 (57.59)
		All	1117066.76	39250.46 (3.51)	45313.83 (4.06)	710.00 (0.06)	375.00 (0.03)	304391.29 (27.25)	58176.29 (5.21)	8336.11 (0.75)	913.43 (0.08)	612566.53 (54.84)

Note: Figures in brackets are percentages of the total production.

Marketed surplus = Total Production – (Seed kept + Home consumption + Kind wage + Anml.&Pol. Feed + Harvst. Wstg + Thresh Wstg. + Straw Wstg. + Transp. Wstg.+ Storg. Wstg.)

Table-4.8.2

Production and Disposal for Pulse(Lentil) of Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Total production (kg.)	Quantity (kg.) for								
				Previous year's seed used	Kept for seed for next time	Exchange as seed	Sold for seed	Home consumption	Kind wage to labour	Used as animal feed	Used poultry feed	Market surplus
Midnapore (East)	Lentil (crop-2)	Marginal	112.00	2.93 (2.62)	7.50 (6.70)	0.00 (0.00)	0.00 (0.00)	95.50 (85.27)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
		Small	430.86	11.34 (2.63)	17.00 (3.95)	0.00 (0.00)	0.00 (0.00)	413.86 (96.05)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
		Medium	503.03	13.25 (2.63)	17.50 (3.48)	0.00 (0.00)	0.00 (0.00)	485.53 (96.52)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
		All	1045.89	27.52 (2.63)	42.00 (4.02)	0.00 (0.00)	0.00 (0.00)	994.89 (95.12)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Murshidabad	Lentil (crop-2)	Marginal	8905.40	224.10 (2.52)	261.70 (2.94)	9.95 (0.11)	6.50 (0.07)	7436.72 (83.51)	0.00 (0.00)	94.42 (1.06)	32.86 (0.37)	720.35 (8.09)
		Small	36653.55	1009.68 (2.75)	1096.60 (2.99)	16.00 (0.04)	403.00 (1.10)	19681.87 (53.70)	0.00 (0.00)	1426.36 (3.89)	286.28 (0.78)	12281.85 (33.51)
		Medium	80935.45	2124.25 (2.62)	2384.50 (2.95)	0.00 (0.00)	2002.00 (2.47)	28501.93 (35.22)	0.00 (0.00)	2056.96 (2.54)	537.67 (0.66)	42982.09 (53.11)
		All	126494.40	3358.04 (2.65)	3742.80 (2.96)	25.95 (0.02)	2411.50 (1.91)	55620.53 (43.97)	0.00 (0.00)	3577.75 (2.83)	856.81 (0.68)	55984.30 (44.26)

Note: Figures in brackets are percentages of the total production.

Marketed surplus = Total Production – (Seed kept + Home consumption + Kind wage + Anml.&Pol. Feed + Harvst. Wstg + Thresh Wstg. + Straw Wstg. + Transp. Wstg.+ Storg. Wstg.)

The quantum of losses may be due to various factors varying from commodity to commodity. Wastages in foodgrains can occur in the field, during threshing, at the stage of cleaning due to carelessness, during storage due to damage caused by insects and pests. It is therefore pertinent to know the volume of wastages at different stages of handling of crop output in making an estimate of how much of foodgrains are actually available for human consumption.

Various studies have estimated the magnitude of foodgrains losses at various post harvest stages. An estimate made by the Ministry of Food and Civil Supplies, Government of India puts the total post harvest losses at 10 per cent of the total production (Source : Basavaraja et.al, 2007). According to a World Bank Study (1999), post harvest losses of foodgrains in India are 7-10 per cent of the total production (Source : Basavaraja et.al, 2007). In a country like ours where 20 per cent of the people live below the poverty line, post harvest losses to the tune of 7-10 per cent is a substantial avoidable loss. Evolving correct policies for minimizing post harvest losses would crucially depend on reliable and objective estimates of such losses. It is thus necessary to have more studies across the states to arrive at an unbiased estimate of wastage ratios of foodgrains. The present study is an attempt to arrive such an estimate. The following paragraphs bring the results of the estimate of wastages of selected cereal and pulse crops occurred at harvest and various post harvest stages.

4.9.2 : Assumptions and Methods

The wastages of foodgrains occur at different stages of handling crop output. These stages ranged from the state of harvest to various operations at post harvest stages and the total wastages were estimated as a sum of losses at all the stages. For estimating the wastage ratios information was obtained from the sample farmers through survey method by canvassing the structured schedule. Data relating to wastages during harvest and different post harvest stages were collected for the selected cereal and pulse crop. Data relating to grains falling in the ground at the time of harvest (sickle), grains left in straw at the time of threshing, grains mixing with dust on the threshing floor, grains wasted in storage due to rats, insects, dampness etc and grains wasted in transportation were collected. Besides these, wastage during home consumption occurred at the time of cleanliness, cooking and eating and wastages during animal and poultry feeding were also collected. Above all, it was assumed that the respondents were knowledgeable and provided unbiased estimate of the desired information relating to the study.

4.9.3: Crop-wise Estimates of Wastages

Crop-wise and farm-size-wise estimates of wastages of the selected cereal (rice) crop are presented in table – 4.9.3.1. The percentage total wastages of selected cereal grain in Midnapore (East) was 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, out of total production of the selected cereal (rice) grain at 1117066.76 kg., total wastage was estimated at 92895.06 kg. and thus the percentage total wastages 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 are furnished in table – 4.9.3.2. The estimates revealed no significant variation in the percentage of total wastages 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 wastage quantity of selected pulse crop (lentil) was recorded at 53.10kg. out of total production of 1045.89kg. and thus 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).

4.9.4: Farm Size-wise Estimates of Wastages

The farm-size-wise estimates of the percentage wastage of selected cereal (rice) grain are shown in table – 4.9.3.1. For the sample farmers of Midnapore (East) district, the total percentage wastage at various production stages was found to be highest (8.19 per cent) in larger-sized (medium) farms followed by small (7.43 per cent) and marginal (6.71 per cent). In Murshidabad district, the total percentage of wastage across the landholding groups ranged between 4.74 per cent among marginal landholding groups and 9.51 per cent among medium sized landholding groups.

At further disaggregated level over the farm-size of holdings, the percentage wastage of selected cereal (rice) was highest in storage for all the size groups in Midnapore (East). For marginal farmers, the percentage wastage was highest during threshing and shattered while it was highest during harvesting in case of small and medium farmers. From table – 4.9.3.1 it is observable that the percentage quantity wastages and its variation across the farm size of holdings during transportation of selected cereal crop in Midnapore (East) were insignificant. The percentage of total wastage during home consumption varied from 0.03 percent for marginal farmers to 0.24 per cent for medium farmers in the district.

In Murshidabad district, the percentage wastage of selected cereal (rice) was highest in medium sized land holding farms (9.51 per cent) followed by small (7.45 per cent) and marginal (4.74 per cent). In all the size groups of holdings, the percentage wastages in storage were found to be highest followed by harvesting (table – 4.9.3.1). In the district, the variations in the percentage of wastages in straw across the farm-size of holdings were significant. It was highest in medium sized farms (1.48 per cent) followed by small (0.93 per cent) and marginal (0.47 per cent). Similar variations over the farm sizes in percentage of wastage during the transportation were located ranging from 0.65 per cent for marginal farms to 1.01 per cent for medium sized farms.

For the selected pulse (lentil) grain in Murshidabad district, (table – 4.9.3.2) wastage was highest in larger sized (medium) farms (5.98 per cent) followed by small (5.34 per cent) and marginal (4.37 per cent). Stage-wise, in all the size groups of holdings, the maximum wastage in the selected pulse crop was found during storage followed by threshing and shattered. Over the farm sizes, the percentage wastages of selected pulse grain during storage were found to be 3.66 per cent in small sized land holdings followed by 3.55 per cent in larger (medium) sized holdings and 3.50 per cent in marginal land holding groups. The percentage wastages of pulse crop (lentil) during harvesting, threshing and shattered, in straw, during home consumption and

left in animal feed were estimated at less than 1 per cent for all the farm size of holdings. Across the farm size of holdings, the proportions of wastages were found to have varied from 0.04 per cent to 0.69 per cent during harvesting, from 0.71 per cent to 0.86 per cent during threshing and shattered, from 0.05 per cent to 0.44 per cent in straw, from 0.06 per cent to 0.43 per cent during home consumption and from 0.01 per cent to 0.02 per cent as left in animal and poultry feed. In all size of holdings, wastage did not occur during transportation.

In Midnapore (East) district, the percentage wastage of selected pulse grain (table – 4.9.3.2) was found to be highest in larger (medium) sized farms (5.87 per cent) followed by small (4.75 per cent) and marginal (2.74 per cent). The percentage wastage of selected pulse grain were found to be highest in storage in all the farm sizes which is found to have increased with the increase in farm size. The estimates pertaining to wastages during storage stood at 1.98 per cent in marginal farms, 3.16 per cent in small farms and 3.84 per cent in medium sized farms. Wastages of the selected pulse grain did not occur during transportation and in animal and poultry feed across the farm size of holdings. The percentage of total wastages of selected pulse grain in Midnapore (East) district, were estimated at less than 1 per cent during harvesting, threshing and shattered, in straw, and during home consumption.

4.10: Estimates of Percentage of Seed, Feed and Wastage and Available Quantity of Selected Cereal and Pulse Crops for Human Consumption

This section presents 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.

The estimates of seed, feed and wastage ratios for the selected cereal grain (rice) are shown in table – 4.10.1. From the table it can be seen that the percentage of aggregate quantity of selected cereal (rice) grain used for seed, animal feed and wastages constituted 13.07 per cent of total production in Midnapore (East) and 12.66 per cent in Murshidabad district. Thus the aggregate quantity used for seed, animal feed and wastages varied marginally across the selected districts. At the disaggregated level across the uses, the percentage quantity of selected grain used as seed found to be more in Murshidabad district (3.51 per cent) as compared to that of Midnapore (East) (3.19 per cent). The proportion of selected cereal grain used for animal feed was observed to be significantly higher (2.15 per cent) in

Table-4.9.3.1

Wastage of Cereal(Rice) at different harvest and post harvest stages in Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Total production (kg.)	Wastage (kg.) at different stages							Total wastage
				Harvesting	Threshing & Shattered	Straw	Transportation	Storage	Home consumption	Left in animal / poultry feed	
Midnapore (East)	Rice (crop-1)	Marginal	175370.86	2006.52 (1.14)	4276.86 (2.44)	864.59 (0.49)	1368.33 (0.78)	3043.57 (1.74)	45.58 (0.03)	155.95 (0.09)	11761.34 (6.71)
		Small	446397.84	6914.03 (1.55)	3550.83 (0.80)	4678.49 (1.05)	3759.97 (0.84)	12560.11 (2.81)	655.12 (0.15)	1056.65 (0.24)	33175.20 (7.43)
		Medium	679972.01	11524.41 (1.70)	5429.73 (0.80)	7078.89 (1.04)	6212.49 (0.91)	21953.00 (3.23)	1626.97 (0.24)	1796.54 (0.26)	55622.03 (8.19)
		All	1301240.71	20444.95 (1.57)	13257.42 (1.02)	12621.97 (0.97)	11340.79 (0.87)	37556.68 (2.89)	2327.62 (0.18)	3009.15 (0.23)	100558.58 (7.73)
Murshidabad	Rice (crop-1)	Marginal	125272.66	1454.81 (1.16)	598.79 (0.48)	593.85 (0.47)	808.96 (0.65)	2368.72 (1.89)	50.70 (0.04)	58.51 (0.05)	5934.34 (4.74)
		Small	355466.66	5928.02 (1.67)	2119.06 (0.60)	3316.74 (0.93)	2936.69 (0.83)	10653.40 (3.00)	1153.46 (0.32)	368.96 (0.10)	26476.33 (7.45)
		Medium	636327.45	10482.60 (1.65)	5159.60 (0.81)	9410.94 (1.48)	6401.51 (1.01)	25135.60 (3.95)	2637.20 (0.41)	1256.88 (0.20)	60484.40 (9.51)
		All	1117066.76	17865.42 (1.60)	7877.46 (0.71)	13321.53 (1.19)	10147.15 (0.91)	38157.71 (3.42)	3841.43 (0.34)	1684.36 (0.15)	92895.06 (8.32)

Note: Figures in brackets indicate percentages of total production.

Table- 4.9.3.2

Wastage of Pulse(Lentil) at different harvest and post harvest stages in Midnapore(East) and Murshidabad districts

District	Crop	Size of holdings	Total production (kg.)	Wastage (kg.) at different stages							Total wastage
				Harvesting	Threshing & Shattered	Straw	Transportation	Storage	Home consumption	Left in animal / poultry feed	
Midnapore (East)	Lentil (crop-2)	Marginal	112.00	0.07 (0.06)	0.56 (0.50)	0.00 (0.00)	0.00 (0.00)	2.22 (1.98)	0.22 (0.20)	0.00 (0.00)	3.07 (2.74)
		Small	430.86	2.36 (0.55)	3.06 (0.71)	0.26 (0.06)	0.00 (0.00)	13.63 (3.16)	1.17 (0.27)	0.00 (0.00)	20.48 (4.75)
		Medium	503.03	3.56 (0.71)	3.97 (0.79)	1.17 (0.23)	0.00 (0.00)	19.34 (3.84)	1.51 (0.30)	0.00 (0.00)	29.55 (5.87)
		All	1045.89	5.99 (0.57)	7.59 (0.73)	1.43 (0.14)	0.00 (0.00)	35.19 (3.36)	2.90 (0.28)	0.00 (0.00)	53.10 (5.08)
Murshidabad	Lentil (crop-2)	Marginal	8905.40	3.66 (0.04)	62.85 (0.71)	4.41 (0.05)	0.00 (0.00)	311.71 (3.50)	5.56 (0.06)	0.87 (0.01)	389.06 (4.37)
		Small	36653.55	148.92 (0.41)	263.01 (0.72)	125.99 (0.34)	0.00 (0.00)	1342.66 (3.66)	71.11 (0.19)	5.97 (0.02)	1957.66 (5.34)
		Medium	80935.45	554.59 (0.69)	694.56 (0.86)	353.85 (0.44)	0.00 (0.00)	2869.31 (3.55)	351.19 (0.43)	13.31 (0.02)	4836.81 (5.98)
		All	126494.40	707.16 (0.56)	1020.41 (0.81)	484.24 (0.38)	0.00 (0.00)	4523.68 (3.58)	427.86 (0.34)	20.15 (0.02)	7183.50 (5.68)

Note: Figures in brackets indicate percentages of total production.

Midnapore (East) district as against that of 0.83 per cent in Murshidabad district. The percentage of total wastage of the selected grain was of the order of 7.73 per cent and 8.32 per cent in Midnapore (East) and Murshidabad respectively. Thus unlike the ratio of rice grain used for seed and animal feed, the percentage of wastage was observed to be quite high in both the selected districts.

At the aggregate level, the percentage quantity of selected cereal grain used for seed, animal feed and total wastage worked out at 13.07 per cent in Midnapore (East) as against the corresponding figure of 12.66 per cent in Murshidabad district. It is now easy to obtain the estimate of percentage quantity of selected cereal grain available for human consumption. From the table – 4.10.1, it can be seen that the percentage quantity of cereal (rice) grain available for human consumption was estimated at 86.93 per cent of total production in Midnapore (East) while the corresponding figure was 87.34 per cent in Murshidabad district.

The estimates of seed, feed and wastage ratios along with the percentage quantity of selected pulse (lentil) grain available for human consumption are furnished in table – 4.10.2. It is observed that the quantity of selected pulse grain used as seed, animal feed and total wastage accounted for 7.71 per cent in Midnapore (East) district and 11.84 per cent in Murshidabad district. The sample farmers of Midnapore (East) district were found to have used 2.63 per cent of the selected pulse (lentil) production as seed while the corresponding percentage appeared to be 2.65 per cent in Murshidabad district. The percentage quantity of

pulse grain used to feed animals/poultry were found to be significantly higher in Murshidabad district (3.51 per cent) while the percentage quantity of selected pulse grain used for animal feed was zero in Midnapore (East). The percentages of total wastages for selected pulse grain were estimated at 5.08 per cent in Midnapore (East) and 5.68 per cent in Murshidabad district. Thus, the percentage of aggregate quantity of the selected pulse grain available for human consumption was estimated at 92.29 per cent in Midanapore (East) while the same was worked out at 88.16 per cent in Murshidabad district.

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

The selected crop-wise estimates of seed, animal feed and wastage ratios along with the percentage quantity of selected cereal (rice) as well as pulse (lentil) grains available for human consumption are furnished in table – 4.11. Overall, at the aggregate level, the percentage quantity of selected cereal grain used as seed, animal feed and wastage was found to be 13.07 percent. At disaggregated level, the percentage quantity of selected cereal (rice) grain used as seed was estimated at

Table-4.10.1

Percentage of Seed, Feed and Wastage in production of Cereal (Rice) in Midnapore (East) and Murshidabad districts.

Sl. No.	District	Crop	Size of holding	Area (ha)	Production (kg)	Seed used		Seed kept		Used as feed		Wastage		Used as seed, feed and wastage (%)	Available quantity for human consumption (%)
						Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%		
1.	Midnapore (East)	Rice (Crop-1)	Marginal	68.82	175370.86	5587.80	3.18	6861.11	3.91	1512.00	0.86	11761.34	6.71	10.75	89.25
2.			Small	169.67	446397.84	14492.58	3.25	19286.91	4.32	8081.36	1.81	33175.20	7.43	12.49	87.51
3.			Medium	268.07	679972.01	21483.89	3.16	36548.95	5.37	18407.82	2.71	55622.03	8.18	14.05	85.95
4.			All	501.55	1301240.71	41564.27	3.19	62696.97	4.82	28001.18	2.15	100558.58	7.73	13.07	86.93
5.	Murshidabad	Rice (Crop-1)	Marginal	58.32	125272.66	4934.51	3.94	5642.07	4.50	298.87	0.24	5934.34	4.74	8.92	91.08
6.			Small	156.74	355466.66	12590.31	3.54	14218.67	4.00	2251.64	0.63	26476.33	7.45	11.62	88.38
7.			Medium	282.56	636327.45	21725.63	3.41	25453.10	4.00	6699.03	1.05	60484.40	9.50	13.96	86.04
8.			All	497.62	1117066.76	39250.46	3.51	45313.83	4.06	9249.54	0.83	92895.06	8.32	12.66	87.34

Table-4.10.2

Percentage of Seed, Feed and Wastage in production of Pulse (Lentil) in Midnapore (East) and Murshidabad districts.

Sl. No.	District	Crop	Size of holding	Area (ha)	Production (kg)	Seed used		Seed kept		Used as feed		Wastage		Used as seed, feed and wastage (%)	Available quantity for human consumption (%)
						Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%	Qty. (kg)	%		
1.	Midnapore (East)	Lentil (Crop-2)	Marginal	0.11	112.00	2.93	2.62	7.50	6.70	--	--	3.07	2.74	5.36	94.64
2.			Small	0.42	430.86	11.34	2.63	17.00	3.94	--	--	20.48	4.75	7.38	92.62
3.			Medium	0.49	503.03	13.25	2.63	17.50	3.48	--	--	29.55	5.87	8.50	91.50
4.			All	0.12	1045.89	27.52	2.63	42.00	4.02	--	--	53.10	5.08	7.71	92.29
5.	Murshidabad	Lentil (Crop-2)	Marginal	8.30	8905.40	224.10	2.52	261.70	2.94	127.28	1.43	389.06	4.37	8.32	91.68
6.			Small	36.34	36653.55	1009.68	2.75	1096.60	2.99	1712.64	4.67	1957.66	5.34	12.76	87.24
7.			Medium	78.05	80935.45	2124.25	2.62	2384.50	2.95	2594.63	3.21	4836.81	5.98	11.81	88.19
8.			All	122.69	126494.40	3358.04	2.65	3742.80	2.96	4434.56	3.51	7183.50	5.68	11.84	88.16

Table-4.11

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

3.19 per cent. The proportion of selected cereal grain production used for animal feed was observed to be 2.15 percent. The percentage quantity of wastage was found to be quite significant (7.73 percent). In the aggregate, the percentage quantity of selected cereal (rice) grain used for seed, animal feed and wastage was worked at 13.07 percent of total cereal (rice) production. 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. It is clear from the above analyses that 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 worthwhile 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.

4.12: 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.

The estimated equation for selected cereal (rice) crop :

$$Y = -19.6903 - 0.2996 X_1 + 0.1188 X_2 + 0.0004 X_3 + 203.1926^{*} X_4 + 6.4059 X_5 + 97.5416 X_6$$
(0.2637) (0.1657) (0.0345) (90.1743) (41.2805) (50.4976)

$$+16.6872^{*} X_7 - 9.6697 X_8 + u_i \ldots\ldots\ldots .. R^2 = 0.9416 \ldots\ldots\ldots .. \text{Equation-1}$$
(7.6353) (8.1665)

Note: Figures within brackets indicate standard error of estimates of coefficients

*Indicates significant at 5 percent level of significance

The estimated equation for selected pulse(lentil) crop:

$$Y = -18.9866 - 0.1376X_1 + 0.0993X_2 + 1.4046^{*}X_3 - 815.9198^{*}X_4 + 165.4365X_5 + 10.7307 X_6$$
(0.2652) (0.1768) (0.3825) (397.1084) (228.0557) (9.7281)

$$- 6.9050 X_7 \ldots\ldots\ldots\ldots\ldots .. R^2 = 0.9426 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{Equation-2}$$
(9.0332)

Note: Figures within brackets indicate standard error of estimates of coefficients

*Indicates significant at 5 percent level of significance

The estimated regression coefficients for selected cereal (rice) grain is presented in equation-1. As follows from the regression equation estimate, variables included in the regression equation 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 (equation-2). In all seven variables are considered in the estimated equation (equation-2) 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.

Chapter-V
Summary & Policy Conclusions

5.1: Background

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. Thanks to the government initiatives, 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.

Agriculture contributes significantly to the aggregate economy through food crops, cash crops, oilseeds, pulses and other crops. Of all the food articles, foodgrains constitute the major. The country, after launching various programmes to raise the production of food crops, has achieved remarkable success in boosting up foodgrains production. 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. So far enough attention has not been paid 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.

For planning purposes, it is pertinent to know how much of foodgrains are available for human consumption after making allowance for seed, feed and wastages out of the gross production of foodgrains. Therefore there is a need to have information on seed, feed and wastage ratios of foodgrains. Keeping in view the need for fresh estimates of seed, feed and wastages ratios, the Ministry of Agriculture, Government of India had asked Agro-Economic Research Centres in the country to undertake a common study on "Estimation of seed, feed and wastage ratios for major foodgrains". The Agro-Economic Research Centre, Visva-Bharati has taken up the study in West Bengal with the following objectives.

5.2 : Objectives of the Study

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.

5.3 : 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.

5.4: Profile of the State

Demography

According to 2001 census, the state has a population of 801.76 lakhs with an area of 88752 sq. km. A total of 577.49 lakhs (72.03 percent) are found to live in rural areas and the rest are urban population, which accounted for 27.97 percent. The total workforce of the state constituted 36.78 percent in relation to the total population. The proportion of cultivators among total workers accounted for 19.18 percent and the corresponding share of agricultural labourers in total working population stood at 24.97 percent.

Pattern of Land Holding in the State

The marginal (below 1ha) and small (1.00 –2.00ha) sized land holdings form the bulk of the farm holdings in the state. These two size classes together accounted for 95.30 per cent of the total holdings. The average size of holdings in respect of all size classes works out to 0.82 ha for the state.

Irrigation

As recorded in 1995-96 agriculture census, the state of West Bengal has 55.24 per cent of the net sown area as irrigated area. Tube-wells play major role as a source of irrigation where 55.80 per cent of total irrigated area is catered to by this source. The next important source is canal which serves 23.50 per cent of total irrigated area in the state. Area irrigated by tanks constituted 10.50 percent occupying the position after canal.

Agriculture, Land Use and Productivity

The economy of the state is mainly based on agriculture. There is not much uncultivated land left which could be conveniently utilized for agricultural purpose. In the year 2003-04, total cultivable area constitutes 67.69 percent of which 92.30

percent are brought under cultivation. About 62.48 percent of the total area of the state falls under net sown area. On an average, 18.83 percent of the area is not available for cultivation. About 14 percent of the area of the state is covered by forests. Density of cultivating population as measured by the number of cultivators per 100 ha of cultivated land works out at 103. The comparable estimates for agricultural labourers stood at 134. In the year 2000-01, net sown area per agricultural worker works out at 0.42 ha. whereas cultivable area per agricultural worker stood at 0.53 ha. As recorded in the year 2003-04, the index of multiple cropping as approximated by the level of crop use intensity is estimated to be 178 percent. Rice is the predominant crop of the state. Productivity level of rice is estimated at 2504 kgs per ha. Productivity of cereals works out at 2484 kgs per ha while the corresponding figure of pulses stood at 840 kg and combining these two crops together, productivity level of food grains is estimated at 2421 kg per ha.

Livestock and Poultry

The rural economy of West Bengal is mostly a mixed economy of agriculture and animal husbandry. As an allied component of agriculture, animal husbandry provides supplementary income to rural households. According to Livestock Census 2003, the total livestock population in the state was 345.43 lakhs of which bovine population comprising of cattle and buffaloes accounted for 54.60 per cent. Ovine population covering sheep and goats formed 38.12 per cent in total livestock population. In the total livestock population of the state, the cattle population accounted for 52.06 per cent while those of buffaloes constituted 2.53 per cent. The state's cattle population comprised of 36.52 percent females, 20.12 percent males and 43.36 per cent young-stock. According to 2003 livestock census, there were 551.14 lakhs poultry birds in the state.

Use of Agricultural Machinery

Use of machineries play on important role in agricultural development of a region. Among the agricultural machineries, tractors, power-tillers and pump-sets in use for irrigation purpose are important ones. According to the livestock census, 2003, density of tractor use as measured by the number of tractors per '000 ha of net sown area stood at 5.54 in number. The use of power-tiller is also prevalent in the state to make agricultural operations cost effective. The number of power-tillers per '000 ha of net sown area was estimated at 4.47. There were about 102 diesel pump-sets and 10 electric pump-sets per '000 ha of net sown area, which were using for irrigation purpose.

Infra-structure

Infra-structure plays the key role in promoting agricultural development. Good infra-structural facility not only ensures smooth flow of inputs and outputs but also facilitates higher accessibilities to knowledge. Again within the group of infra-structures, road transport is crucial.

The road network in the state is maintained by public works and public works (Roads) departments of the State Government, Zilla Parishad and Municipalities. The state has a total of 18091 km. road length maintained by the P.W.D. The area served by rural road system amounts to 42478 km in the state. Such roads are maintained by Zilla Parishad. Those apart, road maintained by the municipality amounts to 20588 km. Thus the total area served by the road system amounts to 81157 km. of which rural roads alone accounted for 52.34 percent in the state. In fact priority is given on improving the connectivity of villages through providing all weather roads to the unconnected villages. The other infra-structure called electrification has focused on extending the grid supply to villages and remote areas and covers 82.66 percentage of total villages in West Bengal. With regard to the access of credit, the state of West Bengal has a wide network of rural financial institutions. There are 4500 scheduled bank offices and this translates to about 18000 people served by each of bank office. In per capita terms bank advances amounted Rs. 6824 as against the total amount of deposit of Rs. 13055.

5.5: Cropping Pattern of the State and Selected Districts

5.5.1: Cropping Pattern of the State

For the purpose of analyzing crop pattern, percentages were worked out based on the share of each crop to the total gross cropped area, for the period 1999-00 to 2003-04. The cropping pattern of the state highlights that the dominant crops in the cropping pattern in order of importance are rice, wheat, rape & mustard, jute and potato. These crops altogether covered 90.68 per cent of the gross cropped area. However during the 5 year period under review i.e. 1999-2000 to 2003-2004, aggregate share of these crops in the total gross cropped area decreased from 92.28 per cent in 1999-2000 to 90.68 per cent in 2003-2004. Further it is noticeable that there has been decline in the area share of foodgrains during the period under review. Foodgrains crops as a whole shared 78.23 per cent of gross cropped area in 2003-2004, which was 80.42 per cent in 1999-2000. However despite decline in the proportion of area under foodgrains, it still accounted for the major in the cropping pattern remaining almost stable at about 78 per cent during the period after 1999-00. Within foodgrains crops, cereals dominated the cropping pattern of West Bengal where about 75.25 per cent of the gross cropped area was covered by cereals as

recorded in 2003-04. The corresponding figure was 77.88 per cent in 1999-2000 and thus cereals suffered loss in acreage during the period. Within the cereal crops, rice and wheat are the major ones and jointly occupied 74.34 per cent of the gross cropped area as in 2003-04 which was 77.17 per cent in 1999-2000. Rice and wheat being principal components of foodgrains jointly demonstrated decline in their area share over the same reference period viz. 1999-2000 to 2003-04. Within the foodgrains crops, the share of pulses in total cropped area increased marginally from 2.54 per cent to 2.98 per cent in the above-mentioned period. Rape and mustard is the major oilseed crop in West Bengal. While the share of total oilseeds accounted for 8.10 per cent in 2003-04, the corresponding share of rape and mustard was 5.35 per cent during the same period. The percentage of area under oilseeds showed increasing trend, area share being increased from 5.95 per cent to 8.10 per cent in the same reference period. As against this area proportion under rape and mustard increased from 4.10 per cent in 1999-2000 to 5.35 per cent in 2003-04. Jute requiring a large amount of human labour per acre, the share of area under the crop increased marginally from 7.27 per cent to 7.34 per cent. Potato, again a crop absorbing a significant amount of human labour and of bullock labour but bringing in higher gross revenue per acre occupied an area of 3.65 per cent of gross cropped area in 2003-04 which was 3.74 per cent in 1999-2000.

The overall changing scenario of the cropping pattern in West Bengal reveals that cropping pattern of the state is still predominated by foodgrains crops, the principal component being cereal crops. One of the striking features of the cropping pattern of the state is the decline in the area share of foodgrains along with its principal component cereals. The decline in area proportion under foodgrains was associated with increase in the area share of commercial crops like oilseeds and jute.

5.5.2: Cropping Pattern of the Selected Districts

In order to have a clear picture of the crop economy of the selected districts, cropping pattern of the selected districts are analyzed. The cropping pattern of Midnapore (East) shows that rice is the single dominating crop in the cropping pattern of the district accounting for about 92.79 per cent of the gross cropped area. The cropping pattern of the district clearly brings out that the district is predominantly foodgrains producing region which covered 94.04 per cent of the cropped area of the district. During the reference period of 1999-2000 to 2003-04, gross cropped area in the district has shown steady decline from 558.9 thousand hectare in 1999-2000 to 455.1 thousand hectare in 2003-04. The overall percentage area under foodgrains increased from 89.89 per cent of gross cropped area to 94.04 per cent during the same period. Rice being the dominant component of foodgrains, improved it's share from

88.92 per cent in 1999-2000 to 92.79 per cent in 2003-04. Though oilseed is the next important crop in the district, it experienced decline in its share from 4.06per cent to 3.91per cent during 1999-2000 to2003-04.

The cropping pattern of Murshidabad district reveals that rice, wheat, lentil, rape & mustard and jute are dominant crops which altogether accounted for 91.07 per cent of the gross cropped area in the year 2003-04. Considering the overall cropping pattern during the five year period ending 2003-04, it is noticeable that area under foodgrains has been on the decline with its share being decreased from 71.38 per cent in 1999-2000 to 69.61 per cent in 2003-04. Evidently, the downward trend in the area share of foodgrains is clearly explained by the declining share of cereals, the major component of foodgrains. The share of pulses has gone up during the same reference period being increased from 5.45 per cent in 1999-2000 to 7.45 per cent in 2003-04. Among pulses, lentil (musur) is the dominant one. Among other crops jute and oilseed are important ones. The share proportion of area under jute remained steady with only a slight decrease from 18.12 per cent in 1999-2000 to 17.66 per cent in 2003-04. Area under oilseed crop on the other hand, increased from 7.88 per cent of gross cropped area to 10.62 per cent during the same reference period.

5.6: 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. In this section, 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.

For carrying out the current year's production, the seed kept from the previous year's production were used which 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.

5.7: Crop-wise Estimates of Grain for Feed

This section presents 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 viz goats, sheep etc. are not fed grains by the sample farmers in the selected districts. It can be noticed that no buffalo was fed the selected cereal grain in Midnapore (East) district selected to represent the cereal crop. In Midnapore (East) 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. It is seen that 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. The percentage quantity of rice grain fed to the livestock taken with respect to total rice production of the sample farmers constituted 0.74 per cent for cows, 1.13 percent for bullocks and 0.08 percent for calves.

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 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 represented for pulse (lentil) crop, the sample farmers were found to be feeding pulse grain which was annually about 11.95 kg of pulse (lentil) 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. Sample farmers in

Murshidabad district have fed higher percentage quantity of the selected pulse grain to their bullocks (1.36 percent of total production).

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. The sample farmers of Murshidabad district had less number of poultry birds than that of Midnapore (East). In Midnapore (East) district, the sample farmers have 702 birds comprising 285 hens and 417 duck and they consume 2564.96 kg of cereal (rice) feed per year whereas in Murshidabad district the sample farmers have 432 poultry birds of which 186 hens and 246 duck and they were fed about 913.43 kg of the rice grain per year. 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 significant quantity of pulse grain to the poultry birds. The sample farmers selected for pulse (lentil) fed about 856.81 kg of selected pulse grain to 432 poultry birds and thus 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 formed 0.23 percent for hens and 0.45 percent of duck in Murshidabad district. In contrast, none of the birds were fed pulse grain in Midnapore (East) and hence the total quantity of consumption of the selected pulse grain in the district were found to be nil. Moreover, in the district where

pulse grain 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.

5.8: 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, out of total production of the selected cereal (rice) grain at 1117066.76 kg., total wastage was estimated at 92895.06 kg. and thus the percentage total wastages 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 wasted quantity of selected pulse crop (lentil) was recorded at 53.10kg. out of total production of 1045.89kg. and thus 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).

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

This section presents 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 grain used as seed, animal feed and wastage was found to be 13.07 percent. At disaggregated level, the percentage quantity of selected cereal (rice) 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. The percentage quantity of wastage was found to be quite significant which stood at 7.73 percent. In the aggregate, the percentage quantity of selected cereal (rice) grain used for seed, animal feed and wastage was worked out at 13.07 percent of total cereal (rice) production. 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. It is clear from the above analyses that 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.

5.10: 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.

5.11 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 where as for pulses (lentil) the ratio might 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. There is therefore need to identify the factors governing the post-harvest losses in foodgrains which would help develop corrective measures to reduce these losses. Thus, 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 for each selected crop viz. rice and lentil. The exercise revealed that the post harvest losses of cereal crop (rice) increased with the non-availability of storage facility implicating 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, facility available in the state are also far from satisfactory. The storage capacity provided by West Bengal State Warehousing Corporation grew at a very meager rate by less than 1 per cent from a level of storage capacity of 248872 metric tonnes in 1995 to 250000 metric tonnes in 2004. 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**).

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