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FOOD PLANNING AND MONITORING UNIT
MINISTRY OF FOOD
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

# STUDY ON THE ESTIMATION OF SEED, FEED AND POST-HARVEST WASTAGE OF FOODGRAIN CROPS IN BANGLADESH

( STUDY CONDUCTED UNDER U S AID TECHNICAL ASSISTANCE GRANT TO FPMU )

UNICONSULT INTERNATIONAL LTD.
1991

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# EXECUTIVE SUMMARY

## BACKGROUND OF THE STUDY

Cereals (Rice and Wheat) are the staple food in Bangladesh. Total foodgrain production in 1989-90 was 18.75 million tons of which 16.87 million tons were available for human consumption after deducting 10% for seed, feed and wastage. This is a traditional method of calculation having no scientific basis. Total foodgrain requirement for the same period was assessed at 18.53 million tons for a population of 112 million. This created a food-gap of about 1.66 million tons. Therefore, to meet the calculated requirement, after assessing the probable availability through domestic procurement the Government had to import the balance quantity and distribute through its public foodgrain distribution system (PFDS). This is the main frame of food budget.

The Ministry of Food every year prepares food budget taking into consideration the foodgrain situation of the country. While estimating availability and annual requirement as mentioned above, 10 per cent of total production is assumed, as a rule of thumb, to be unavailable for human consumption due to use as seed and feed, and as losses due to post-harvest operations. Uptil now no systematic study has been carried out to estimate the reliable quantity of foodgrains not available for human consumption.

In recent years, due to large scale introduction of modern varieties of rice and wheat and improvement in cultural practices, the seed requirement of foodgrain crops is likely to be reduced than what was in earlier days. Seed rates for different varieties in different seasons vary considerably. A precise estimation of seed use by farmers needs to be known. Foodgrains are also used in small quantity as cattle and poultry feeds. Reliable data on these are, however, not available, nor has any study been carried out as yet to investigate into the extent of use of grains as feed. Similarly, post-harvest losses or wastage of foodgrains at different stages, from harvest to consumption, are also not known. It is, however, assumed that a significant quantity of foodgrains is lost at different operational stages in the post-harvest period. For the purpose of this study, the production estimate as finalized by BBS for the year 1989-90 is shown in the Table below :

Foodgrain Production in 1989-90

| Crop | Production (000 tons) | Remarks |
|---|---|---|
| Aus<br>Aman<br>Boro | 2487<br>9202<br>6167 | BBS finalized this estimate in the month of March, 91 |
| Total Rice | 17856 | |
| Wheat | 890 | |
| Total Food-grain | 18746 | |

The necessity of estimating the extent of foodgrains not available for human consumption due to post-harvest losses and its use as seed and feed cannot be over-emphasized. This would enable planners and policy makers to determine accurately the demand-supply condition of foodgrains in Bangladesh. Therefore, to carry out a detailed study, the Ministry of Food, Government of the People's Republic of Bangladesh undertook the present study with the following objectives.

## OBJECTIVES OF THE STUDY

- To generate data on the use of grains (paddy and wheat) as seed and their variation with modern and traditional varieties and cultural practices.
- To estimate quantum of foodgrains used as Cattle and Poultry feeds.
- To estimate the post-harvest losses of foodgrains at various stages of handling, drying, milling, storage, transportation at farmers and private traders level.
- To generate reliable data base to support preparation of food budget.

## METHODOLOGY

Operation and uses of both local and modern varieties of Aus, Aman, Boro and Wheat crops were studied by using specific questionnaires approved by the Functional Committee in selected areas to estimate foodgrain loss (post-harvest) in Bangladesh. Besides the questionnaires for farmers, separate questionnaires were used for respondents to estimate the losses in marketing, milling and storing. Multiple sampling techniques were used to cover the entire aspect of the survey.

The country was divided into eight broad Agro-Ecological Zones (AEZ), based on the area under modern variety as a proportion to the total area under paddy cultivation. 18 Upazilas i.e., about 4% of the Upazilas from each broad AEZ were selected. About 2% of villages from each Upazila were selected, making a total of 76 villages for survey. From each selected village, 7.5% of the households i.e., a total of 1175 households were selected for door to door survey. The same households were included for the survey in each of the foodgrain crops under Study. Sampling was random.

Loss in marketing at farmers level was estimated by using the same three stages (Upazila - Village - Households) sampling plan. Loss in the private traders godown was estimated from 5% randomly selected godowns in 18 Upazilas. Use of foodgrain as Livestock and Poultry feed was estimated from 10% Cattle and Poultry farms of the country. There are about 47 specialized cattle and poultry farms in the country.

Trained Enumerators were engaged to collect data from farmers, private traders, rice mill operators, and cattle and poultry farm managers through direct interview using the approved questionnaires.

## FINDINGS AND CONCLUSIONS

- The study indicates that the percentage of foodgrains (paddy and wheat) used as seed, feed and wastage during the post-harvest operations of the sample household was 11.58 percent in 1989-90. The seed, feed and wastage in post-harvest operations was 13.20 percent in Aus, 12.38 percent in Aman, 10.38 percent in Boro and in Wheat it was 11.84 percent. Insignificant variation was observed when five years national foodgrains production was used as a weight.

- On the basis of above estimate of loss, the total quantity of foodgrains not available for human consumption in Bangladesh in 1989-90 amounted to around 2.17 million tons against the BBS production estimate of 18.75 million tons. This lost quantity was almost equivalent to foodgrains consumption for about 13.13 million people for one year at the rate of 453 grams/person/day.

- The volume of foodgrain not available for consumption, but lost in course of operation alone, may be estimated at 1.75 million tons, the value of which at Government procurement price of that year was Tk. 1570.05 crore. The losses of foodgrain during post-harvest operations are estimated at 9.34% ; 1.73% were used as seed and 0.51% were used as feed. The quantity used as seed and feed could be deemed to have

been used for economic purpose. However, the rate of PHL appeared to be high and should be reduced by adopting improved post-harvest technology and operational efficiency.

- Variations in the loss were observed in different areas. The overall minimum non-availability of foodgrains for human consumption of the sample households was recorded in the Mymensingh/Kishoreganj/Jamalpur region (10.65%) and maximum was recorded in the Dhaka/Tangail region (13.57%). In Chittagong/Noakhali region it was recorded as 10.91%; in Comilla/Sylhet region as 13.02%, Rajshahi/Bogra/Pabna region as 13.01%, in Rangpur/Dinajapur region as 11.97%, in Jessore/Kushtia/Khulna region as 10.91% and Barisal/Faridpur/ Patuakhali region as 12.93%. The variation happened due probably to difference in operational method, milling, storage and seed rate etc.

**Seed**

- Foodgrains used as seed in 1989-90 was 1.73 percent of the total production of the sample households. In rice it was 1.60 percent and for wheat it was 5.73 percent of their respective production.

- The quantity of seed used for Aus crop was 2.89 percent; for Aman 1.80 percent and for Boro 0.89 percent. Higher proportion of seed used in Aus crop was due to its higher seed rate (mostly broadcast) and lower yield potential than the Aman and IRRI/ Boro crops. Percentage of seed declined in HYV but increased in LVs.

- The seed rate varied with crops, varieties and methods of planting. Among the foodgrain crops, seed used (relative to total production) for wheat (5.73%) was higher than that for paddy (1.60%). Again, modern varieties of paddy required less seed (1.25%) than the local varieties (2.57%). Study indicates that about 62 percent paddy area was under modern varieties (including pajam) and 38 percent area under local varieties. Expansion of modern varieties would increase the production and reduce the seed requirement relative to total production.

- The percentage of seed used in Aus crop was found to be the highest among all the rice crops (2.89%). The percentage of Aus seed used in Dhaka-Tangail region was found to be the highest and in the Chittagong-Noakhali region it was the lowest.

- Highest quantity of Aman seed was used in Barisal-Patuakhali-Faridpur region (4.84%) indicating lower share of

modern varieties. The lowest quantity was found in Rangpur-Dinajpur region having a higher share of modern varieties.

- The seed used for Boro crop was 0.89% of total production. It varied, according to survey data, from 0.73% in Jessore - Kushtia -Khulna region to 1.09% in Comilla-Sylhet region. The local varieties of Boro crop was found more in the greater Sylhet district than in other areas. Seed rate in local Boro was higher than that of HYV Boro.

- Percentage of seed used for wheat was 5.73% of the total production. Wheat crop comprised mostly of modern variety. The Dhaka-Tangail region used highest percentage of wheat seed while the Rajshahi-Bogra-Pabna region used the lowest percentage relative to production.

**Feed**

- This study revealed that about ninety percent of the households reported rearing of livestock and poultry birds. Paddy was seldom used as livestock and poultry feed.

- The population of cattle, buffaloes, sheep and goats had declined to some extent than what was reported in the Bangladesh Census of Agriculture and Livestock : 1983-84 but that of chickens and ducks had gone up slightly in domestic farms and appreciably in specialized farms in recent years.

- It was also observed that in most households, the foodgrains were not available as feed beyond two months during every cropping season. In the areas under study, the quantity of foodgrains used as feed was estimated at 0.51 percent (against the total foodgrains production) of which 0.68 percent was Aus, 0.50 percent was Aman, 0.46 percent was Boro and 0.46 percent was Wheat.

- Number of specialized farms compared to the total population of livestock and poultry was insignificant. There are about 47 specialized poultry and livestock farms in the country. In the specialized dairy farms the foodgrains were not directly used as feed. In these farms, nearly 50 percent of the concentrate feed ingredients was wheat but the use of paddy as feed was practically nil.

- Loss of foodgrain kept as feed in the stores of specialized farms was insignificant, since the feed was not required to store for a long period.

## Post-harvest Loss (PHL)

- Post harvest loss of foodgrain comprises a number of stages in its process. The most significant operating stages are stacking, carrying, threshing, winnowing and drying and storing etc. Total post-harvest loss aggregated to 4.14% of all the crops (compared to total production). Of this, threshing loss was 1.19%; stacking loss was 0.91%; carrying loss was 0.74%; winnowing was 0.68% and drying loss was 0.54%.

- The post-harvest loss of Aman crop was the highest (4.39%) followed by Aus (4.18%), Boro (3.88%) and wheat (3.04%). Post-harvest loss of 4.14% (against total production) was considered very high for a country like Bangladesh. The causes of such huge loss were due to weather, un-scientific operation, lack of knowledge and poor economic condition of the farmers who could not afford proper materials in these operations.

## Milling Loss

- Loss of paddy during drying and parboiling was 1.86% of which the maximum loss occurred in soaking followed by eating by poultry birds. As for individual crops, the highest loss was 2.14% in Aman, then 1.86% in Boro and 0.95% in Aus. At millers level the average parboiling and drying loss for paddy was 1.03%. In both the cases soaking loss comprised of 57% to 65% of the total loss during this process.

- The share of paddy milled by Dheki (pounding) and mechanized husking mills would be around 8% and 92% respectively. The recovery percentage of rice in Dheki was 69.68% and in husking mill was 67.61%. If all the paddy produced in 1989-90 (about 27055 thousand m. tons) was husked in Dheki alone than about 560 thousand m. tons of foodgrain would have been saved. The value of which is around Tk. 50.82 million at 1989-90 procurement price. Improvement in milling recovery and adoption of traditional husking may significantly reduce the current milling wastage.

- Milling loss at farmers' level through Dheki operation was found to be 0.53%, and through rice huller it was 0.70%. Recovery of rice was 69.68% in Dheki operation, 67.61% in rice huller and 68.00% in big rice mills. This compared to Government allowed rate of recovery of 65% to 65.5% (varying from area to area) for resultant rice from paddy supplied to rice mills. It may be assumed that government received less rice than what was actually recovered by the millers. On an average government received 2.0% to 3.0% less than the average found in the country.

## Storage Loss

- Storage loss at farmers' level was 1.03% of which the maximum was due to evaporation of moisture followed by the rodents damage. As regards crop varieties the loss in Aus was 2.44%, in Aman 1.16%; and in Boro it was 0.90%. [Variation of loss in stores in different types of container was also observed].

- As against average storage loss of grain at farmers and traders level, the loss at public sector stores was higher although storage condition was much better in public sector. Comparative storage loss at different operators level was found to be as follows :

| Operator | Rate of loss (%) | |
|---|---|---|
| | Paddy | Rice |
| Farmer | 1.03 | - |
| Trader | 0.30 | 0.35 |
| Public Sector * | 1.00 | 0.75 |

* Ministry of Food.

- The average loss of foodgrain due to storing at primary traders' level was 0.34% and at secondary traders' level was 0.36%. The average storage loss was found to be 1.70% at millers level. At traders' and millers' level, foodgrains are usually stored in gunny bags for a brief period of 2-3 months where loss due to evaporation was maximum. Evaporation loss was found minimum in Govt. stores where grains at optimum moisture of 12-14% were stored.

- Loss due to evaporation during storage may not be considered as a loss of foodgrain since the loss occurred due to imperfect drying.

## Transportation Loss

- Foodgrain loss during transportation channel was examined at several levels of transaction : farmers, traders in the primary and the secondary markets including wholesale markets. The survey result revealed that the share of foodgrains transported at the above mentioned levels was 8.0, 28.0 and 64.0 percent respectively. The overall transportation loss of foodgrain was found at 0.27 percent which was the weighted average at the level of farmers and traders in the primary, secondary and wholesale markets.

- Mode-wise transport loss of foodgrain was found to vary from 0.16 percent in case of headload to about 0.42 percent in

the case of railways. Between these two extremes, foodgrain loss while carried by rickshaw van, shoulder sling, boat and truck came in order of 0.22, 0.23, 0.28 and 0.31 percent respectively.

- Three factors like use of hooks, transshipment and pilferage, causing foodgrain loss were examined. These factors came in the order mentioned above in respect of their significance to foodgrain loss.

- Substantial variation of foodgrain loss was found across the regions. It ranged from 0.10 percent in Dhaka-Tangail to 0.41 percent in Mymensingh-Kishoregonj-Jamalpur. It appeared that the regional variation in foodgrain loss was somewhat related to the level of development of transportation system; the loss tended to be higher in far-flung and relatively poor transportation facility areas of the country.

The above findings of transportation loss at farmers' and traders' level in different transport modes compares to Govt.'s allowable transport losses as evidenced from the following table.

| Operator | % of transportation loss | | |
|---|---|---|---|
| | Truck | Railway | River |
| Farmer | 0.54 | - | 0.37 |
| Trader | 0.31 | 0.42 | 0.41 |
| Public Sector* | 0.25 | 1.00 | 0.50 |

* Ministry of Food.

## Marketing Loss

- Handling loss was highest at the farmers' level and lowest at the traders' level. On the average, the rate of handling loss at the farmers level was estimated at 0.42% (weighted) while the average rate of handling loss in the wholesale market at Badamtoli Ghat was found to be 0.14%. This difference in the rate of handling loss was probably attributable to differences in the nature of handling in the two stages of marketing. Farmers often used old and worn-out bags; also, the grain was weighed and packed in the earthen floor. As a result, grains falling on the ground could not be fully recovered, and this resulted in a slightly higher rate of foodgrain loss at farmers level. On the other hand, most of the grain spilled in the unloading process in the wholesale market was found falling in the shop premises (mostly pucca) and therefore, could easily be recovered; hence a lower rate of handling loss was observed in the case of traders.

- Handling loss in the primary markets was, on the average, 0.31%. Handling loss was higher [(0.32%) for paddy ] than the same for rice (0.08%). Average handling loss at the secondary market was 0.30%. However, in the secondary market the rate of handling loss was almost similar for both paddy and rice.

- Rate of handling loss also differed by type of crop. At the farmers level, the rates of handling loss obtained in Aman, Aus and Boro were 0.49%, 0.22% and 0.34% respectively. The handling loss in wheat was found about 0.22% and 0.45% at the primary and secondary market respectively. The observed differences in handling loss rates by type of crop were partly attributable to differences in weather at the post-harvest time for the three corps. Random errors in measurement might also be partly responsible for the observed differences in handling loss rates by type of crop.

## LIMITATION

- The study was designed to investigate interalia loss of foodgrain in the post- harvest operations of domestic production; hence public sector foodgrain handling which mostly composed of imported grains were not brought into the scope of the study. However, a small quantity of foodgrains was procured domestically in the public sector for which loss estimate could be derived from the data available in other study or from official records.

- Within the scope of the study and resource and time table available to the Consultant, it was not possible to cover wider areas and large number of factors involved and multi-dimensional socio-economic variables linked up with other important national issues. However, within the resources, the consultant tried to make the study meaningful backed by investigated/surveyed primary data. However, consultant thinks that a few micro-level study covering other important variables such as recent loss information in Government storing houses efficiency of heterogeneous milling technologies, modern milling, drying and soaking systems should be undertaken to have a complete picture.

## RECOMMENDATION

- The study revealed that about 11.58% of foodgrains (rice and wheat) annually produced in the country are not available for human consumption because of use as seed, feed and loss during post-harvest operations. This estimated rate obtained through the survey is higher than the rate used by the Government in food budgeting. The extent of loss of foodgrain in post-

harvest operations may be reduced through application of improved post-harvest technology.

- Proportion of seed used in 1989-90 was 1.73% of the total production. Proportionate seed requirement (5.7%*) was higher in wheat which could be reduced by use of good seed of high yielding varieties and sowing under favorable environment for higher rate of germination and survival of the seedlings. In rice crops proportionate use of seed (1.6%*) can also be reduced by reducing broadcast method of sowing and bringing more areas under transplantation of modern varieties. This calls for a stronger extension programme, timely availability of seeds, and other inputs with good marketing systems.

- Use of foodgrains as feed is likely to be increased in the coming years with the increase of organised poultry and duck farming in the country. Increased use of grain as feed may be compensated by saving grain in seed use and by reducing the loss in the loss in post-harvest operations.

- The estimate Post-harvest processing loss (at 4.14%) can be reduced by adopting modern technology. Present study indicated that loss in threshing was higher among the operations. This loss may be reduced by using paddle and other improved threshing devices. A strong extension programme with availability of threshers in rural areas could popularize the methods and save considerable quantity of foodgrains that are lost during threshing.

- Milling loss which is estimated 0.70% at farmers level and 0.65% at millers level may probably reduce by using improved milling technology. Although it is not within the TOR to examine the milling technology and rate of the recovery under variable milling techniques, it was noticed that milling losses were higher in old and out-dated rice mills. This old rice mills should use the modern devices and reduce milling loss.

- Milling loss can be reduced by using Dheki where rice recovery percentage is relatively higher than husking mills. However, the Dheki process is slower and laborious than the modern rice mills. The Dheki system needs improvement (may be fitted with improved kind of husking devices). Although recovery in Dheki is higher, the use of Dheki is generally reducing in the country.

- Storage loss can be reduced by improving rural storage conditions through the use of pot type storage structure, earthen jars and metal drums. The small and medium large flat

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* Relates to 1989-90 production.

type pucca stores may be used on cooperative and collective basis. The rural farmers, traders and 'arathdars', 'beparis', millers and stockists may be grouped together to use cooperative/ collective storage facilities. Farmers and stockists of foodgrain should be trained on ideal storage, processing operations, maintaining grain hygienic specifications, such as moisture, admixture, dust and broken, shriveled, infested grains and other standard needed for longer shelf life.

- Loss during transportation may be reduced considerably with improved handling and transportation facilities. Use of hooks and defective and tornout bags cause considerable loss during transportation. Automatic bagging and stitching may be introduced by large stores and traders.

- Marketing loss mainly occurs during handling. This loss may be reduced by improving rural grain markets with pucca floor/premise for weighing and packing. Improved type container/carrier for transportation to and from markets may reduce loss.

- The present study was conducted in one cropping year with selected variables/functions at macro-level. These issues may be studied at micro level with stress on seasonal and regional variations covering large areas of sampling and higher sample-population fractions. A similar study covering two to three cropping years may be undertaken to estimate for an average normal year.

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## ACRONYMS

| | | |
|---|---|---|
| AEZ | : | Agro-Ecological Zone |
| AIS | : | Agriculture Information Service |
| Aman | : | Winter Rice Crop, harvested in November-December |
| Arathdar | : | Commission Agent |
| ARM | : | Automatic Rice mill |
| Aus | : | Summer Rice Crop, harvested in June-July |
| BADC | : | Bangladesh Agricultural Development Corporation |
| BARC | : | Bangladesh Agricultural Research Council |
| BARD | : | Bangladesh Academy for Rural Development |
| BARI | : | Bangladesh Agricultural Research Institute |
| BRRI | : | Bangladesh Rice Research Institute |
| BASWAP | : | Bangladesh-Swiss Agricultural Project |
| BBS | : | Bangladesh Bureau of Statistics |
| BCSIR | : | Bangladesh Council of Scientific and Industrial Research |
| Bepari | : | Rural Trader |
| BIDS | : | Bangladesh Institute of Development Studies |
| BITAC | : | Bangladesh Industrial Technical Advisory Centre |
| BKB | : | Bangladesh Krishi (Agriculture) Bank |
| Boro | : | Spring Rice Crop, harvested in April-May |
| BSB | : | Bangladesh Shilpa Bank |
| BSCIC | : | Bangladesh Small and Cottage Industries Corporation |
| BSRS | : | Bangladesh Shilpa Rin Sangstha |
| Chhatak | : | Local weight equal to 58.3 grams |

| | | |
|---|---|---|
| CSD | : | Central Storage Depot |
| DAE | : | Department of Agricultural Extension |
| Dalal | : | Broker |
| DC Food | : | District Controller of Food (under MOF) |
| Dheki/Dhenki | : | A foot-operated wooden implement used for rice husking in rural areas |
| Dole | : | Bamboo-made container of paddy |
| FAO | : | Food and Agricultural Organization |
| FAQ | : | Fair Average Quality (of grains as prescribed by MOF) |
| Faria | : | Small rural trader |
| FFW | : | Food for Works Programme |
| FPMU | : | Food Planning and Monitoring Unit ( Under MOF) |
| Gola | : | Storehouse for grains |
| GOB | : | Government of the People's Republic of Bangladesh |
| Govt. | : | Government |
| HM/HRM | : | Husking Rice Mill |
| HYV | : | High Yielding Variety |
| Kutial | : | A trader who buys paddy, processes the same and sells resultant rice |
| Kutcha | : | Muddy/made of beaten earth |
| LSD | : | Local Storage Depot (of MOF) |
| LGEB | : | Local Government Engineering Bureau (under LGRD) |
| LGRD | : | Local Government and Rural Development |
| Maund | : | Local weight equivalent to 37.326 kg |
| MOF | : | Ministry of Food |
| Motka | : | Container of rice made of burnt clay |

| | | |
|---|---|---|
| MRM | : | Major Rice Mill |
| O/C | : | Officer in Charge (of L.S.D.) |
| OMS | : | Open Market Sale |
| PFDS | : | Public Foodgrain Distribution System |
| Pucca | : | Cemented/Paved/Metalled |
| RC Food | : | Regional Controller of Food (under MOF) |
| SARM | : | Semi-automatic Rice Mill |
| Seer | : | Local weight equal to 933 grams |
| TCL | : | Total Cultivable Land |
| Tk. | : | Taka |
| TL | : | Total Land Owned |
| TPC | : | Temporary Procurement Centre |
| TOL | : | Total Operating Land |
| Tola | : | Local weight equal to 11.66 grams |
| TS | : | Total seed used for any particular crop |
| Upazila | : | Sub district |

## CONVERSION TABLE

### AREA EQUIVALENTS

| | | |
|---|---|---|
| 1 hectare | = | 10,000 square meters |
| | = | 2.471 acres |
| 1 square meter | = | 10,000 square centimeters |
| 1 square foot | = | 0.0929 square centimeters |
| 1 square mile | = | 2.590 square kilometers |
| | = | 640 acres |
| | = | 259 hectare |
| 1 acre | = | 0.4047 hectare |
| | = | 4840 square yards |
| | = | 43,560 square feet |
| | = | 4047 square meter |
| | = | 3.025 bighas |
| 1 bigha | = | 20 katthas |
| | = | 14,520 square feet |
| | = | 1,613 square yards |
| 1 kattha | = | 16 chhattaks |
| | = | 80 square yards |
| 1 chattak | = | 5 square yards |
| | = | 45 square feet |

### WEIGHT EQUIVALENTS

| | | |
|---|---|---|
| 1 ton | = | 26.79 maunds |
| 1 quintal | = | 2.68 maunds |
| 1 maund | = | 40 seer |
| 1 kilogram | = | 1.07 seer |
| 1 seer | = | 16 chattaks |
| | = | 2.057 lb |
| | = | 0.9328 kg |
| 1 chattak | = | 5 tolas |
| | = | 0.1286 lb |
| | = | 0.0583 kg |

| | | |
|---|---|---|
| 1 tola | = | 180 grains |
| | = | 0.4114 oz |
| | = | 11.66 g |

LENGTH EQUIVALENTS

| | | |
|---|---|---|
| 1 kilometer | = | 1,000 meters |
| | = | 3,281 feet |
| | = | 1,093 yards |
| | = | 0.6214 miles |
| 1 mile (statute) | = | 5,280 feet |
| | = | 1,760 yards |
| | = | 1,609 kilometers |
| 1 rod | = | 5.5 yards |
| | = | 16.5 feet |
| | = | 5.029 meters |
| 1 fathom | = | 6 feet |
| 1 centimeter | = | 0.3937 inch |
| 1 inch | = | 2.54 centimeter |
| 1 foot | = | 12 inches |
| | = | 0.3048 meter |
| | = | 30.48 centimeters |
| 1 meter | = | 100 centimeters |
| | = | 3.23 feet |
| | = | 39.37 inches |

OTHERS

| | | |
|---|---|---|
| Paddy to Rice | = | 0.677 |

# Chapter I
# INTRODUCTION

## 1.1 FOODGRAIN SITUATION IN BANGLADESH

Foodgrains in our country primarily mean rice and wheat. They occupy more than two- third of the cropped area and provide staple food for the population. Production of foodgrain is still insufficient to meet the domestic requirement, and thus substantial quantity of foodgrains is imported every year. In the South East Asian region, Bangladesh is one of the largest foodgrain importing country. As such Government's food policy has to lay stress on the major cereals. The assurance of adequate availability of basic food stuff, particularly rice and wheat, to meet the increasing demand of the country's large and growing population (estimated at 112 millions-1990, BBS) is an objective of the highest priority.

To increase country's production of rice and wheat (thereby to reduce import), substantial technical and financial support are provided by the government in the form of guidance, production inputs (seeds of modern varieties, fertilizer and pesticides) and credit to the farmers on concessional terms. Such support is further complemented and strengthened by the government's policy of rice price to guarantee the farmer minimum price for his product in consideration of the limited purchasing power of the people. Since an important objective of the government is to improve the nutritional standard of the population, the Government policies in respect to foodgrains are thus oriented towards higher production, consumption and nutrition supply. But, the diversity of agro- climatic zones and level of adoption of modern varieties led to non-homogenous foodgrain production and consumption pattern.

### 1.1.1 Foodgrain Production

The average annual foodgrain production of the last five year period (1985/86 - 1989/90) was 16.55 million tons compared to 15.38 million tons of the previous five year period (1980/81- 1984/85), an increase of 7.61 per cent with a growth rate of 1.5 per cent per annum. Area and production of foodgrain (rice and wheat) in Bangladesh during 1947-48 to 1989-90 is presented in Appendix 1.1.

Production of foodgrain has been showing an increasing trend since the 60's but the extent of fluctuation caused by weather has also been too large. A fall in production as large as one million tons has been observed in the past. For instance, foodgrain production during 1971/72 was 10.04 million tons whereas the production in the preceding year was 11.25 million tons. The decline is attributable to the disturbing political situation and the vulnerability of agriculture to the vagaries of nature. Decline in foodgrain production continued upto 1974/75 period. In the subsequent period, there was an increase in foodgrain production. Growth rate during 1974/75 to 1984/85 was more than 4 percent. This may be attributed to dissemination of technology i.e. expansion of modern varieties and related production inputs. Growth

rate between 1984/85 and 1988/89 was very poor i.e.less than one per cent per annum due to flood and other natural vagaries. Production varied from 16.10 million metric tons to 16.57 million metric tons in 1985/89.

Production suffered due to floods in 1987-88 and 1988/89 but production 1989/90 (especially Aman crop) improved due to a number of factors, of which favorable weather stood out quite predominantly. Besides, there was adequate and timely rainfall and retention of soil fertility due to loss of crops in preceding two years and a larger area was brought under modern varieties and there was no major pest attack during the cropping seasons.

Foodgrains are the main consumable items in Bangladesh accounting for about 60 percent of the household expenditure and 85 percent of the total calorie intake. Thus foodgrain production is also a major determinant of the level of nutrition. Crop failures resulting in food shortages cause acute deprivation to the country's poor. To the small and marginal farmers they mean below normal food stocks on the farm, greater recourse to costly open market purchases, and reduced employment opportunities, lower wages and sub-normal calorie intake. At the national level the crisis in the wake of crop failures divert much of the planning and administrative efforts away from the long-run development priorities into short run crisis management.

### 1.1.2 Foodgrain Import

The chronic shortage of foodgrains developed since 1950's in Bangladesh had been met by the import (aids and commercial imports). Food imports during the last few decades varied from less than one million tons to about 3 million tons (MOF, 1990) in order to keep the average availability of foodgrains at or near 15.5 ounces/person/day (in recent years the rate is 16 ounces/ person/day). National Nutrition Institute of Bangladesh has recommended 2700 as the daily calorie intake which comprises cereals 434 g, roots and tubers 423 g, sugar/gur 29 g, pulse 112 g, vegetables 213 g, fruits 56 g, oil 6 g, and animal food 98 g. etc.

Foodgap increased from 1.99 million tons in 1984/85 to 3.22 million tons in 1988/89. It is to be mentioned that the foodgrains available for consumption remained between 14 and 15 million metric tons during the period. Within this period population was increased by 11.2 million people. This raised the requirement of foodgrains from 16.48 million metric tons in 1984/85 to 18.13 million metric tons in 1988/89.

To make foodgrains available to the people with a stable price and to maintain a stock for food security, the government had to import 10.62 million metric tons of foodgrains (aid and commercial

imports) during 1984-85 to 1988-89 with an average of 2.12 million tons per year : (FPMU 1990).

### 1.1.3 Food Budget

In order to make foodgrain available to all people at all times, Ministry of Food prepares food budget every year. While preparing food budget of the country; estimated production (excluding 10% for seed, feed and post-harvest wastage from the gross production), requirement, procurement and distribution factors are considered. Foodgrain requirement is calculated by population times 16 ounces/person/day/irrespective of adult or minor. The country is yet to achieve self sufficiency foodgrain in production. According to Ministry of Food, the foodgrain shortage during 1984-85 to 1987-88 was on an average 2.2 million tons per year with an exception of 4.13 million tons in 1987-88. Most of the foodgrains shortage of Bangladesh are met through imports (MOF, 1990).

## 1.2 BACKGROUND OF THE STUDY

As mentioned earlier Ministry of Food has to prepare food budget ahead of time to process aided foodgrains for the whole year (Appendix 1.2). In making food budget while estimating availability, and assessing annual requirements, 10 per cent of total production is assumed to be not available for human consumption. In other words the net production for consumption was arrived by deducting 10 percent from the gross production as seed, feed and wastages as thumb rule. Uptil now no study work has been carried out to determine the exact quantity of foodgrains available for consumption. Accurate quantity of deduction could make it easier for policy makers to determine the quantity that would be available for consumption, import, distribution, and stock for food security. One percent error in estimation of foodgrain production would cause a fluctuation of 167 thousand metric tons, a quantity equivalent to the consumption of one million people for a year.

With the introduction of modern varieties and improvement in cultural practices, requirement for seeds is likely to be reduced than what was in earlier days. Seed rates for different varieties in different season vary considerably. A precise average estimate of seed rate for rice and wheat crops needs to be known.

Besides, foodgrains produced by farmers are used in small quantity as cattle and poultry feeds. But data on these are not available, nor any such study has yet been carried out to investigate into the extent of use of grains as feed.

Similarly, post-harvest losses or wastages of foodgrains at different stages from harvest upto consumption are not known. It is however, assumed that a significant quantity of foodgrains is lost at operational stages. Following are the areas by which grains are lost:

1. Loss due to different types/methods of harvesting and threshing.

2. Loss in the drying yard:

   i. At the post-threshing period.

   ii. Pre-mill drying loss after parboiling at farmers and millers level.

3. Milling loss due to different methods of milling/husking/ hauling.

4. Storage loss due to different types of storage methods used by the farmers and the private traders.

5. Loss due to different modes of transport by the private traders and the farmers.

6. Other probable losses like insects, rodents and weather etc.

The necessity of estimating the extent of foodgrains not available for human consumption due to post harvest losses and its use for seed and feed can not be over emphasized. Because this would enable planners and policy makers to determine more accurately the demand-supply condition of foodgrains in Bangladesh.

## 1.3 OBJECTIVES OF THE STUDY

To carry out a detailed study, FPMU, Ministry of Food designed the present study with following objectives:

1. To generate data on the quality of foodgrains (Rice and Wheat) used as seed and its variation with modern and traditional varieties and cultural practices.

2. To estimate quantum of foodgrains used as Cattle and Poultry feed.

3. To estimate the post-harvest loss of foodgrains at various stages like handling, drying, milling, storage, transportation at farmers and private traders level.

4. To generate reliable data base to support preparation of foodgrains budget.

## 1.4 TERMS OF REFERENCE OF THE STUDY

To undertake the study UNICONSULT International was selected by the FPMU, Ministry of Food under the following terms of reference:

1. To review the existing literature and studies carried out in relevance to the objectives of the study.

2. To estimate seed requirement for modern and traditional varieties of each foodgrain crop (Rice and Wheat).

3. To estimate how much foodgrains are used as Cattle and Poultry feed.

4. To estimate losses at different stages including traders level from harvest upto consumption.

5. To study the nature and causes of the losses in the post-harvest operations for each foodgrain crop.

6. To estimate storage loss for each foodgrain crop for each storage type used by farmers and traders separately.

7. To estimate transport loss by modes of transport used by the private traders and the farmers separately.

8. To estimate aggregate seed, feed and wastage with share of each component at national as well as farmers level.

9. Other issues relevant to study.

The study started on 22 June, 1989 with a total duration of 18 months to complete the study under the guidance of a functional committee constituted by the FPMU.

## 1.5 ORGANISATION OF THE STUDY

Keeping in view the objectives and terms of reference mentioned above the study was undertaken to assess the extent of foodgrain loss due to use as seed and feed, and post harvest wastage. The study is presented in the following sequences: the introduction is followed by the review of literature, methodology results and finally the conclusion.

# Chapter II
# REVIEW OF LITERATURE

The available literature on the loss of foodgrains due to different operations has been examined in chronological order in order to be familiar with the theoretical frameworks and empirical results of the studies etc. for helpful guidance. To achieve this paper/documents etc. dealing with individual use of foodgrains as seed and feed (not available for human consumption) as well as loss occuring during post-harvest operations, different levels of marketing, storing and milling processes etc have been depth.

## 2.1 SEED

Certain portion of the output of foodgrains is used as seed and therefore, not available for human consumption. The quantity of seed used in planting is the function of area under cultivation and seed rate per unit area. To estimate the total quantity of seed used in Bangladesh for rice (Aus, B. Aman, T. Aman and Boro) and wheat, it is necessary to know the total area under cultivation of different foodgrain crops (discussed in Chapter 1) and the seed rate per hectare for these crops (discussed below). Experimental evidence showed that the rate of seed used per hectare was different for local and modern variety depending ion the method of planting used such as broadcasting, line sowing, transplanting or dibbling and also on environmental conditions that prevail in different regions (Islam, 1989).

### 2.1.1 Seed Rate

1. Rice

Seed rate for different rice crop varies according to type of variety, size, germination percentage of the seed, method of planting and survival rate of seedlings under different environmental condition (Islam, 1989). According to Agricultural Information Service (AIS, 1989) for normal environmental condition the seed rate for Modern Variety (MV) of Aus (transplanted) was 25 kg/ha, MV of T. Aman 25 kg/ha, and Boro 25 kg/ha.

BADC (1980) in a study found that the average seed rate per hectare was 98 kg for paddy, the rate per hectare ranged from 46 kg in case of T.Aman to 100 kg/ha in case of B.Aman. The seed rate for HYV paddy of B.Aus was 90 kg/ha and Boro was 40 kg/ha. It was also observed that the seed rate for local varieties of paddy was almost the same as that of high yielding varieties when same methods of planting are practiced with similar germination capacity seed.

In Aus rice, BRRI (1976) in a direct seeding experiment with Chandina variety found that the maximum grain yield was obtained from the seed rate of 90 kg/ha. Hussain and Elias (1981) found that the average seed rate for Modern Varieties of transplanted Aus

rice was 48 kg/ha. BRRI (1987) stated the optimum seed rate for broadcast, line sown and transplanted Aus crop were about 100, 70 and 45 kg seed/ha, respectively,at Joydevpur. Alim (1982) concluded from the results of several experiments on seed rate for broadcast Aus that 66 kg/ha seed was optimum under normal environmental condition.

For broadcast Aman, Alim (1982) observed that there was a progressive increase in yield with the increase in the seed rate starting from 66 kg to 132/ha, but the difference at each stage was not statistically significant. Recommended seed rate was 82 kg/ha. BRRI (1985) observed that the average seed rate in Broadcast Aman was 66 kg/ha, in Jamalpur and 63 kg/ha in Sherpur, the overall average was 65 kg/ha. For Transplanted Aman, the average seed rate was 45 kg/ha, varying from 45 kg/ha in Jamalpur to 47 kg/ha in Sherpur. The average seed rate for transplanted Aus was reported at 46 kg/ha.

BRRI (1984) found that the average seed rate used per hectare in single and mixed deep water Aman varied from 54 kg/ha in Mymensingh Sadar North to 75 kg/ha in Kishoreganj with the district average of 64 kg/ha. For Transplanted Aman, the average seed rate was 47 kg/ha varying from 39 kg/ha in Mymensingh Sadar North to 53 kg/ha in Kishoreganj. The average seed rate for Aus was 52 kg/ha and for Aman 47 kg/ha. In many cases it was observed that the farmers used more seed than the requirement. It might be due to low germination percentage or to offset loss of germination resulting from reduced moisture content of soil, unfavourable tilth and excess water.

2. Seed Rate of Wheat

Seed rate of wheat varied on the methods of sowing and cultural practices in Bangladesh. AIS (1989) recommended 140 kg/ha for wheat under irrigated condition and 110 kg/ha for rainfed condition. However, the seed rate varied according to local environmental condition in different parts of the country. BARI, BARC, BADC and other research organisations made experiments on the seed rate of wheat. The results of some of the important experiment and study are summarized below.

BARC (1975) stated that the recommended rate of Wheat seed was 70 to 100 kg/ha, with the germination percentage of 81 and the plant population of 103 and 156 numbers/square meter for maximizing yield. BARI (1980) stated that the recommended rate of wheat seed was 110 and 120 kg/ha in irrigated condition for line sowing and broadcasting respectively. To compensate the loss of yield due to late seeding, additional 10-20 kg seeds were recommended. Again, for dry land cultivation, 70-90 kg/ha seeds were recommended depending upon the varieties and time of seeding. In case of Sonalika, additional 10-20 kg seeds were needed for both irrigated and dry land conditions (BARI, 1982). For wheat, BARI (1982)

recommended a seed rate of 120 kg/ha for irrigated condition and 100 kg/ha for non-irrigated condition. Hossain and Elias (1982) in a study found that the rate of Wheat seed used by the farmers of Akcha, Munshirhat and Durgapur was 139, 141 and 140 kg/ha respectively. Elias and Hussain (1983) reported that the seed rate of Wheat varied not only among the farms but also in different locations as well as in different years. In 1980-81, the average seed rate was 143 kg/ha while in 1982-83 it was reduced to 125 kg/ha. The average seed rate in these years was observed lowest in Shailkupa (120 kg/ha) and highest in Daudkandi (146 kg/ha).

BARC (1983) reported that seed rate of wheat varied with types, time and method of planting, moisture availability etc. Under irrigated condition a seed rate of 115 kg/ha was found optimum. Since Sonalika had bigger grains and required lesser tillers, a higher seed rate (5 kg/ha more) was recommended. In late planting (December 15), 10-20 kg/ha more seed was required. Higher plant density might have minimized the yield loss resulting from less tillering.

High yielding varieties of wheat are mostly grown in Bangladesh. CIMMYT (1982) estimated that of the 600,000 ha planted to Wheat in 1980-81 in Bangladesh, about 96 percent was MV. The variety Sonalika, from India was dominant, covering roughly 68 percent of the MV area. Next in importance was the Mexican variety Inia 66, seeded to 10 percent of the HYV area, followed by the varieties Pavan 76, Jupateco 73 and Tanori 71.

3. Conclusion

In conclusion it may be mentioned from Hashem (1986) that four kinds of Paddy are grown in Bangladesh. These are - Aus, Broadcast Aman, Transplanted Aman, and Boro. Seed rate of broadcast and transplanted Aus was 90 kg and 30 kg/ha, respectively. The seed rate of broadcast Aman paddy was 90 kg/ha. The seed rate of Transplanted Aman paddy was 30 kg/ha. The seed rate of Boro paddy was 30 kg/ha. The seed rate of Wheat for irrigated and nonirrigated lands was 110 kg/ha and 130 kg/ha, respectively.

### 2.1.2 Seed Requirement

The quantity of seed required to plant an area of land varies with the type of crop and method of planting. The local variety which is usually broadcast requires larger quantity of seed per hectare than the modern varieties which are usually transplanted with seedling raised in the seed beds, earlier. The cultural practices before sowing and planting in different regions of the country also influence the seed rates.

Hashem (1986) estimated that the yearly national requirement of Modern Varieties (MV) of paddy seed is about 54,000 metric tons

and the Local Varieties (LV) is about 4,82,000 metric tons. The requirement of buffer stock seeds was 10,950 metric tons in recent years.

Total seed requirement for rice and wheat is about 567,720 tons which is 3.4 per cent of the total foodgrains produced in Bangladesh. The yearly national requirement of Wheat seed is about 54,590 metric tons and Paddy is 513,000 metric tons (BBS, Ministry of Food) as shown in Table 2.1.

Table 2.1: Foodgrains (Rice and Wheat) Used as Seed in Bangladesh.

(000 tons)

| Crops | MV | Local | Total |
|---|---|---|---|
| Aus | 12.86 | 197.27 | 210.13 |
| Aman | 117.60 | 148.88 | 266.48 |
| Boro | 27.00 | 9.52 | 36.52 |
| Sub-total | 157.46 | 355.67 | 513.13 |
| Wheat | 54.09 | 0.50 | 54.59 |
| Grand total food grain | 211.55 | 356.17 | 567.72 |

(Based on last 10 years' average acreage and recommended seed rate)

Most of the farmers who grow Wheat and Rice, preserve seeds from year to year from their own produce. Seed sale between farmer to farmer has also been an important form of seed distribution in Bangladesh. It is estimated that more than 80 percent of the total national wheat seed requirement is being met through farmer seed stock and sales among themselves (BADC, 1980).

BADC (1985) stated that the demand for seed particularly MVs of paddy was erratic since farmers themselves attempt to keep their seeds. Damage of crop seeds by natural hazard causes fluctuation in seed demand. Of total requirement, BADC supplied 22 and 5 percent of Wheat and Paddy (MV) seed, respectively.

No study has yet been carried out to determine the exact quantity of seed used for different crops of the country.

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## 2.2 FEED

The use of foodgrain as feed is limited in Bangladesh. The main feed supply for cattle, goats and sheep comes from the by-product of food (bran, husk of rice and wheat) and the by-product of crops (straw, weeds from the crop field). Cattle is also fed legumes and grasses grown on irrigation bunds, fallow lands, road sides and river levies etc. (Hossain 1989, Saadullah 1984). Occasionally, for milch cows farmers use low grade rice and broken rice. But there is no estimate or published report on the quantity of foodgrains used as feed by the farmers. For poultry birds, chicken and duck, farmers use broken rice, wheat and other foodgrains. No statistics are available on the feed and feeding rate of these animals.

In the Government farms and organized private farms, poultry are fed concentrate feeds containing grain. However, the quantum of food grains used as ingredients in the poultry feed is not precisely known. Booklets and leaflets published by the Livestock Department and the Department of Agricultural Extension indicate that foodgrains constitute between 45 percent to 50 percent of the processed feed (Anonymous 1989, Salam and Aftabuddin, 1987).

### 2.2.1. Livestock Population

According to Agriculture Census 1983-84 in Bangladesh, there are 3,62,87,000 livestock heads including 2,14,95,000 cattle, 5,67,000 buffaloes, 1,35,58,000 goats and 6,67,000 sheep. Also there are 7,37,13,000 poultry birds including 6,10,93,000 chicken and 1,26,20,000 ducks (BBS 1986). Besides these, there are some other birds such as pigeon etc. in the country for which no statistics are available.

Bangladesh has a high density of domestic animals ( 2.23 unit cattle and 4.79 unit chicken/ha of land). Dhaka district has the highest density (3.30 unit/ha of cultivable land) of cattle and Noakhali has the lowest density (1.33 unit/ha of cultivable land) of cattle. For chicken Jamalpur has the highest density (9.6 heads/ha of land) whereas Khulna has the lowest density (1.2 heads/ha of land area) (BBS 1989).

### 2.2.2 Source of Feed

Rice straw is the principal component of the diet of cattle and buffaloes. Total production of rice straw in respect of all varieties was 16.9 million tons in 1983-84. Nearly 80% of the total dry feed available for livestock each year in cultivated land comes from rice straw. This feed source has declined both in quantity and quality due to introduction of MV paddy. The increased use of straw as fuel and compost making has further reduced the quantity of this

feed source. It is estimated that about 2.0 kg of straw is available per head per day for the cattle population and supplements amount to about one kg. of green fodder, plus about 20g/day of cereal and oilseed by- products. Tareque (1985) estimated that 48 percent of foodstuff supply wasnot utilised as animal feeds, while Madamba (1985) estimated a loss of 40 percent. The quantity of roughage to be fed depends on the size or weight of the animal, and the requirement of concentrate is dependent on performances in terms of milk production, work and growth of the animal. The roughage consists of straw, hay, grass or legumes, and the ingredients of concentrate mixture are usually rice bran or wheat bran, pulses (crushed), oil cakes, urea-molasses and salts. Concentrates contribute only 5.8% of the total dry matter (Hossain 1989).

Poultry feed sources are quite different. Feed ingredients may be broadly classified as energy supplements (cereals, wheat bran, rice bran), protein supplements (oil cakes, maize, wheat, fish meal, skim milk powder, meat meal), minerals, vitamins, non-protein feed additives (antibiotics, antioxidants). Very little grains are available for feeding of animals in the country. Conventionally, poultry are fed on grains in the Government and commercial farms. The bulk of poultry population are reared by backyard poultry farms on scavenging grains from the field and yards as and when available. Out of the 73 million heads of poultry in the country, only about 0.2 million are reared by specialized farms consuming 45-50 percent grains in the ration. The remaining 72.8 million heads are reared by backyard poultry farms (Dicky & Huque 1986). It is estimated that 190 thousand tons of grains are available to the livestock feeding contributing to 15.7 percent of the total amount of concentrates (Tareque and Saadullah 1988).

### 2.2.3 Livestock and Poultry Farms

Under the Directorate of Livestock Services there are at present five Dairy Farms, one Buffalo Farm, one Sheep Farm, one Goat Farm and one Pig Farm (Appendix 3.8). It is learnt that there is no provision of any grain (paddy, rice or wheat) in the ration of the animals (Dy. D.L.S, personal communication).

Under the same Directorate there are 33 Chicken Farms and two duck farms (Appendix 3.8) consuming nearly 35 metric tons of wheat per day. Chickens consume 120-125 g and ducks consume 140- 150 g of concentrate feed per head per day. Wheat contributes nearly 50 per cent of the total feed (Dy. D.L.S, personal communication).

### 2.2.4 Feed Mills

During the last few years as many as eight Livestock Feed Mills (Appendix 3.9) have been established. The total capacity of these Feed Mills are approximately 250 M.T/day for catering the partial needs of livestock and poultry of the country both in Public and Private sectors (Sheikh, et.al. 1989).

Their cattle feed ingredients are mostly rice bran, rice polish, wheat bran, oilcake, pulses, molasses, salt and bone meal.

The poultry feed ingredients are wheat bran, fish meal, oil cake, pulses, wheat, oyster shell and vitamins. Wheat contributes about 45-50 percent of the prepared poultry feed.

The rice meal comprises rice, rice bran, rice husks and broken rice. The average breakdown of rice milling in the country is rice 67 percent, husk 26 percent, bran 6 percent and broken rice 1 percent. Mainly rice bran, rice husks and broken rice are used as livestock feed.

Five percent of the total available Wheat of 3.1 million tons (1.2 million tons domestically grown + 1.9 million tons imported) is milled for flour. The production of bran at an extraction rate of 20 percent is 27,000 tons, contributing 2.2 percent to total concentrate production. Keeping 10 percent of the total production of pulse for seed and other purposes, about 54,000 tons of bran are produced for use by livestock (Tareque and Saadullah, 1988).

### 2.2.5 Rate of Grain use in the Feed

There is no fixed rate of food grain use in the animal feed in rural Bangladesh. However several authors proposed different rates of rice and wheat bran/broken grain for use in the animal feed (Table 2.2). Fisheries and Livestock Department of the Agricultural Information Services (Anonymous, 1989) indicated 1500 gm of wheat/rice bran per head/day for bullocks, 2000 gm for milch cows, and 1000 gm for buffaloes. Conventionally food grains are not used in the feed of cattle, buffalo, sheep or goat. For chicken and duck different rates are proposed by Anonymous, 1989 and Salam and Aftabuddin, 1987 for different age groups. However, on the average, the rate of food grains in the feed is about 60 gm per head per day for chickens and 75 gm per head per day for ducks.

Table 2.2: Rate of Bran and Broken Rice/wheat Used in Livestock and Poultry Feed cited by different Authors.

| Livestock & Poultry | Rate gm/day/head | Source |
|---|---|---|
| Bullocks | 1500 | DAE, 1989a |
| Milch Cow | 2000 | Ahmed 1984. |
| Dry cow | 1000 | DAE 1989a |
| Buffalo | 1000 | - - |
| Chicken | 120 | DAE 1989b, 1989c |
| Duck | 150 | DAE 1989d |
| Goat | 250 | - - |
| Sheep | 250 | - - |

## 2.2.6 Quantity of Foodgrains Used as Feed

There is no statistics available in the country on the total quantity of foodgrain used as Cattle and Poultry feed. The total quantity of foodgrain used as feed in the country may be estimated from the number of livestock and poultry and the rate of foodgrain use as feed. Sheikh et.al 1989 cited that annual requirement of feed for livestock including green grass and roughages are 9,00,00,000 MT/year. Rice bran/Wheat bran requirement is 1,08,00,000 MT/year (@ 1.5 kg/head/day) and requirement of other grains such as Kheshari/Masur (pulses) are 36,00,000 MT/year (@ 0.5 kg/head/day) in Bangladesh. The present study was designed to estimate the total quantity of foodgrain use as feed in the country.

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## 2.3 WASTAGE: POST-HARVEST OPERATIONS

### 2.3.1 Post-Harvest Operation

The post harvest operations for rice and wheat include field stacking, carrying of harvested crop to threshing yard, threshing, cleaning, drying, parboiling and milling of grains. Other processes such as marketing, transportation and storage of foodgrains will be discussed in respective sections.

Rice is harvested by sickle. The harvested paddy is left in the field before carrying to the threshing yard generally at home. Sometimes threshing yard is prepared in the field. This is done in Aman season. If rice is harvested in flooded field, the bundles are kept on levee. Considerable yield is lost during the process. In Aman season, sometimes grains are left in the field after harvest for few days for drying. This is not a very good practice as grain shattering increases during transportation to threshing yard. This practice is not seen much now as farmers are afraid of grain theft from the field.

The harvested crop is transported from the field to the threshing yard by head-load, shoulder load or sling, carts and others like rickshaw van. During the carrying process considerable grains are also lost.

Occasionally, farmers need to stack their harvested crop near their threshing yard for few days when they are very busy with harvest, and/or bullock and pedal thresher is not available immediately. Sometimes, in Aman season they do it willingly to soften the stalks of grains so that they can be threshed easily. If harvesting is done by contract labour on grain share basis, the threshing is done on the same day whenever possible. Continuous rain sometimes compel farmers to stack their wet grain at threshing yard. Quality deterioration and loss of grain due to eating by livestock and poultry birds may occur during the process.

Hand beating against drum or wooden pieces, bullock- treading, the use of pedal thresher and the combination of hand beating followed by bullock-treading are the common methods for paddy threshing. Both quantitative and qualitative loss may be due to threshing. During threshing husk of the grains may also get damaged which will be susceptible to easy insect infestation. Threshing by pedal thresher makes the grain most susceptible to husk damage and hand beating against drums or smooth wooden pieces the least susceptible. Wet grains are more susceptible to husk injury which is most common in Boro and Aus crop.

Winnowing and cleaning to separate plant materials and grains are done commonly by the use of 'Kula', wind breeze or fanning. This operation helps to improve quality of grains. If grains are not cleaned properly, the presence of chaff, other plant materials

and foreign matters lower the quality of grains. In the wet season however, it is difficult to clean the grains properly. Boro and Aus crops mostly face this problem. A considerable grain is lost during the process.

Rice is dried under the sun before storage. The home yard is used as drying floor. In the dry months farmers do not face any problem in drying paddy but in the wet months they face difficulty because of rain and wet floor. Sometimes in the summer farmers overdry their crop causing damage to the grain. A considerable quantity of grains is lost during the process.

Parboiling is a traditional process in the country except Chittagong and Sylhet. It is mostly done by the farmer at farm level. Rice is soaked generally for 24 hours and then steamed till the opening of husk. Parboiled paddy is then dried in the sun. Underparboiled rice gives more breakage during milling. More breakage also occurs if rice is overdried after parboiling.

Rice is milled at farm level generally by husking machine with steel huller and sometimes with Dheki. The Dheki which was a very common traditional device for milling rice a few decades ago, is now rarely used for milling purpose. Dheki gives undermilled rice which is more nutritious but has poor storing quality.

### 2.3.2 Study on Post-Harvest Wastage

Wastage refers to the quantity of foodgrains which is not available either for food or feed. It is usually lost during post harvest processing involving foodgrains which drop during transportation from field to threshing yard; which scatter during threshing operations and winnowing but not collected and which are eaten by scavenger, poultry and ducks as well as birds while drying the grains. Small quantities are lost during transportation from farm to market, from one market to another and in course of storing at farm and traders level. These wastages or losses can not be totally eliminated but can be reduced if right kinds of economically feasible measures are adopted. However, such losses create problems for countries like Bangladesh having shortage of foodgrains every year.

Studies have been conducted in Bangladesh and elsewhere to identify the agents of loss and its extent. Some of the literatures deal with wastages occurring between harvest and winnowing, some deal with other aspects of post harvest operations.

Estimates of wastage or loss of foodgrains during post harvest operations would differ depending upon the varieties of crops, climate and weather conditions during harvesting. In case of local varieties post harvest loss is higher than the high yielding

varieties. When treading by bullock method is used in threshing on wet-floor, the loss is higher than that of dry floor.

Besides physical and biological factors, food losses are related to social phenomena. Cultural attitudes and practices associated with post harvest operations also determine the extent of food grain loss.

Rice harvesting in Nepal is similar to that in Bangladesh. Harvesting is done manually with a sickle, harvested grain- bundles are carried to threshing yard on shoulder-slings and then threshed with oxen or beaten against drums or wooden logs to separate the grains from the stalk. But Mallick (1981), in his book on Rice in Nepal referred to a study in that country which found about 22% loss occurred during threshing and harvesting, field drying, carrying to threshing floor and threshing with oxen. This estimate appears to be rather higher than the estimates made in Bangladesh (ARDICOL 1988, Quasem, 1985, FAO, 1985).

Greely (1980), conducted a study in 4 villages from Chandina upazila of Comilla district and in 4 villages from Madhupur of Tangail district on farm level post harvest loss of rice. He reported of total physical losses in operations from harvesting to drying not exceeding 7 percent.

Karim and Hurley 1982, conducted a study in 1981 on Aus paddy in Mymensingh found a loss of 3 percent during cutting and threshing operations.

Haque, et.al 1984, while talking of post harvest technology stated that improper harvesting and threshing usually result in losses of upto 5% of the crop. This seems to be a closer estimate found by a number of authors (ARDICOL 1988, BRRI 1985. FAO 1986) carrying out a detailed study on post harvest losses covering 35 villages in Dhaka, Sylhet, Comilla, Bogra and Rajshahi districts. Crops studied were Aman of 1983, Boro and Aus of 1984. Loss assessment in harvesting was done on a measured area of 50 sq. meter (10m x 5m). The crop was harvested using sickles, bundled, transported and threshed to get the grain weight as obtained yield. The grains that fell on the ground were manually collected indicating that the study was meticulously performed. Estimates of post harvest losses covering relevant operations were 5.31 percent for 1983 Aman, 3.72 percent for 1984 Boro and 4.28 percent for 1984 Aus. Loss occurring in various stages is shown in the Table 2.3.

The loss on account of drying was also reported to be 2.11 percent in case of Aman and 1.63 percent in case of Boro. The drying loss of Aus 1984 was 2.84 percent while it was 1.86 percent for Aus 1983. The Aus season of 1984 had less sunny days than in 1983 Aus. The above losses are in addition to quantities indicated in the above table (after Haque, et. al 1984a, 1984b).

Table 2.3 : Percentage of Post harvest losses of Aus, Aman and Boro crops during 1983-84 in Bangladesh.

| Post-harvest operations | Aman (1983) | Boro (1984) | Aus (1984) | Average |
|---|---|---|---|---|
| Pre harvest * | 0.49 | 0.32 | 0.26 | 0.41 |
| At harvest** | 2.01 | 0.82 | 1.75 | 1.53 |
| Field stacking/ bundling/drying | 0.80 | 0.72 | 0.58 | 0.70 |
| Field transport | 0.57 | 0.52 | 0.52 | 0.54 |
| Threshing | 0.98 | 0.77 | 0.81 | 0.86 |
| Cleaning/Winnowing | 0.46 | 0.57 | 0.36 | 0.46 |
| Sub-total | 5.31 | 3.72 | 4.28 | 4.75 |
| Drying | 2.11 | 1.63 | 2.84 | 2.19 |
| Parboiling | 2.04 | 1.93 | 2.75 | 2.36 |
| Milling | 3.28 | 4.54 | 3.55 | 3.79 |
| Storage | 0.30 | 1.20 | 0.30 | 0.60 |
| Total | 13.04 | 13.02 | 13.72 | 13.26 |

* excluded from total. ** Loss due to shatering at harvesting time.
Source: FAO, 1986

FAO conducted a post-harvest rice loss assessment survey in the country during 1982 and 1984 cropping seasons (FAO, 1986). The study showed that from harvesting through drying and cleaning of unparboiled paddy there was 5.4-7.4% grain loss, the highest loss was in Aman 7.4 percent followed by Boro 5.3 percent. The lowest loss occurred in Aus (5.1 percent) season. The grain shattering was the major cause of high loss in Aman season. Deep water rice suffered very high loss because of their uneven lodging of the plant in the field. Delay in harvesting in Aman season was also responsible for preharvest as well as post- harvest shattering. Modern varieties suffered less shattering loss than local varieties.

The threshing methods observed in the FAO project were bullock treading, hand beating and pedal thresher. The hand beating caused highest loss. The pedal thresher had similar loss as hand beating. The bullock treading had the lowest loss. The study also showed that large farmers suffered slightly higher losses than the small farmers.

The FAO study also reported that about 80 percent farmers were aware of the loss in the different post harvest operations. More than 60 percent farmers opined that the losses were normal and occurred naturally.

## 2.4 MILLING LOSSES

Milling of rice in Bangladesh is a process which involves parboiling, drying and then milling. Wheat milling involves cleaning, conditioning and flour milling. In greater districts of Sylhet, Chittagong and Chittagong Hill Tracts the local people consume unparboiled or 'Atap' rice. In Bangladesh rice is milled either manually or mechanically. Before the sixties most of the rice of Bangladesh was used to be manually milled with the help of 'Dheki' a hand/foot operated mortar and pestle. BCSIR, World Bank's report (1981) revealed that there had been a steady growth of mechanical milling of rice increasing from 17% in 1967 to 30% in 1981. The growth is much higher in 1990. About 60% rice husking is made using Dheki, 30% by rural husking mills and 10% by commercial mills (BCSIR, 1982) in the country.

The method of milling varies with the nature of milling and types of mills. Rice mills may be divided into following 5 classes:

- Rice husking by 'Dheki' at home-stead level.
- Rural husking mills without drying yard.
- Husking mills with drying yard.
- Major rice mills (MRM).
- Automatic/modern rice mills (ARM).

Information on the total number and capacity of currently operating/existing rice mills and dhekies in the country is not precisely known. Rice mills are required to take license from the Food Department. The task force report by the BCSIR/BSB in 1981 showed the number of husking mills was 10,495, major mills was 300 and modern mills was 20. The growth of husking mills during 1977-81 was estimated by the Task Force at 700 per annum. BBS (1989) reported that there were 251 major rice mills with a daily milling capacity of 4066 tons of rice in 1985.

### 2.4.1 Parboiling and Drying of Paddy

In rural areas farmer level parboiling process consists of placing the paddy in earthen wares and soaking in water for 24 to 48 hours (ARDICOL 1988). The soaked paddy is then poured into metal or earthen pans and steamed for about 30 minutes to one hour. Usually rice straw or paddy husk is used as fuel. The paddy is then sun dried in kutcha courtyard. Wherever available, farmers also use metalled road surface for drying paddy. Such drying usually takes 1 to 3 days depending on availability of sunshine, temperature, day length and type of surface of the drying yard. In winter it takes about 2 days for drying Aman crop; drying of Aus crop is usually completed in one day with full sunshine of summer, and in wet summer it takes longer period. Same is true for drying Boro paddy. During sun drying poultry and bird scaring is necessary and the

paddy is raked with a 'harpata' or turned around with feet. Generally the services of the female members of the family are used for parboiling and drying and the drying capacity per family is about 4-5 maunds a day. High yielding varieties require longer time than the local varieties in parboiling.

### 2.4.2 Milling of Rice

1. Dheki: Dheki is a foot operated mortar and pestle, processing about one maund of paddy per day usually requiring attention of 2 to 3 women. The out-put is roughly 2 to 4 kg per woman- hour. Milling by dheki is time consuming and highly labour intensive. Rice, broken rice, husks and bran are separated by winnowing using basket or 'kula'. Rice out turn is highest in this process, about 69-72% with higher proportion of broken grains. Storing quality of dheki rice is low but this creates no problem as the rice is consumed immediately. Nutritionally dheki rice is superior to milled rice and rural people have preference for dheki rice. Husks and brans are by-products and these are used as fuel and animal feed respectively.

2. Rural Husking Mills without Drying Yard: In the husking mills which do not provide parboiling and drying facilities the customers themselves parboil and dry paddy in the homestead and bring the dried paddy for milling only. These are mostly single engine Engelberg-type hullers. Capacity of such huller generally varies from 0.4 to 1.3 tons of paddy per hour. Milled rice which is a mixture of whole grain and broken rice of medium to low quality and ground-up rice husk mixed with bran and small broken are the products of these mills. These products are separated by the customers either with the help of family labour or by hired labour. Total rice out turn of these mills varies from 66 to 69%.

3. Husking mills with Drying Yard: Such mills have parboiling and drying facilities. These mills may take up parboiling and drying of their own paddy or the customers' paddy on contract basis. Metallic containers are used for parboiling where grains in the bottom are boiled in water and those in the upper layers are steamed during parboiling causing non-uniform parboiling affecting quality of rice. Parboiled paddy is dried on the concrete drying yards. The paddy is turned by attendants for uniform drying. Where major roads and national highways are used as the drying floor, vehicular traffic running over the paddy crack the kernels resulting in higher percentage of broken rice. In such cases paddy is also mixed up with dust, dirt, oils, lubricants and other foreign matters affecting the quality of the grains.

4. Major Rice Mills: Like the husking mills they also do not pre-clean paddy before parboiling. They generally steam paddy for 5 to 10 minutes before soaking. This steaming time is not long enough to kill the paddy germs. Steamed paddy is soaked in concrete tanks.

Soaking time varies from 24 to 36 hours. They generally change the water after each batch to avoid bad odour. Soaked paddy is parboiled for 10 to 20 minutes in steel/iron pans. The parboiled paddy is sun dried in large concrete/cement drying yards. There are some losses in course of sun drying due to feasting by birds with an estimated average of 0.74% ranging from 0.01% to 2.25%. These are non-modernized mills using 4 to 5 steel hullers with capacity varying from 1 to 2 tons per hour. The mills usually have improved multi-stage equipment to remove the husks and more carefully polish the grains to produce a higher quality milled rice than is possible by the husking mills. Total grain outturn is lower than husking mills but the proportion of broken rice is lower. Keeping quality of the rice turned out by these mills is much better that of usking mills.

5. Automatic/Semi-automatic Rice Mills: The automatic rice mills have full range of equipment for pre-cleaning, soaking, parboiling and drying whereas the semi-automatic rice mills generally do not have the mechanical dryers because of high operating cost. Some of the automatic rice mills which have the dryers use the same during rainy season only and go for sun drying during the rest of the year. Some of the automatic rice mills have also some adjustment for manual parboiling facility using husk-fired boiler for steaming of paddy before and after soaking. The mills generally have paddy separator and rice grading and produce better milled rice with higher outturn, less broken and less moisture with better keeping quality. Capacity of these mills veries from 1.5 to 6 tones of paddy per hour. These mills operate on their own account and also under contract with the food department for milling locally procured paddy. They also mill paddy of traders.

6. ARMs and SARMs: Upto seventies only one Automatic Rice Mill (ARM) was in operation. Government encouraged establishment of ARM on the ground of higher recovery and improved quality of rice with better keeping quality because of lower broken and moisture content, and better quality of by-products than husking mills. Bangladesh Shilpa Bank (BSB), Bangladesh Shilpa Rin Sangstha (BSRS) and Bangladesh Krishi Bank (BKB) provided necessary fund for setting up of ARMs and SARMs. By March, 1988 (ARDICOL 1988) these financial institutions have funded 66 ARMs and SARMs in the country.

### 2.4.3 Milling of Wheat

Modern wheat processing and milling include wheat cleaning, conditioning and flour milling. According to information available no comprehensive study has yet been made in Bangladesh regarding loss of wheat due to milling. From the information available in the Food Department, it reveals that there exist three types of wheat milling facilities in Bangladesh where losses of wheat may occur. The process of wheat milling are briefly described below:

1. Small Scale Wheat Crushers: These are diesel/electricity operated low capital intensive small crushers owned by individual entrepreneurs. The farmers/owners bring their wheat to the mill for crushing in exchange of some charges. After crushing the owners take back the crushed wheat and separate the flour from bran. The separated flour is locally called 'Atta' and used as human food. The bran is used as cattle or poultry feed. This type of wheat crushers are available in each nook and corner of the country and their actual numbers have not yet been surveyed. These crushers do not get any allotment of wheat from the Food Department.

2. Roller Mills: This type of mills are of medium size. These are electrically operated. As per information with the Food Department, in June 1990, there were 789 roller mills in Bangladesh with a total monthly crushing capacity of 13,661 metric tons of wheat in one shift basis: Food Department allocated 1,566.50 metric tons of wheat for the month of June, 1990 to get 1,019 metric tons of flour.

3. Major/Compact Flour Mills: As per Food Department the total number of Major/Compact Flour Mills in June, 1990 was 171 with a monthly crushing capacity of 43,977.88 metric tons in one shift basis. In June, 1990 Food Department made allocation of 23,432 metric tons of wheat to these mills to get 14,350 metric tons of flour at the rate of 65% yield.

### 2.4.4 Process of Wheat Milling

1. Wheat Cleaning : Wheat arriving at the flour mill is either grown locally or brought from another country through import. The locally grown wheat comes straight from the threshing floor, or from storage in rick or silo, and it may have already been dried on the farm. The imported wheat is generally passed from the field to a silo where it may receive preliminary cleaning, and from there is brought by ocean vessel to a port and thence to different distributing points including will by barge, rail or road transport. The wheat, as the miller receives, may contain impurities that enter from the field, during storage and transport, or accidentally. The impurities frequently encountered include mud and dust, weed seeds, other cereal grains, straw and sticks, husk, stones, fungal impurities, insects, mites, rodent excreta and hairs, string and binder twine, fragments of metal, etc (Kent 1966, Lockwood 1960, Jones 1964, Scott 1951, Smith 1944 and UNIDO 1979).

2. Wheat Conditioning: The objectives of wheat conditioning are primarily to improve the physical state of the grain for milling, and sometime to improve the baking quality of the milled flour. The process of conditioning involve the addition of moisture to wheat which is too dry or the removal of moisture from those grains which are too wet. The particular objectives of conditioning as regards

milling are to toughen the bran and make it less brittle, to improve the separability of endosperm from bran, to increase the friability of the endosperm, and to improve the sifting of the flour.

3. Flour - Milling: The objectives of the milling of wheat flour are:

- To make a separation of the endosperm from the bran and germ so that the flour shall be free from brown speck and good colour, and the palatability and digestibility of the product shall be improved and its storage life lengthened.

- To reduce the maximum amount of endosperm to flour fineness, thereby obtaining the maximum extraction of wheat flour from the wheat, and at the same time to ensure that the amount of damage to the starch granules does not exceed the optimum. The reduced endosperm is the flour, the germ, bran and residual endosperm is a by-product used primarily for animal feeding.

4. Whole Meal and Brown Flour: Whole meal and brown flours have extraction rates more than 85% (95-100% extraction). They are frequently made by adding all for whole meal or some for brown flour of the offals to the straight run flour, milled as white flour. The course bran would generally be ground before blending with the flour and fine offals.

5. Hygiene of Flour Mills: Insects do not flourish if frequently disturbed and exposed to light. Hence regular sweeping and cleaning help to control them.

### 2.4.5 Foodgrain Loss Due to Milling

Loss of foodgrains (rice and wheat) also occur during milling process, but no quantitative information is available. Study (IDST 1984) undertaken by the different organizations have a component of milling but the information provided is not enough to make conclusion.

ARDICOL (1988) observed that in the milling process maximum outturn of rice was 68.4 percent by Dheki, followed by husking mills 67.1 percent, modern mills 66.8% and minimum outturn by major mills 66.2%. They observed system loss of 1.3% due to milling in the modern mills only (they do not show any loss due to other milling process). They also observed a loss due to dust and dirt of 1.5% in Dheki, 2.1% in husking mill, 3.6% in major mills and 2.45% in modern mills. The quantity of husk realized was 17.2% in Dheki, 30.8% in husking mills, 21.9% in major mills and 25.3% in modern mills. The realization of bran was 12.9% in Dheki, 8.3% in major mills and 4.43% in modern mills (Table 2.4).

Table - 2.4 : Physical Properties of Rice Processed in Different Types of Commercial Rice Mills and Dhekies (ARDICOL1988)

| Sl No. | Types of Mill | Degree of Milling | Moisture content | Breakage (%) | Foreign matter(%) | Immature (%) | Damaged (%) |
|---|---|---|---|---|---|---|---|
| 1. | HRM | WM | 13.20 | 15.20 | 0.20 | 0.80 | 1.60 |
| 2. | HRM | WM | 12.00 | 24.00 | 0.20 | 1.60 | 0.90 |
| 3. | MRM | MM | 11.60 | 16.50 | 0.50 | 2.70 | 1.80 |
| 4. | HRM | WM | 11.20 | 19.60 | 0.20 | 1.10 | 0.60 |
| 5. | HRM | MM | 13.20 | 23.20 | 0.30 | 1.00 | 0.80 |
| 6. | Dheki(A) | UM | 14.10 | 13.70 | 0.20 | 1.70 | 1.70 |
| 7. | HRM | WM | 12.20 | 18.40 | 2.20 | 0.80 | 0.80 |
| 8. | Dheki | UM | 14.70 | 6.45 | 0.20 | 1.00 | 2.00 |
| 9. | MRM | MM | 12.40 | 14.30 | 0.40 | 2.30 | 1.40 |
| 10. | ARM | UM | 12.60 | 13.60 | 0.10 | 1.10 | 0.90 |
| 11. | SARM(A) | HUM | 14.60 | 45.00 | 0.40 | 1.40 | 0.90 |
| 12. | SARM(A) | UM | 14.00 | 40.40 | 0.50 | 0.90 | 0.90 |
| 13. | SARM | UM | 14.10 | 14.20 | 0.50 | 1.10 | 1.10 |
| 14. | SARM | MM | 13.60 | 18.10 | 0.50 | 0.50 | 0.50 |
| 15. | SARM | UM | 14.20 | 23.50 | 0.40 | 0.40 | 0.40 |
| 16. | MRM(A) | UM | 13.10 | 31.50 | 0.50 | 2.70 | 3.20 |
| 17. | MRM | MM | 12.90 | 27.70 | 0.40 | 1.20 | 0.80 |
| 18. | MRM | MM | 11.80 | 19.60 | 0.20 | 0.80 | 0.40 |
| 19. | MRM(A) | HUM | 13.00 | 11.60 | 1.60 | 2.80 | 0.80 |
| 20. | MRM(A) | UM | 12.40 | 34.90 | 0.20 | 0.80 | 4.60 |
| 21. | MRM(A) | UM | 13.50 | 24.40 | 1.10 | 2.80 | 6.00 |
| 22. | MRM(A) | WM | 13.20 | 26.10 | 0.10 | 0.90 | 0.50 |
| 23. | MRM | UM | 13.50 | 9.20 | 0.20 | 4.40 | 3.30 |

HRM = Husking Rice Mills, ARM = Automatic Rice Mills,
SARM = Semi-automatic Rice Mills, MRM = Major Rice Mills,
A = Atap Rice, HUM = Heavily under milled, UM = Under Milled,
MM = Medium milled, WM = Well milled.

NB:Samples collected by ARDICOL from the Mills/Market in different parts of the country.
Source : ARDICOL, 1988

Apart from milling methods milling out-turn varied due to the following factors:

- Variety :High Yielding Varieties(HYVs) had a higher rice outturn than local varieties.

- Quality of Paddy : Paddy containing excessive foreign matters, chaff and admixtured with different varieties yielded lower rice outturn. There had been a general complain that Food Department paddy had higher foreign matter content and was highly admixtured resulting in lower rice outturn.

- Moisture Content : Excess moisture content in paddy also affects the rice outturn.
- Management and Condition of the Mill : Poor level of management and old/unsatisfactory condition of the mill also results in lower rice outturn.

### 2.4.6 Milling Charge

ARDICOL's report revealed that the charge realized by the electricity/diesel operated rural husking mills for milling only varied from Tk. 0.11 to Tk. 0.19 per kg of paddy. The charge realized for parboiling, drying, milling, cleaning and handling by the husking mills or major mills found to be between Tk.0.38 and Tk.0.46 per kg including the imputed value of husk and bran which are retained by the mills; cash charge varied from Tk.0.18 to Tk.0.27 per kg of paddy. Total charge realized by the ARMs/SARMs for the above operation ranged between Tk.0.48 and Tk.0.67; cash charge varied from Tk.0.27 to Tk.0.40. Total charge realized for milling by dheki including parboiling, drying, cleaning and transportation varied from Tk.0.54 to Tk.0.80 per kg of paddy; cash charge varied from Tk.0.40 to Tk.0.67. The Food Department pays milling charge to the contracted millers at the rate of Tk.0.23 per kg to the husking mills and major mills and Tk.0.27 per kg to automatic rice mills. The millers are responsible for parboiling, drying, cleaning, bagging, stitching, weighing and delivery ex-mill. The millers deliver rice at the prescribed rate varying from 63.5% to 66.67%. The millers retain the husk, bran and the excess rice recovered, if any.

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## 2.5 STORAGE LOSSES

Storage loss can be classified into quantitative and qualitative loss. Quantitative loss occurs due to unsatisfactory packing and packing materials, insufficient precaution against theft, pilferage, insects, birds, rats, rains, moisture content, etc. Foodgrain quality deterioration is due to excessive moisture content, heat, fungi, lack of timely checking and segregation, lack of drying facilities, spraying, insecticides, etc.

### 2.5.1 Existing Storage Facilities and Practices

1. Farm Level Storage

The storage structure and practices at farm level vary from place to place. Farmers store their surplus rice as raw paddy, parboiled paddy or parboiled milled rice. ARDICOL (1988) stated that surplus rice has been considered as rice which was not consumed by the farmers but sold immediately after harvest. It was observed that the paddy for sale was stored in the farm as raw or unparboiled paddy. ARDICOL (1988) also observed that farm level storage structure could be broadly classified as bamboo type and pot type. Among bamboo type structure "Dole" and "Gola" are predominant. "Dabor", "Motka" and "Cola" (Mait) are major pot type structures. Gunny bags, earthen jar and metal drums are also used.

Gola and Doles are made from bamboo with or without plaster of cowdung mixed with mud. These stores are built or kept on elevated platform to avoid damp and rodent attack. Such structures also allow ventilation. Some Golas are also made of corrugated tin. Dabor, Motka and Gola are made of earth. The size and shape of these pots are round with narrow mouths which are closed with lids. These pot type of structures are constructed hard and compact, and save grain from insect, rodent attack and weather hazards. Among the other types, bags and drums are used for temporary storage of raw and parboiled paddy and rice. Bags are usually kept on pallet to avoid moisture migration from kutcha floor and to provide ventilation. Sometimes grains are stored temporarily on the floor.

The Gola and Dole are used for storing raw paddy (unparboiled). Dole is plastered with mud to store parboiled paddy. Earthen pots are used for storing parboiled milled rice. Metallic pots are generally used for storing seed and wheat. Used woven polypropylene fertilizer bags are also used for storing wheat seed. The pot structure has more protection against rats and insects than bamboo made structures.

## 2. Storage at Traders Level

In private trade the storage function is basically concerned with making the product available at desired time. Storage of agricultural products for longer period is the usual practice as the crops are required to be carried over from one production season to another to ensure continuity of supply without interruption. Foodgrain crops namely, rice and wheat are harvested during relatively short period of time and these are highly seasonal. The demand for foodgrains on the other hand is quite constant throughout the year. The storage function ensures matching of market supply with consumption pattern. In Bangladesh different rice crops are harvested almost year round. Because of the harvesting of three crops in the country in different months of the year, the need for storage of the crop for a long period is reduced which would have been necessary in case only one crop was harvested.

ARDICOL (1988) reported that 78.9% of the traders stored their Aman paddy for less than one week; over 15.6% for less than two weeks while only 5.5% of all traders reported that they stored the Aman paddy for the period upto one month and none beyond a month.

Storage of Aus paddy showed that nearly 86% of all traders reported to have stored Aus paddy for less than one week while only 14.3% of the traders stored for the period upto two weeks. This implies that about 100% of the traders stored their Aus paddy for one and two weeks. In case of Boro paddy the survey revealed that 80.4% of the traders stored their Boro paddy for less than one week while 11.2% of the traders stored for two weeks. Over 8% of the traders stored Boro paddy upto one month. In case of wheat 100% of all traders stored their wheat for less than a week. About 84% of Aman rice, 86% of Boro rice and 89% of the Aus rice were stored upto one week by different types of traders.

## 3. Warehousing Facilities for Farmers

To make provision of Public Warehousing Facilities with a view to (i) enabling the farmers to obtain high price for their crops, (ii) increasing supply of credit in the agriculture sector and (iii) reducing food losses through improved storage facilities many committees, commissions and consultation were appointed in the sub-continent since the thirties. Quasem's study (1987) shows that the small and marginal farmers sell larger proportion of their marketed quantity of paddy/rice after harvest at a lower price and buy back at a much higher prices during off- season. The small/deficit farmers who are forced to sell their crop at a very low price immediately after harvest to meet their urgent need for cash can be assisted in getting higher price for their crops if they have access to public warehouses. They can store their crops in these warehouses immediately after harvest where storage loss would be minimum and borrow from banks against the crops stored in

the warehouses to meet their urgent need for cash and thus stave off post-harvest sale at a low price, and sell the crops at the most opportune time.

## 4. Foodgrain Seed Storage

In this sub-chapter attempt has been made to provide a world-wide review of the principles and objectives, organization and methods of cereal (Rice and Wheat) seeds storage in different stages from harvest to next plantation. Production and distribution of quality seed is recognised as one of the main inputs required to achieve increased crop productivity, yields and cropping intensities. The expanded use of quality seed in conjunction with other inputs such as water and fertilizer, is essential to the progressive intensification of agriculture. The production and utilization of quality seed are still limited in many developing countries due to inadequate technical knowhow. In developing countries, increased foodgrain crop production is the main issue, as the food supply will have to be increased annually to keep pace with population growth and to meet the demand for food. However, in most developing countries the increases have been well below this level in recent years.

Provisional seed status review made in 1970 by FAO (Barton,1967) covering ninety seven countries indicated that more than 90 percent of the seventy three developing countries studied would need to develop or strengthen their seed production and supply system. In 1975 FAO published a Monograph on cereal seed technologies. Seed is a living thing. It is subject to genetic and other transformation and death. Therefore, the maintenance of genetic characters and physical quality demands well-defined procedures and control breeding to farm delivery. Quality seed is a product of specialised farming. The subject matter covered may be divided into ten broad divisions such as variety evaluation, variety release, seed production, seed processing, seed storage, seed marketing, seed testing, seed certification, seed legislation and extension. Barton (1961) has listed as many as 708 references on storage investigations, plus hundreds of others on such topics as humidity, storage temperature, drying requirements and factors affecting germination, viability and vigour. Investigations on the maintenance of seed viability during storage have ranged from the time the seed reaches physiological maturity until it is planted including the following stages:

- in the field before harvest,
- between harvesting and processing,
- after processing until despatch
- in transit,
- in retail distribution points, and
- on the users premises.

### 2.5.2 Foodgrains Loss During Storing

A few studies carried out earlier on foodgrain storage loss at farmers level, traders level and Government warehouses are reviewed briefly in the following paragraphs.

1. Loss at Farmers Level

Farmers identified proper drying as the most important measure for maintaining grain quality both for long and short term storage. For long-term storage two stages of drying have been mentioned. First, grain must be well-dried before storage and second, if grains absorb moisture from ambient atmosphere, they are dried again. Use of pesticides by the farmers to prevent infestation in stored grains is not common. Savin and Phostoxin are generally used as pesticides by the farmers to prevent insect infestation.

FAO conducted a post-harvest crops loss on rice in Bangladesh during the year 1982-84 (FAO, 1984). The findings reveal that storage loss of Aus and Aman crops during 1983 stood at 2.3% and 0.30% respectively. In the following year 1984, storage loss of Boro and Aus crops was 1.2% and 0.3% respectively indicating that storage loss of foodgrain varies from year to year and by crops. ARDICOL (1988) reported that for a satisfactory storage, grains should be properly dried and cleaned and kept free from infestation, bad odour and foreign materials to maintain their quality. According to them, the combination of these four measures are required to maintain quality of grain.

At farmers level, rat damage and insect infestation were identified as the major problems for maintaining grain quality in the store. The FAO (1984) study indicated that the farmers were more concerned with rat infestation in the store. The stored paddy in bamboo made Dole or Gola could not give protection against rat damage. Milled rice had less exposure to rat attack as they were generally stored in Motka. However, loss estimate in the storage due to rats (rodents) was not available as reliable loss estimation procedure was not known.

In the bamboo made Dole and Gola, insect infestation was common, but the farmers did not consider it as an acute problem. The FAO (1984) stated that not more than 1% grains were lost due to insect infestation in the stores. The milled rice stored in Motka sometimes also got insect infestation. The Motka is protected against the insect, if the lid is closed and plastered with mud. Still the grains may have infestation in it if they were already contaminated during drying and milling of parboiled paddy.

## 2. Loss at Traders Level

At traders level, rat damage appears to be the major cause of foodgrain loss which accounts for 36% of the total storage loss. Damage by rain (18.19%) as well as for damp (16.53%) due to poor physical condition of the storage appears to be equally significant causes which together accounts for 34.72% of total foodgrain storage loss (ARDICOL, 1988).

ARDICOL (1988) reported that the storage structures with the private trade are of three types such as KUTCHA, SEMI-PUCCA and PUCCA. Kutcha structures have beaten earth floor, bamboo/CI sheet walls and CI sheet roofs; semi-pucca structures have cemented floor, CI sheet/cemented walls and CI sheet roofs, while pucca structures have cemented floor, cemented walls and concrete roofs. In the primary markets the structures are mostly kutcha while in assembly and terminal markets they are semi-pucca or pucca. Even in the wholesale market of Dhaka city some of the structures have Kutcha floor. They are subjected to rat infestation and leakage of rain water. In the wholesale market of Dhaka city about 50% of the assemblage are kept on the road/open space on bamboo dunnage.

ARDICOL (1988) made a study on shelf-life of food grains with respect to harvest time. They observed that the shelf-life of foodgrains depends on post-harvest quality control measures, the type of storage used and storage practices adopted by farmers. In Bangladesh different rice crops are harvested at different time of the year and so the shelf-life of foodgrain also depends on the weather condition at harvest time as well as post-harvest period when the grains are stored. This implies that the storage period and the shelf-life also depend on the cropping pattern and harvest season. BRRI (1985) stated that in simulated village level storage system, the moisture content in paddy had a tendency to decrease in the storage period from January to March. It also depicted that the moisture content of stored paddy increased from April to September. During December to March the temperature and humidity remain low. During this period the stored paddy has no chance to absorb moisture from atmosphere if they are stored at safe moisture content (less than 14%). The wet season starts in the country from May and continues upto September. During this wet season both the temperature and humidity in the atmosphere are high. In such condition stored paddy absorbs moisture even if they are stored at safe moisture content. The high moisture content in the stored paddy makes them susceptible to insect and mould infestation. The FAO (1985) observed that the most common insects in the store were rice weevil (Sitophiles Oryzea L.), grain borer (Rhizophus dominica F.), grain beetle (Tribolium castemium H.) and grain moth (Sitotrogra cerealella O.).

## 3. Loss at Government Warehouses

EUREKA Report (1986) explained the causes of storage loss i Public Sector Warehouses. According to them there are three mai causes of storage losses, namely grain quality, godown conditio and management standard. All these three factors are interactiv in character. Storage loss varies with type of construction o godowns. Construction has been divided into two types: Pucca an Semi-pucca. A pucca has the floor, wall and roof of cemen construction while semi-pucca means pucca floors and walls with th roof made of other materials than cement construction. Storage los for semi-pucca godown (0.59%) is more than the pucca (0.54%) one

During their field survey ARDICOL carried out physica inspections in 16 LSDs, 2 CSDs and one Silo as per se questionnaire to identify packing, stacking and handling procedure that were followed. As per set rule at the time of receivin foodgrains the godown in-charge is to observe the followin procedures:

- The quality needs to be checked by piping to identif whether a particular bag contains wet pockets or grains mixed with abnormal foreign matters. Bags containing wet grains or abnormal foreign matters are to be kept separately for reconditioning.
- 100 percent of the bags are to be weighed.
- Torned or damaged bags are to be stitched or patched up.
- Water soaked or water damaged bags or bags contaminated with chemicals are to be separated for reconditioning/ inspection by the Technical Inspector.
- During stacking in the godown standard stacking pattern is to be followed and enough spaces between the walls and the grain stacks are to be ensured.
- Dunnages should be cleaned and treated with insecticides before and after use.

According to ARDICOL in many instances the procedures as enumerated above were not strictly followed. In case of silo standard bagging and meaningful weighment were carried out to ascertain the actual quantity of foodgrain received/despatched. In case of LSDs although tally sheet was maintained for 100% weighment, but in practice such weighment did not reflect the actual quantity received/despatched. In case of LSD, 60% of the godown in-charge recorded the weighment figures declared by the scaleman appointed by the handling contractor without physically verifying the weight as indicated in the dial of the scale. As a result, the transit loss as recorded by the godown in-charge did

not reflect the actual loss. In almost all cases godown in-charge recorded transit shortage as a matter of course within allowable limit.

Directorate General of Food has given the following allowances for storage loss in CSDs and LSDs and no allowance for silo as presented in Table 2.5.

Table 2.5: Allowances for Storage Losses

| Commodity | Period | Permissible Limit |
|---|---|---|
| Rice | : Upto 6 months | 0.5% |
| | : Upto 12 months | 0.75% |
| | : + For additional 3 months | + 0.25% |
| Wheat | : Upto 6 months | 0.5% |
| | : Upto 12 months | 0.75% |
| | : + For additional 3 months | + 0.25% |
| Paddy | : Upto 6 months | 0.50% |
| | : Upto 12 months | 1.00% |
| | : + For additional 3 months | + 0.25% |

Source : D G Food

Bangladesh Second Foodgrain Storage Project (1978): World Bank document embarked upon the reorganisation of procurement and storage system of foodgrain in Bangladesh. In the document it was observed that in addition to sub-standard nature of storage facilities in some localities of Bangladesh were favourable to rapid growth of insect and fungus. For control of storage loss, recommendations were focused on equipment, inspection, testing laboratory and pest control. Estimated storage loss of paddy for difference of moisture content, as found in the study is presented in Table 2.6.

Bangladesh Project Management Institute (BPMI) conducted a study during 1982-83 on Foodgrain Stock Management and Inventory Control System with special reference to spoiled stock and inventory control. The study highlighted the quantum of transit and storage loss in details. Storage Loss at LSD's was highest followed by CSD. In 3 years average from 1978-79 to 1980-81, storage loss for LSD was 2.84%, for CSD it was 0.51%, for TPC it was 0.41% and for silo it was 0.0018%.

Table 2.6 : Estimated Storage Loss of Paddy for difference of Moisture Content

| Facility | Storage period | | Weighted average (6 months) | Monthly percentage |
|---|---|---|---|---|
| | Dec.-May | June-Oct. | | |
| a. For 13% Moisture Content in Aman Paddy: | | | | |
| 1. Private Sector Storage. | 4.5% | 9.0% | 6.0% | 1.0% |
| 2. Hired/dilapidated tin Sheds | 4.0% | 6.5% | 4.8% | 0.8% |
| 3. Dhaka godown | 2.5% | 4.0% | 3.0% | 0.5% |
| 4. Dhaka with effective management. | 1.0% | 1.5% | 1.15% | 0.2% |
| b. For 17% Moisture content in Boro Paddy: | | | | |
| Facility | Storage period | | Weighted average (6 months) | Monthly percentage |
| | Dec.-May | June-Oct. | | |
| 1. Dhaka godown | NA | 8.0% | - | 1.33% |
| 2. Dhaka with effective management. | NA | 1.0% | - | 1.11% |

Source : World Bank 1978

Qualitative Loss: From various studies basic causes for qualitative losses have been identified by Eureka Bangladesh Ltd. in 1986 as follows:

i. Excessive moisture content.
ii. Admixture of inferior varieties.
iii. Foreign matter, and
iv. Damaged grains.

Quality Loss due to Moisture: Eureka (1986) observed that both the qualitative as well as partly quantitative loss of foodgrains occured mainly due to difference of moisture contents. Results of their observation have been reproduced in Table 2.7.

Eureka (1986) further stated that the higher moisture content in the foodgrain had direct bearing on the rate of insect infestation and fungal growth in the stored foodgrains. According to their godown survey, in 11% cases, qualitative loss had been reported to be due to fungus and in 48% cases due to difference in moisture content. Due to longer stay in the storage and excess moisture content the quality of foodgrain deteriorates and in many cases grains become unfit for human consumption. Some percentage of such stock is sold in the open market through auction, some destroyed and the rest retained.

Table 2.7 : Loss Due to Moisture Content.

| Foodgrain | Loss due to percentage difference of moisture content | | |
|---|---|---|---|
| | 14% | 15% | Total |
| Paddy | 1.30 | 0.44 | 0.53 |
| Rice | 0.72 | 0.46 | 0.72 |
| Wheat | 0.37 | 0.47 | 0.46 |
| Overall | 0.73 | 0.47 | 0.57 |

Source : Eureka 1986

Shortage in godown storage is defined as the difference in weight of foodgrain despatched for different off-takes from the weight recorded in the godown at the time of receipt. In the study report of Eureka (1986), storage loss has been computed as shortage in storage as percentage of quantity received during the reference year May, 1984 to April, 1985. Primary data on storage loss was collected in two stages: first, under the main survey and second, under a review survey. The main survey was conducted over 34 godowns consisting of 2 silos, 4 CSDs, 26 LSDs and 2 TPCs. The above study revealed the overall storage loss as 0.50%. Storage loss was highest in LSD (0.63%) followed by CSD (0.58%) and TPC (0.28%). No storage loss was observed in Silo. In respect of type of foodgrains it was highest for rice (0.55%), followed by wheat (0.53%) and paddy (0.42%).

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## 2.6 LOSS OF FOODGRAINS DURING TRANSPORTATION

Transportation of post-harvest foodgrains is an important function of the marketing process to make foodgrains available finally to the consumers. Thus the process involves different stages called markets and various operators in the markets. Depending on the type of markets and operators and also the communication system in existence, different modes of transport are used. The extent of foodgrain loss in the course of transportation and handling is influenced by a variety of factors which are discussed briefly below.

Domestic foodgrains market originates from the 10 million farmers in Bangladesh. The marketing system of Bangladesh is fragmented and dispersed throughout the country. However, some sale of the foodgrains takes places at the farm yard. The Agricultural Marketing Department, Government of Bangladesh identifies six types of such markets. These are rural primary market, rural assembly market, secondary market, urban wholesale market, urban retail market and urban wholesale-cum-retail market. The most numerous of these are rural primary and rural secondary markets being 4950 and 2635 in numbers respectively. The urban retail and urban wholesale markets come next in numerical strength with 182 and 55 markets respectively. The secondary and urban wholesale-cum-retail markets are almost equal numerically being 41 and 40 respectively.

Rural primary markets are operated by the growers, local traders and small retailers. In the rural assembly markets sellers and buyers are generally commercial/large farmers and outside traders respectively. The Secondary markets which are entirely traders' markets are operated by commission agents, stockists/wholesalers, exporters etc. Urban wholesale markets are usually operated by commission agents. They arrange procurement of food grains from distributing traders and sale to the retailers.

Different modes of transport are in use to carry foodgrains to and from different markets. In the rural markets, the predominant modes of transport are boat, cart and head/shoulder load respectively. Together, they account for about 80 to 90 percent of traffic handled (Bangladesh Unnayan Parishad, 1984). Other modes of transport of these markets are animal back, bicycle, rickshaw van etc. The secondary and other distant markets are connected by pucca roads, highways and railways. As such other means of transport like trucks, railways etc. besides boat/launch appear more significant in these markets.

When carriage of foodgrains to and from all markets by different modes of transport are considered together, boat tops the list accounting for about 20.0 percent of all transported foodgrains (BRRI, 1987; ARDICOL, 1988); truck occupies the second position transporting about 17.0 percent; modes of transport like bullock cart, push cart and rickshaw/rickshaw vans come very close

accounting for about 12.0, 10.4 and 9.0 percent respectively of the transported foodgrains. Other means like railway, motor launch, horse/pony are insignificant, the combined carriage of these being not more than 3.0 percent. Headload also accounts for about 3.0 percent. Different modes of transport are used in combination also and this accounts for as much as about 24.0 percent of all transported foodgrains.

Many other factors such as distance travelled and environmental conditions like rain, sun and humidity to which foodgrains are subjected to during the course of transportation; type and condition of bags in use, whether hooks are used in handling etc. also influence the extent of transportation of foodgrain to some extent.

### 2.6.1 Loss Due to Transportation

Loss of foodgrains during transportation to and from the rural primary and assembly markets is likely to be less than what it is in the case of secondary and urban wholesale markets. This is because marketing in the rural areas involves carrying of foodgrains in smaller quantities, which do not require use of hooks for handling purpose, travel of shorter distances which generally avoid long distance hazards like pilferage, exposure to rain, sun, humidity and long waiting at some point(s) of travel due to natural and social reasons.

The North-Western districts are important surplus areas of foodgrains. Surplus grains are transported to the rest of the country mostly by road and to some extent by railways. The North-Western districts are separated from Eastern part by the mighty river, Jamuna. Due to inadequate and inefficient road and ferry systems, transportation of surplus grains to the Eastern part of the country often involves delay in general and long waiting in the ferry ghats. These leave the foodgrains vulnerable to pilferage, exposure to bad weather conditions etc. In addition, transportation by railways is often slow due to the paucity of landing and warehouse facilities. The Eastern and particularly the Southern regions are criss-crossed by innumerable rivers and rivulets which become hazardous during the monsoon season and less navigable in the dry season.

### 2.6.2 Evidence of the Loss of Foodgrains due to Transportation

Empirical evidences regarding foodgrain loss on account of different modes of transport come in line with the indications given above. The extent of transportation loss by different modes of transport (ARDICOL) is shown in the Table 2.8.

Table 2.8 : Transit Loss of Foodgrains by Different Modes of Transport in Private Traders Level.

| Mode | Transit loss in % of total quantity carried | Reasons |
|---|---|---|
| Truck | 0.70 | Use of hooks, careless handling, poor conditions of bags resulting in splitting of bags and consequently splitting loss and evaporation of moisture. |
| Railway | 0.51 | Use of hooks, careless handling, pilferage and evaporation of moisture. |
| Boat | 0.49 | Poor condition of bags, hook damage and pilferage. |
| Horse | 0.95 | Poor condition of bags and spillage. |
| Launch | 0.51 | Pilferage, hook damage, bad conditions of the bags and careless handling. |
| Bullock cart | 0.18 | Handling. |
| Rickshaw/rickshaw van<br>Head/Shoulder<br>Bicycle | | Negligible |

Source : ARDICOL (1988)

It will appear from the above table that at the traders' level the loss varies from about 0.50 percent of total quantity carried by each of the means like boat, launch and railway to about 0.70 percent in the case of trucks (ARDICOL 1988). The reasons of such losses are found to be the use of hooks, careless handling, pilferage and poor condition of bags etc. in all the cases. Foodgrain loss on account of bullock cart transport comes down to 0.18 percent of the quantity carried. The loss is far more less and negligible in the cases of push cart, rickshaw, rickshaw van, head/shoulder and bicycle (Table 2.8).

EUREKA's (1986) findings provide support to the view expressed earlier that foodgrain loss would vary directly with volume of transported grains and particularly distance covered in the course of transportation. The study estimated transit loss in the course of carrying foodgrains to LSDs and CSDs, the former being more in numbers and involving shorter hauls than the latter. In the case of transportation to LSDs, the average loss of paddy, rice and wheat was 0.51 percent due to the overall mode of transport by road, truck, barge and boat. The corresponding figure of loss was 1.84 percent for the CSDs. Table 2.9 shows the percentage loss of foodgrains by mode of transport, type of commodity and godown types.

EUREKA's study also highlights monthly loss to foodgrain due to transportation. The loss stands at its peak, ranging from 0.71 to 0.89 percent, during the busy months of November to February, the period of procurement of Aman and also distribution including food for works. These high rates of loss in the busy months can be compared to as low a rate of 0.40 percent or 0.51 percent in the months of June and May respectively as shown in the Table 2.10.

Table 2.9 : Percentage Loss of Foodgrains by Mode of Transport, Type of Commodity and Godown Types

| Type of Godown/ Commodity | Transit Loss (in Percentage) | | | | | | |
|---|---|---|---|---|---|---|---|
| | Rail | Truck | Barge | Boat | Cart | Head | Overall |
| LSD | 1.67 | 0.36 | 0.36 | 0.44 | - | - | 0.51 |
| a.Paddy | 0.23 | 0.34 | - | 0.60 | - | - | 0.56 |
| b.Rice | 1.72 | 0.46 | 0.49 | 0.44 | - | - | 0.41 |
| c.Wheat | 2.33 | 0.42 | 0.36 | 0.41 | - | - | 0.41 |
| CSD | 3.05 | 0.23 | 0.76 | - | - | - | 1.84 |
| a.Paddy | 0.47 | 0.12 | - | - | - | - | 0.30 |
| b.Rice | 2.66 | 2.30 | 0.76 | - | - | - | 2.01 |
| c.Wheat | 3.20 | 2.30 | 0.75 | - | - | - | 2.36 |
| SILO | 0.58 | - | - | - | - | - | 0.58 |
| a.Paddy | - | - | - | - | - | - | - |
| b.Rice | - | - | - | - | - | - | - |
| c.Wheat | 0.58 | - | - | - | - | - | - |
| TPC | 0.60 | - | - | - | 0.40 | 0.10 | 0.56 |
| a.Paddy | - | - | - | - | 0.15 | 0.01 | 0.08 |
| b.Rice | 0.56 | - | - | - | - | - | 0.56 |
| c.Wheat | 0.63 | - | - | - | 0.25 | - | 0.60 |
| OVERALL | 1.30 | 0.52 | 0.41 | 0.44 | 0.40 | 0.01 | 0.87 |
| a.Paddy | 0.47 | 0.22 | - | 0.60 | 0.15 | 0.01 | 0.31 |
| b.Rice | 0.17 | 0.56 | 0.45 | 0.44 | - | - | 1.00 |
| c.Wheat | 1.50 | 0.59 | 0.36 | 0.31 | 0.25 | - | 0.99 |

Source : Eureka 1986

Table 2.10 : Monthly Transport Loss of Foodgrains by Mode of Transport.

| Months | Transport Loss (%) by Mode of Transport | | | | | | |
|---|---|---|---|---|---|---|---|
| | Train | Truck | Barge | Boat | Cart | Head | Overall |
| May, 1984 | 0.64 | 0.50 | 0.41 | 0.16 | - | - | 0.51 |
| June, 1984 | 0.61 | 0.36 | 0.58 | 0.36 | - | - | 0.40 |
| July, 1984 | 0.78 | 0.90 | 0.57 | 0.49 | - | - | 0.73 |
| August, 1984 | 1.39 | 0.78 | 0.63 | 0.45 | - | - | 0.84 |
| September, 1984 | 0.70 | 0.65 | 0.70 | 0.37 | - | - | 0.59 |
| October, 1984 | 0.63 | 0.48 | 0.23 | 0.27 | 1.60 | - | 0.53 |
| November, 1984 | 1.12 | 0.73 | 0.14 | 0.20 | - | 0.01 | 0.71 |
| December, 1984 | 1.65 | 0.55 | 0.47 | 0.25 | - | - | 0.76 |
| January, 1985 | 1.84 | 0.59 | 0.29 | 0.37 | - | - | 0.89 |
| February, 1985 | 1.72 | 0.42 | 0.33 | 0.29 | 1.10 | - | 0.73 |
| March, 1985 | 1.25 | 0.37 | 0.35 | 0.42 | - | - | 0.59 |
| April, 1985 | 0.88 | 0.50 | 0.75 | 0.28 | - | - | 0.54 |
| Yearly Average | 1.30 | 0.52 | 0.41 | 0.45 | 0.17 | 0.01 | 0.87 |

Source : Eureka 1986

## 2.7 MARKETING OF FOODGRAIN IN BANGLADESH

Marketing is the process through which the produced good is brought from the producer to the consumer. This process is considerably important for both agricultural producers as well as for overall economic development. On the one hand, market sale of produce is a major,if not the only, source of income of the farmers. On the other hand, the pace of industrial development is at least partly dependent on the market supply of foodgrains via the latter's effect on wages. Most agricultural commodities are easily perishable and this leads to varying degrees of wastage for different products in the marketing process. This underlies the need for quick and smooth marketing of agricultural products.

### 2.7.1. Need for Foodgrain Marketing

Marketing involves distribution of foodgrain to the consumers. It is, in the words of Richard L.Kohls, "the performance of all business activities involved in the flow of goods and services from the point of initial agricultural production until they are in the hands of the ultimate consumer". The importance of foodgrain marketing derives from the fact that it increases consumers utility and also leads to an increase in the consumption of agricultural products. Marketing can be viewed as a mechanism for fixing prices. While there is a stable demand for foodgrains since these are edibles, the supplies are irregular due to the seasonal nature of production. Supply is adjusted to demand through marketing, with price being the adjustment factor. The middleman plays a crucial role in this adjustment process. It is he who collects a multitude of products from many producers and disperses these to many consumers. He also decides what prices are necessary in order to adjust demand to supply for obtaining maximum benefit.

Several important services must be performed before the producers and the consumers of foodgrains can be brought together. First, the foodgrains must be collected from the farms and assembled in bulk. Second, the heterogeneous output has to be sorted into grades. This stage involves sorting the produce into different lots, each with substantially the same characteristics with respect to market quality, and each having its own label or name. Different consumers have different tastes and the objective of grading is to satisfy different consumer preferences. Third, the foodgrain is often processed before being passed on to the consumer. Processing adds to utility of the product. Fourth, there is the important stage of storage. Foodgrain production is irregular, and hence there is the need for storage to even stop supplies and thereby stabilize prices at certain arbitrory level. Fifth, the foodgrain must be transported from the place of assembly to that of final sale. Transportation is a major cost of marketing

and hence there is the need for cost effective transportation. Finally, the foodgrain must be sold to the consumers. This stage also involves storage since consumers generally do not buy in large quqntity in advance but only just before consumption.

### 2.7.2 Organisation of Foodgrain Marketing in Bangladesh

There are two distinct channels of grain marketing in Bangladesh, viz., (i) Private Sector, and (ii) Public Sector operated by the Government. Private Sector marketing is operated under a free enterprise system with some government controls. The private sector handles about 80-85% of the country's trade in foodgrains. The public sector mainly markets imported foodgrains, and to some extent grains purchased from growers under government procurement programmes. Imported supplies are stored in central storage units, later distributed to government godowns, and finally sold to consumers through ration shops operated by commission agents. The government also makes open market sales from time to time in order to stabilize prices.

The private sector grain marketing system in Bangladesh is more complex. The markets can be classified into 3 groups: (i) Primary or Village Market; (ii) Secondary or City Market; (iii) Terminal or Post Market. The village market or `hat' serves as market for buyers and sellers residing within 5-25 sq. miles. Each `hat' generally meets once or twice a week and serves as a major marketing outlet in the rural area. These markets are characterised by the operation of functionaries who buy here and supply the nearest city market. There are approximately 6,500 primary markets in Bangladesh.

The secondary market is basically a wholesale market. Agricultural produce of the surrounding 20-25 sq. miles is collected and distributed from these markets. A secondary market generally operates 6 days a week. The lion's share of foodgrain trade takes place in these markets. There are about 450 secondary markets in Bangladesh.

A terminal market serves as the assembly and redistribution point for both primary and secondary markets. There are 4 major terminal markets serving the major urban centres.

### 2.7.3 Methods of Marketing Foodgrains in Bangladesh

All farmers produce but only about a quarter of farmers sell paddy. A study by BRRI (1987) shows that sale varies from 119.40 Kg per farm per sale in June to a low of 44.77 Kg in October. Sales are mostly in the form of paddy with a very limited sale of rice (i.e. processed paddy).

The farmers either (i) sell directly from the field, or (ii) sell in the nearest `hat', and sometimes (iii) sell at the nearest government procurement centre. In the 1970s about a quarter of total sales were made directly from the field. Improvement in transportation facilities has brought down the proportion of direct field sales by farmers in recent times to about 15% of total sales. Prices are generally 10% lower for sales at the farm, but the farmer saves on transportation and storage costs. Sale at the local market is the dominant method of marketing.

A number of functionaries operate in the grain marketing system in Bangladesh. `Farias' are generally full-time local traders who handle only small volumes of trade. `Kutials' purchase paddy directly from farmers or from local `hats'. They either process the paddy by 'Dheki' at home or at local husking mills and sell the milled rice in primary markets or at retail. `Beparis' are full-time traders who handle large volumes of trade. `Dalals' perform the useful role of bringing the buyers and sellers together. They normally charge a fixed brokerage fee. `Arathdars' buy and sell in large volumes; they also provide storage facilities. They charge fixed fees and commissions. Wholesalers purchase in large volumes from `Arathdars', hold it temporarily in storage and then sell to local retailers at a profit. They operate in major markets. `Paikars' purchase their supplies from `Arathdars' and wholesalens and sell at retail.

Paddy is assembled for sale in local `hats' by farmers, `farias' and `beparis' who have purchased the paddy from the farms. This paddy is then transported to the secondary market or sold for local consumption by `kutials'. The paddy assembled in the secondary market is generally sold to rice millers and some portion to `kutials. The processed rice is then sold to `beparis' or `Arathdars. The latter store the rice and sell to `paikars' who retail the rice. In Bangladesh farmer actually received from 71 to 80 percent of the amount the consumer paid for foodgrains. The rest goes to the process mentioned. The proportion is considered as highest in the world. The equivalent rate for Thailand is 60-65% and for USA 50% (Islam, et.al. 1981).

### 2.7.4 Foodgrain Loss in the Marketing Process

Two major weaknesses of foodgrain marketing in Bangladesh are unsatisfactory and inadequate storage and transportation facilities which are also the major causes of grain loss in the marketing process. Inadequacy of storage facilities compels the farmers to use gunny bags, `dole' or large bamboo baskets, and big earthen pots for storing grain. Better storage facilities are available in secondary markets. Modes of transportation used are generally slow. Boat is the major mode of transport used in this riverine country. Bullock carts, push carts and rickshaws are also widely used.

Attack by pests and humidity are two major causes of foodgrain loss during storage. In a study by ARDICOL (1988) it was found that damage by rats was the major cause of foodgrain loss during storage and accounted for 36% of total storage loss of foodgrain at traders level. Unsatisfactory condition of storage often allows rain water to seep in and this is also an important cause of foodgrain loss, particularly for the Boro and Aus crops. The dampness resulting from rains and high humidity also causes damage to stored foodgrains. In the ARDICOL (1988) study, it was found that damage by rain and dampness accounted for 18% and 16% respectively of total storage loss.

Since three rice crops (Aus, Aman & Boro) are harvested in Bangladesh in different months of the year, the need for storage for a long period is reduced. Furthermore, government restriction on the period of foodgrain storage upto a maximum of 20 days in between purchase and sale and 7 days in a particular place has also helped to reduce storage loss.

The study by ARDICOL op.cit. shows that average storage, handling and transit loss ranges between 0.32% to 0.87% in case of LSD and between 0.66 to 1.23% for CSD. The Food Ministry's estimate of loss for these operations is 2.78%.

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# Chapter III
# METHODOLOGY

## 3. METHODOLOGY

For estimating the post - harvest losses of foodgrains in Bangladesh, both local and modern varieties of Aus, Aman, Boro and Wheat crops were studied. In the light of the objectives as outlined in the TOR and approved by the Functional Committee questionnaires were prepared (Appendix 3.1). Sampling at three stages was done to cover the total aspects of the survey. The country was divided into 8 broad-based Agro-Ecological Zones (AEZ). About 4 percent of the Upazila from the 8 AEZ and about 2 percent of villages from each Upazila were selected. From each of the selected villages, 7.5 percent of the households i.e. a total of 1175 households were selected for survey of all the foodgrain crops under study. The sampling was random. Sample distribution is shown in Figure 3.1. For the estimation of loss of foodgrains in marketing process at farmers level, the above mentioned procedures (Upazila - Village- Households) were followed. Regarding loss of foodgrains in the private traders godown, about 5 per cent randomly selected godowns from the list of all godowns in 18 Upazilas were selected for survey. For Livestock and Poultry Feed estimate, 10 per cent of Cattle and Poultry farms were selected for survey. Data were collected by the trained Enumerators.

### 3.1 SELECTION OF AGRO-ECOLOGICAL ZONES

It is recognized that there are regional variations in cultural practices associated with farming system affecting the use of seed and feed as well as in the post-harvest operations in different geographical regions of Bangladesh. To select the food grain production areas, identical features with respect to yield and cropping pattern, the country was originally divided into nine broad Agro-Ecological Zones (AEZ). to represent the Agro-Socio-Economic characteristics of foodgrain production and regional differences in the cultural practices associated with post-harvest operations. The Agro-Ecological Zone of Chittagong Hill Tracts could not be considered due to problems of transportation and communication in the interior where farm families were to be surveyed. Therefore, the Hill Tract Zone was dropped from the survey and only 8 AEZ were surveyed.

Recognizing the importance of modern varieties of Paddy on the growth of foodgrains production particularly in the coming years, more emphasis was accorded to this variety in selecting sample upazilas. Accordingly, Agro-Ecological Zones (AEZ) were ranked based on the area of modern variety as a proportion to total area under Paddy cultivation during 1982-83 to 1987-88 cropping years. Average ratio of the area under modern varieties and total area under Paddy in respect of each AEZ was then divided by the national average ratio (of area under modern varieties and the total area under paddy cultivation) to obtain the weight. The weight was then

multiplied by the number (equivalent to 4% of the total upazila under each AEZ) to get the selected number of upazila under each AEZ. It was intended that the AEZ with higher concentration of modern variety would have its due share in the selection of Upazilas.

## 3.2 SELECTION OF UPAZILA

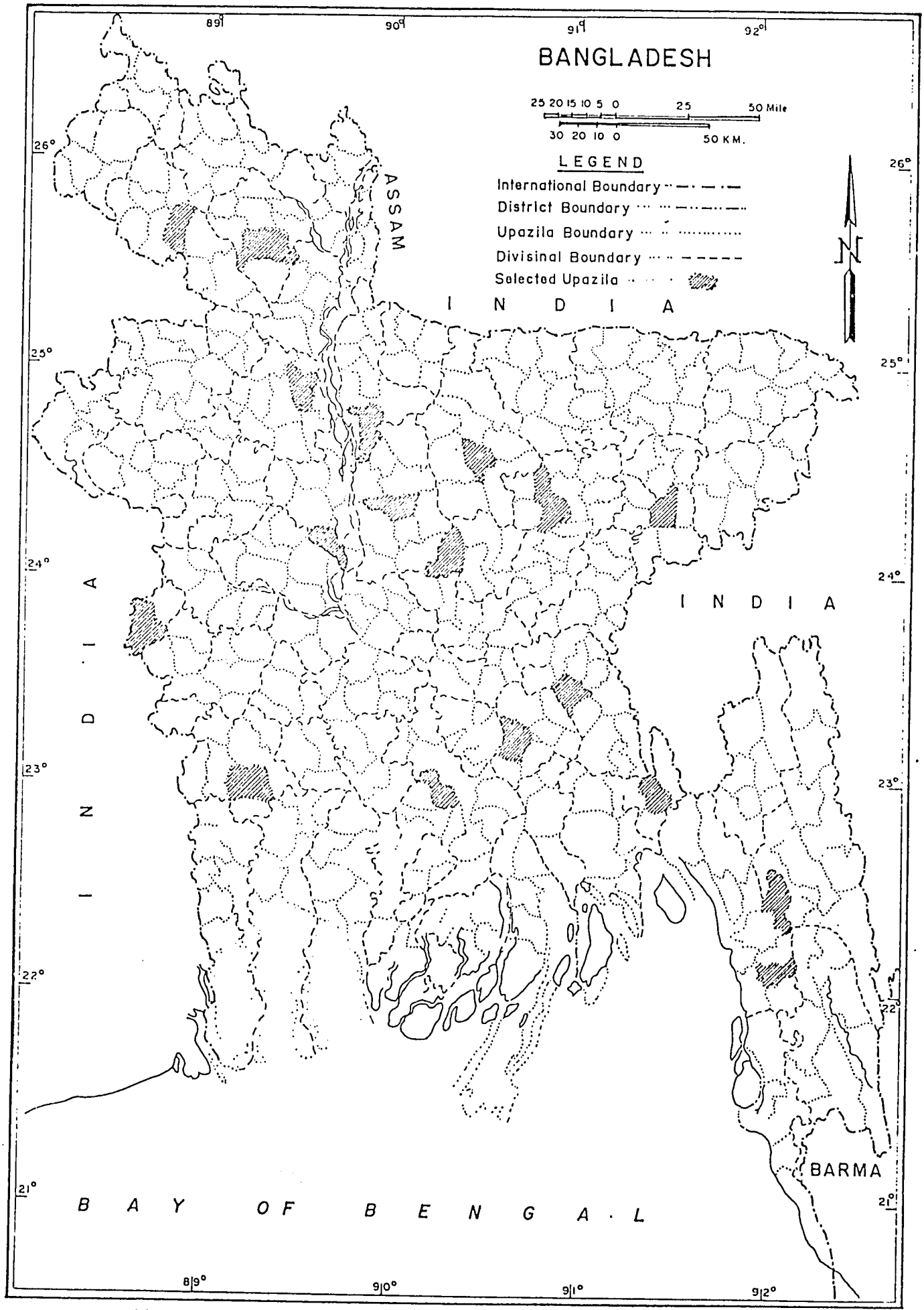
About 4 per cent of the total number of Upazilas from each AEZ was taken for the survey i.e. a total of 18 Upazilas. After ranking, Upazilas were selected by applying the statistical method of probability proportional to sample size (PPS). The total area of Paddy and Wheat for 1982/83 has been used as weight. Upazila-wise crop acreage for subsequent years were not available. This double weightage enables better representation of AEZ in the sample. A list of selected upazilas is shown in Table 3.1 and distribution of the selected Upazilas in the study area is presented in Map 3.1.

## 3.3 SELECTION OF VILLAGE

Villages from the selected upazilas were randomly selected. The list of villages within each Upazila was collected from the Bureau of Statistics (vide Bangladesh Population Census, 1981). From the list, a total of 76 villages were selected, representing 2 per cent of all villages in the respective selected upazilas. In case, a selected village was not traceable, a neighboring village was taken as a replacement.

Villages selected from each Upazila remained unchanged except for Chandpur and Gournadi Upazilas. In Chandpur, the selected village Mirzapur under the Union Hanarchar Paschim could not be located since it had already been engulfed by the river Meghna. The Enumerator, in collaboration with the Upazila Chairman andUpazila Agriculture Officer, selected the Village Makinpur under Baghadi Union. The reason for changing the village was different in Gournadi. The two selected villages of Kathvia under Gaila Union and Chhayagram under Ratnapur Union were politically separated from Gournadi Upazila and made them as parts of the newly formed (1985) Agailjhara Upazila. The Enumerator selected two other villages, namely Basudevpur of Batazor Union and Ashukati of Mahilara Union of Gournadi Upazila. This was done in consultation with the local Upazila officials.

List and name of the selected villages are presented in Appendix 3.2.




Map 3·1 Distribution of Selected Upazila in the Study Area

Table 3.1: Number and the name of selected Upazilas in different Agro-Ecological Zones (AEZ).

| Agro-Ecological Zones | Total Upazilas | Weight* factor | Selected No** | | Names of Selected Upazilas |
|---|---|---|---|---|---|
| | | | @ 4% | Weighted | |
| Chittagong-Noakhali. | 40 | 2.07 | 1.60 | 3.31 | Rangunia<br>Satkania<br>Feni |
| Mymensingh-Kishoregonj-Jamalpur. | 45 | 1.41 | 1.80 | 2.54 | Trishal<br>Kishoregonj<br>Sarishabari |
| Dhaka-Tangail. | 49 | 1.11 | 1.96 | 2.18 | Kaliakoir<br>Kalihati |
| Comilla-Sylhet. | 63 | 1.07 | 2.52 | 2.70 | Chandina<br>Chandpur<br>Habiganj |
| Rajshahi-Bogra-Pabna. | 66 | 0.96 | 2.64 | 2.53 | Gabtali<br>Shahzadpur |
| Rangpur-Dinajpur. | 58 | 0.78 | 2.32 | 1.81 | Mithapukur<br>Chirirbandar |
| Jessore-Kushtia-Khulna. | 59 | 0.70 | 2.36 | 1.65 | Monirampur<br>Meherpur |
| Barisal-Faridpur-Patuakhali. | 66 | 0.41 | 2.64 | 1.08 | Gournadi |
| Total | 446 | | 18.40 | 17.80<br>say, 18 | |

* Weight is the ratio of the area under modern variety to the total area under paddy in each AEZ as proportion to the ratio of the national average (area under modern variety divided by area under paddy of five years average).

** Selected number of upazila in each AEZ (weighted) is the product of weight by number (equivalent to 4 percent of the upazila of each AEZ).

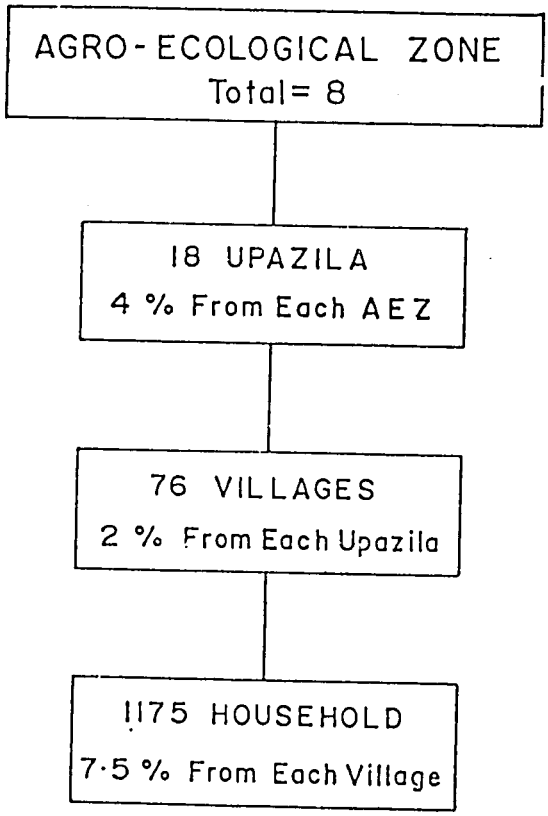



Figure 3·1 Distribution of Samples in the Study Area

## 3.4 SELECTION OF HOUSEHOLD

A census of the households of each selected village was done on the spot to identify the total number of households and head of the family. From the census, about 7.5 percent of the total households were randomly selected for interview. The selection procedure was as follows:

Suppose, a list contains names of n household heads. When n was a 2-digit number then a 3-digit random number from the random table was used. When n was a 3-digit number, then a 4-digit random number was used and so on. The selected number from the random table was divided by the n when the random number was greater than n. The remainder of the division was used as the selected number. When the random number was divisible by n then n was selected as the sample number. When a random number was less than n, the household was selected using the serial number equal to the random number i.e. nth household. No household was selected for more than once.

## 3.5 SELECTION OF SAMPLE MARKETS

For estimation of the foodgrain loss in marketing at farmers level, the same three steps (upazila -village - households) sampling plan was used as follows :

Fifty four primary markets in and around the sampled villages were selected for interview of 5 percent of the traders to estimate loss of foodgrain at the primary market level. A list of the primary market surveyed is presented in Appendix 3.3.

One important secondary market was chosen at random from each selected upazila. There were 18 such secondary markets which formed approximately 3 per cent of all secondary markets in Bangladesh. From each secondary market, 5 per cent of traders were randomly selected. The list of Secondary Markets surveyed is presented in Appendix - 3.4.

Besides primary and secondary markets, big consumer (Terminal) markets, such as, Badamtali, Dhaka and Krishi market in Mohammadpur, Dhaka were taken up for assessing market losses at wholesale and retail outlets. Five percent Arathdar/Wholesalers and 2 per cent retail dealers were interviewed. Data were collected from selected traders using specified questionnaire. List of selected big markets is presented in Appendix - 3.5.

## 3.6 Estimation of PHL

PHL of foodgrain is a function of the following variables :

PHL = f(S+C+T+B+BT+PT+OT+W+D+WR)

Where

PHL = Post-Hervest Loss

S = Stock Loss (Stacking in the field and farm yards)
C = Carrying loss (from fields to farm yards)
T = Threshing by hitting on a hard surface
B = Threshing with bullock after hitting
BT = Threshing by bullock
PT = Paddle threshing
OT = Other threshing loss i.e. beating or flailing on the crop with a stick
W = Winnowing and cleaning loss
D = Drying loss
WR = Bad weather loss

## 3.7 ESTIMATION OF STORAGE LOSS

Storage loss in the private traders godowns was estimated from 5 per cent randomly selected godowns from the list of all godowns in 18 selected Upazilas. List of godowns was available with the Upazila Food Officers. List of selected godowns is presented in Appendix 3.6.

## 3.8 SELECTION OF MILLER

For estimating loss at miller's level on storing, soaking, parboiling and husking, 5 per cent of rice mills/husking mills in each upazila were selected at random. The list of the Rice Mills/Wheat Crushers at upazila level was available from the Food Offices. A List of selected Godowns, Rice Mills/Wheat crushers is presented in Appendix 3.7.

## 3.9 SELECTION OF POULTRY AND LIVESTOCK FARMS AND FEED MILLS

To estimate livestock and poultry feed, 10 per cent cattle and poultry farms in Bangladesh, including the Government Cattle farm at Savar, were interviewed. The Department of Livestock Services provided the list of Poultry and Cattle Farm in the country. A List of Poultry and Cattle Farms surveyed is presented in Appendix - 3.8. For estimation of foodgrain use in the Government and private feed mills, 20 percent of the important feed mills of the country were selected for the survey. A list of the important feed mills is presented in Appendix - 3.9. The trained Enumerators collected data from Managers and feed mill operators through direct interview using the questionnaire (Appendix 3.1d).

## 3.10 CASE STUDY

A Case Study on the estimation of foodgrains loss due to field stacking, carrying and threshing was conducted in all the Upazila surveyed. For details of the methodology please see Appendix 3.10.

A case study on the loss of foodgrains due to storing was also done. The enumerators collected small samples (one kg each) of the stored grains to assess qualitative loss through laboratory test.

The test was done to determine the storage quality of grains for consumption and germination of seeds under different methods of storage. For details of the methodology please see Appendix 3.11.

## 3.11 TRAINING OF THE FIELD ENUMERATORS

Seven days training in November, 1989 was imparted to enumerators covering the following aspects:

a) Technique of random sampling.

b) Procedures of approaching the respondents (farmers) and the technique of obtaining required information from them.

c) Various problems and solutions for recording data in different formats of the questionnaires.

## 3.12 PRE-TEST OF THE QUESTIONNAIRE

To verify whether the questionnaires need modification and to provide scope for practical training to the Enumerators for correct data collection, a pre-test was carried out. All the members of the Study (Consultants, Supervisors, Enumerators) including a representative from FPMU, Ministry of Food, participated in the pre-testing of questionnaire in Kalampur of Dhamrai Upazila in December, 1989. On the experiences gained from pre-test, the questionnaires were duly modified.

## 3.13 FIELD SURVEY

The cropping seasons were divided into 3 phases for data collection according to the cropping pattern in the country (Figure 3.2). Field survey was conducted during harvesting of respective crops as follows:

1st phase - December, 1989 - January, 1990 for collection of data on Aman Crop. At this stage, data on post-harvest operations were collected.

2nd phase - April-June, 1990 for collection of post-harvest data on Boro and Wheat and storage, marketing and milling losses of Aman crop.

3rd phase - July-September, 1990 for collection of data on Aus and collection of storage, milling and marketing loss of Boro, Wheat and Aus crop.

## 3.14 DATA COLLECTION

After random selection of households from the census list, the enumerators visited the selected households from door to door for direct interview. The respondents were the head of the households but in case the household head was not available, immediate

alternate respondent was his wife or his eldest son. When alternate respondent was not available, a substitute household was taken. Enumerators were instructed to select at random, some extra households in advance. From the extra households, the substitute household was taken in serial order.

The enumerators collected data on direct interview from farmers, private traders, rice mill operators and cattle and poultry farm managers based on the questionnaires. Surveys were conducted during harvest of each of the four crops . The load of work was almost equally heavy each time, since the enumerators had to collect (i) information on the harvesting operations of the current crop and (ii) the information on storage and marketing of the immediately preceding crop of the study. This procedure of survey ensured quality of data since those were collected as the events had just occurred or memories of the respondents were still fresh.

## 3.15 CHECKING OF THE DATA

After data collection in the field, the filled-in questionnaires were checked by another group of enumerators and Consultant at the Head Office. This group checked for correction of entries recorded by the primary investigators rechecked when necessary before the questionnaires were passed on to the tabulation group.

## 3.16 TABULATION

Household was the ultimate sample unit for the Study and individual questionnaire was used for such unit. For identification of respective household, code numbers were used for different administrative units, such as region, upazila, village and household(s). Data were computed using numeric symbol.

## 3.17 DATA INPUT TO THE COMPUTER AND CHECKING

UNICONSULT adopted a procedure of simultaneous data collection, tabulation and computation. Collected data from the field were sent to Computer Section for checking, tabulation and computation. Tabulated data were then rechecked by a group comprised of the System Analyst, the Statistician and the Field Supervisors.

## 3.18 ANALYSIS OF DATA

Estimates of region and upazila totals, averages and ratios of important parameters have been calculated using appropriate formula for three stage stratified sampling design.

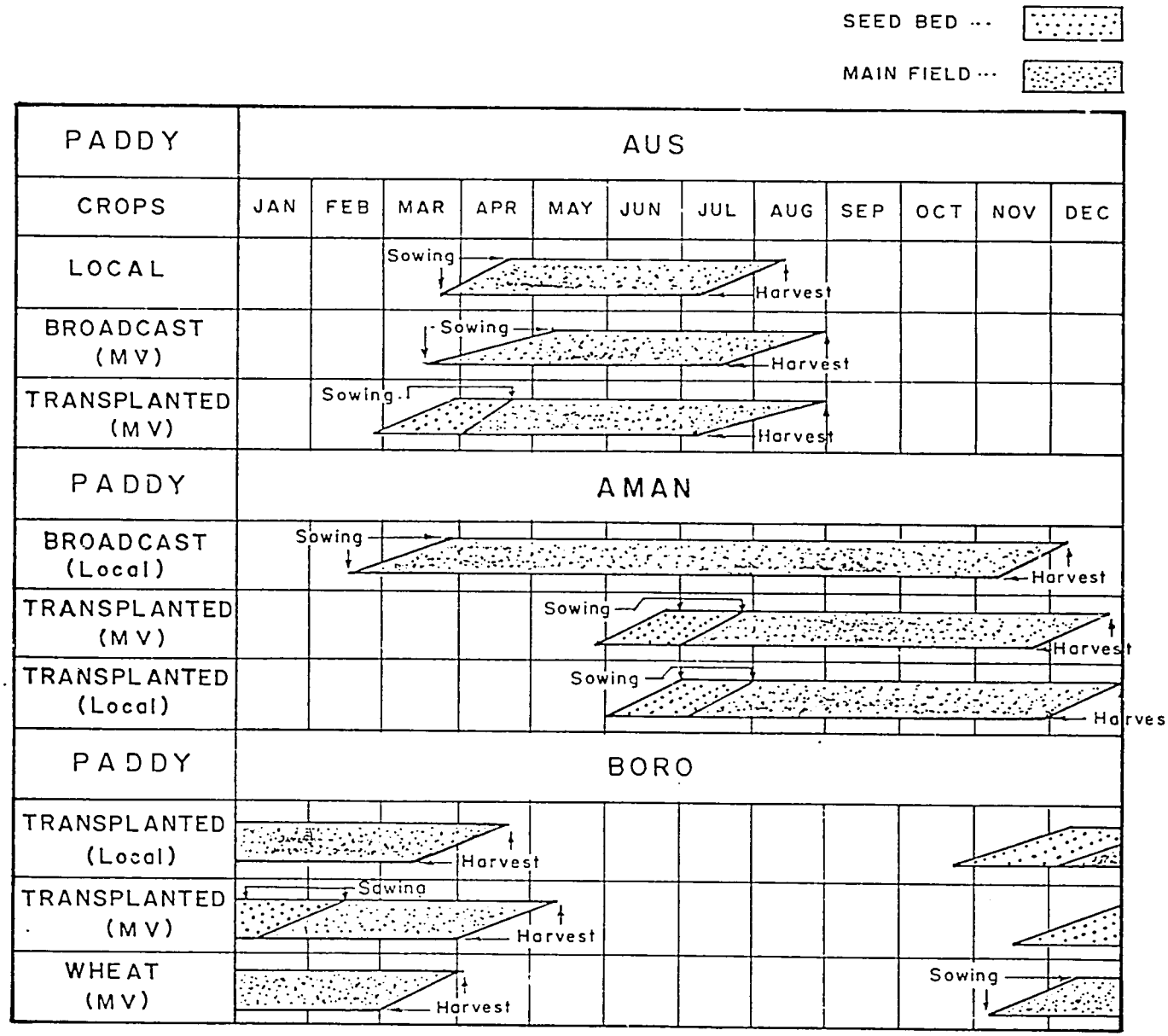



Fig. 3·2 Crop Calender of Bangladesh(Foodgrains)

## 3.19 WEATHER CONDITION

Weather condition, in general during 1989-90 was favorable for foodgrain production in Bangladesh. Total rainfall during the year was 2072 mm compare to 2047 mm of 1988-89 and 2442 mm of the average rainfall of last ten years. Rainfall during 1989-90 is presented in Table 3.2.

During Aus crop production drought at seedling stage affected the crop to some extent. Rainfall was adequate during vegetative phase. In July excessive rainfall and flash flood in parts of Sylhet and Chittagong caused damage to the crop. In general the weather condition was favorable for the crop.

Weather during Aman crop production was favorable. However, B. Aman suffered due to drought at seedling stage. During T. Aman production a few norwesters in different parts of the country at flowering hamper pollination and cause damage to the crop to some extent.

During Boro production weather condition was also favorable. However, in Jessore and Rangpur drought affected adversely the sowing of modern variety. In Kishoregonj local Boro suffered some damage due to high temperature during pollination and heavy rain at harvest.

During wheat growing season, crop sowing was affected adversely due to untimely rain in Comilla. In vegetative and flowering stages the temperature was high and at maturity stage there was heavy rainfall and hailstorms in the major wheat growing districts. As a result wheat production affected to some extent.

Table 3.2 Rainfall During 1989-90 Compare to 10 Years Average (in mm.)

| Month | 10 years Average | 1988-89 | 1989-90 |
|---|---|---|---|
| July | 537 | 474 | 526 |
| August | 429 | 429 | 134 |
| September | 304 | 236 | 289 |
| October | 186 | 164 | 237 |
| November | 35 | 98 | 0 |
| December | 09 | 1.3 | .03 |
| January | 03 | 2.0 | 0.1 |
| February | 15 | 13 | 50 |
| March | 42 | 07 | 121 |
| April | 111 | 76 | 133 |
| May | 265 | 203 | 245 |
| June | 506 | 344 | 334 |
| Total | 2442 | 2047 | 2072 |
| Average | 203.92 | 170.63 | 172.67 |

Source : FPMU 1990.

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# Chapter IV
# FINDINGS AND DISCUSSIONS

## 4.0 THE OVERALL PICTURE

The percentage of foodgrains used as seed, feed and loss during post-harvest operations of the sample households was 11.58. This being the weighted average of 13.20 percent loss in case of Aus, 12.38 percent loss in case of Aman, 10.38 percent loss in case of Boro and 11.84 percent loss in case of wheat. Use of foodgrains as seed relative to total production was 1.73 percent whereas use of foodgrains as feed relative to total production was 0.51 percent (Table 4.1). Post-harvest loss from field stacking to winnowing and drying was 4.14 percent. Similar result was also reported by FAO, 1986 for post-harvest loss of Aus, Aman and Boro crops. Figure 1 depicts the use of foodgrain as seed, feed and loss at different stages of its operation before consumption.

Among the post-harvest losses, the overall loss due to field stacking was 0.91 percent, carrying from field to threshing yard was 0.74 percent, threshing loss by beating was 0.65 percent, threshing with bullock was 0.16 percent, threshing by beating followed by threshing with bullock was 0.23 percent, threshing by paddle thresher 0.15 percent and threshing by other methods such as beating by stick was 0.02 percent. Loss due to winnowing was 0.68 percent and drying was 0.54 percent. The loss due to parboiling was 1.82 percent whereas milling loss was 1.21 percent. Handling loss at farm level in course of weighing and putting in gunny bags/baskets for sale was 0.42 percent. Transportation loss in marketing at farmers level was 0.32 percent. Storage loss at farmers level was 1.03 percent. Therefore, the total loss at farmers level was 11.21 percent. Loss at traders level was 0.37 percent. Regionwise distribution of percent foodgrains loss in 1989-90 is presented in Appendix 4.1. Distribution of total foodgrain loss in 1989-90 is presented in Table 4.2 and regionwise distribution of loss is presented in Appendix 4.2.

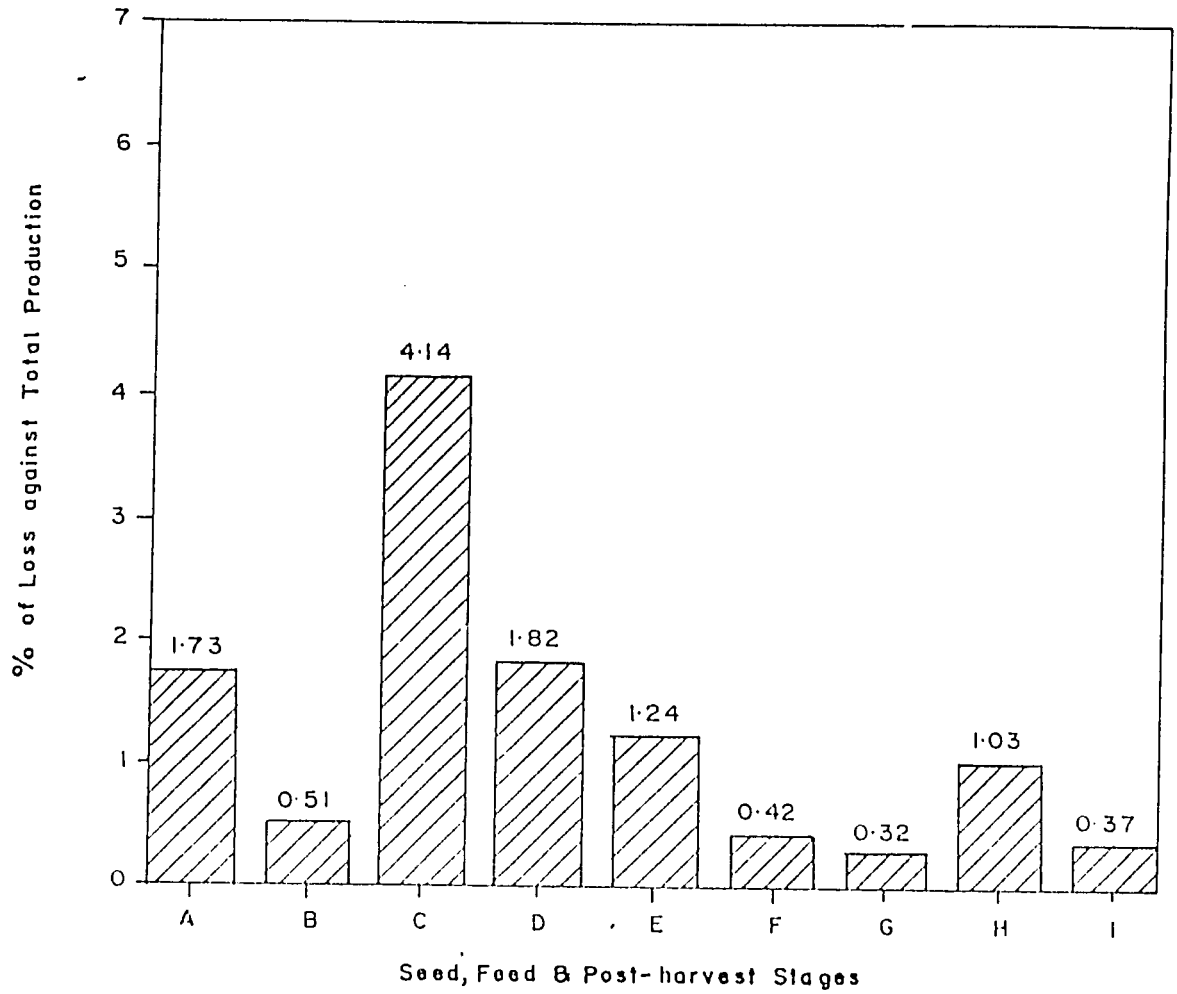
It is estimated that the total quantity of foodgrain loss in Bangladesh in 1989-90 would be around 2.12 million tons (calculated from the provisional estimate of foodgrain production of 18.33 million tons in 1989-90 of FPMU). This is equivalent to food for about 13.0 million people for one year at the rate of 453 grams/person/day (Table 4.2).

The weighted foodgrain (rice) loss due to use as seed and feed, and post-harvest operations relative to the total national average production of Bangladesh during 1983-84 to 1987-88 is presented in Table 4.3. This Table indicates that the total average loss of foodgrains (rice) in Bangladesh was 11.03 percent. Among them 13.20 per cent was in case of Aus, 12.38 percent in case of Aman and 10.38 percent was in case of Boro. Regionwise distribution of weighted loss of rice is presented in Appendix 4.3. Figure 2 presents the use of foodgrain as seed, feed and different loss at different stages of the rice and wheat production.

Among the regions, the minimum overall loss of the sample households was recorded in the Mymensingh/Kishoreganj/Jamalpur region (10.65%) and maximum was recorded in the Dhaka/Tangail region (13.57%). The overall loss recorded in Chittagong/Noakhali region was 10.91%, in Comilla/Sylhet region 13.02%, in Rajshahi/Bogra/Pabna 13.01%, in Rangpur/Dinajapur 11.97%, in Jessore/Kushtia/Khulna 10.91% and in Barisal/Faridpur/Patuakhali 12.93% (Appendix 4.3).

Table 4.1 : Seed, Feed and Post-harvest Loss as % of Total Production of Foodgrains of the Sample Households during 1989-90.

| CROPS | Total (Survey area) | | | | |
|---|---|---|---|---|---|
| | Aus | Aman | Boro | Wheat | Total |
| Area (in decimal) | 84224 | 236163 | 123492 | 28719 | 472598 |
| Production (in kg.) | 707405 | 2697527 | 2051315 | 174637 | 5630884 |
| Rice equivalent (in kg.) | 475660 | 1835991 | 1386325 | | 3697976 |
| Seed used % of production | 2.89 | 1.80 | 0.89 | 5.73 | 1.73 |
| Feed as % of production | 0.68 | 0.50 | 0.46 | 0.46 | 0.51 |
| Field Stacking Loss | 0.41 | 1.09 | 0.87 | 0.54 | 0.91 |
| Carrying loss | 1.00 | 0.62 | 0.82 | 0.57 | 0.74 |
| Beating loss | 0.63 | 0.68 | 0.61 | 0.66 | 0.65 |
| Bull threshing | 0.27 | 0.25 | 0.02 | 0.05 | 0.16 |
| Beating after threshing | 0.23 | 0.31 | 0.13 | 0.02 | 0.23 |
| Paddle threshing | 0.13 | 0.16 | 0.16 | 0.00 | 0.15 |
| Other threshing | 0.00 | 0.03 | 0.00 | 0.05 | 0.02 |
| Winnowing | 0.69 | 0.82 | 0.50 | 0.63 | 0.68 |
| Drying (birds, goats etc.) | 0.68 | 0.43 | 0.65 | 0.48 | 0.54 |
| Bad weather | 0.13 | 0.00 | 0.11 | 0.03 | 0.06 |
| Total post harvest loss | 4.18 | 4.39 | 3.88 | 3.04 | 4.14 |
| Parboiling loss | 0.95 | 2.14 | 1.86 | 0.00 | 1.82 |
| Milling loss | 1.05 | 1.22 | 1.32 | 1.48 | 1.24 |
| Handling loss | 0.45 | 0.49 | 0.32 | 0.46 | 0.42 |
| Transportation loss | 0.23 | 0.38 | 0.26 | 0.34 | 0.32 |
| Storage loss | 2.44 | 1.16 | 0.90 | 0.00 | 1.03 |
| Total loss at farm level | 12.87 | 12.08 | 9.89 | 11.51 | 11.21 |
| Weighted traders loss | 0.33 | 0.30 | 0.49 | 0.33 | 0.37 |
| Grand Total | 13.20 | 12.38 | 10.38 | 11.84 | 11.58 |




A : Seed

B : Feed

C : Total Post-harvest Loss

D : Parboiling loss

E : Milling Loss

F : Handling Loss in Marketing Process

G : Transportation Lose

H : Storage Loss

I : Loss at Traders Level

Fig 4·1 Seed, Feed and Post-harvest Loss as Percentage of Total Production of Foodgrain Crops in 1989-90

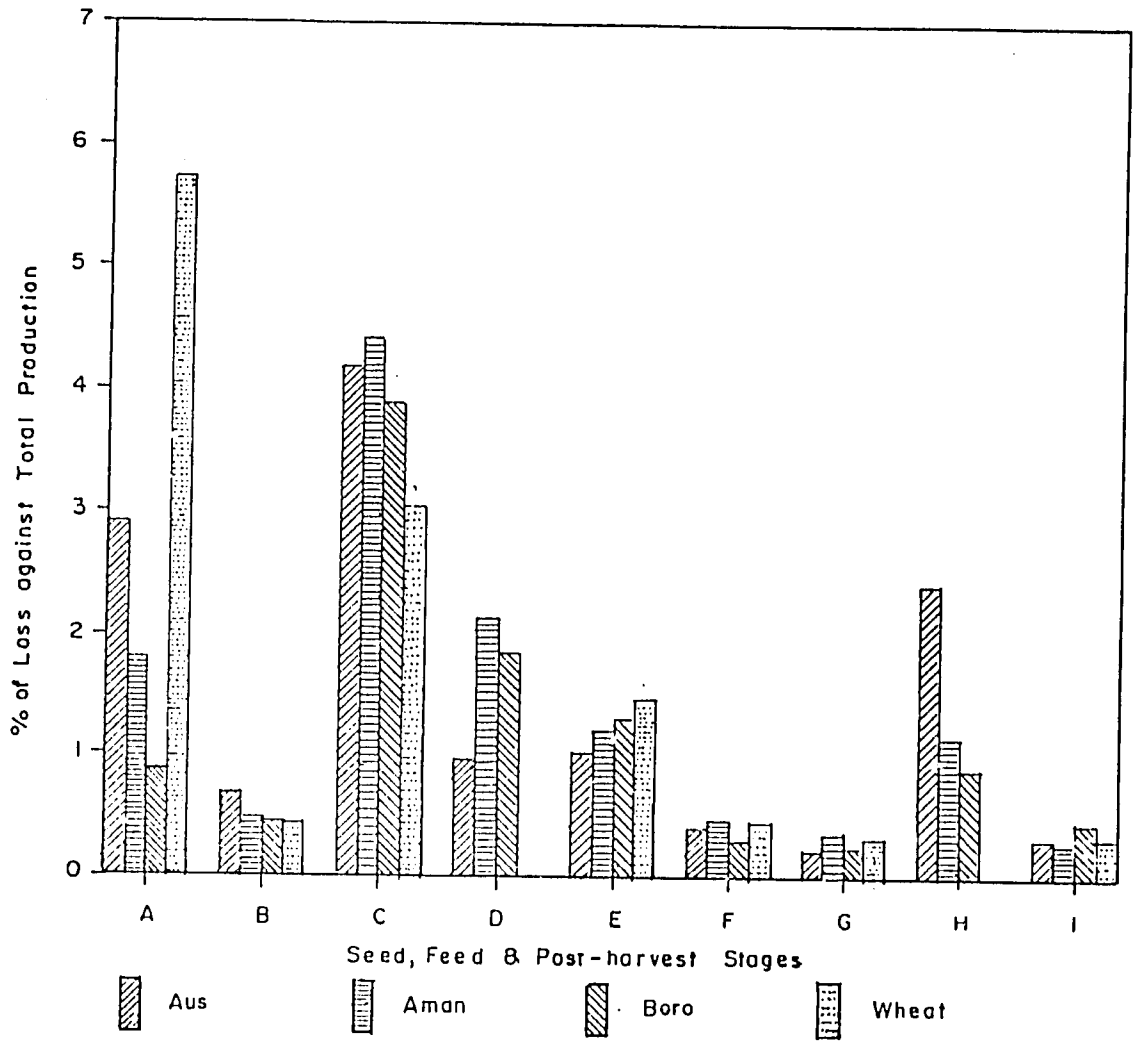
Table 4.2 : Estimated Seed, Feed and Post-harvest Loss of Foodgrain Crops during 1989-90 in Bangladesh.

| CROPS | Metric Ton | | | | |
|---|---|---|---|---|---|
| | Aus | Aman | Boro | Wheat | Total |
| Production | 2487530 | 9202040 | 6166750 | 890000 | 18746320 |
| Seed | 71890 | 165637 | 54884 | 50997 | 324311 |
| Feed | 16915 | 46010 | 28367 | 4094 | 95606 |
| Field Stacking Loss | 10199 | 100302 | 53651 | 4806 | 170592 |
| Carrying loss | 24875 | 57053 | 50567 | 5073 | 138723 |
| Beating loss | 15671 | 62574 | 37617 | 5874 | 121851 |
| Bull threshing | 6716 | 23005 | 1233 | 445 | 29994 |
| Beating after threshing | 5721 | 28526 | 8017 | 178 | 43117 |
| Paddle threshing | 3234 | 14723 | 9867 | 0 | 28119 |
| Other threshing | 0 | 2761 | 0 | 445 | 3749 |
| Winnowing | 17164 | 75457 | 30834 | 5607 | 127475 |
| Drying (birds, goats etc.) | 16915 | 39569 | 40084 | 4272 | 101230 |
| Bad weather | 3234 | 0 | 6783 | 267 | 11248 |
| Total post harvest loss | 103979 | 403970 | 239270 | 27056 | 776098 |
| Parboiling loss | 23632 | 196924 | 114702 | 0 | 341183 |
| Milling loss | 26119 | 112265 | 81401 | 13172 | 232454 |
| Handling loss | 11194 | 45090 | 19734 | 4094 | 78735 |
| Transportation loss | 5721 | 34968 | 16034 | 3026 | 59988 |
| Storage loss | 60696 | 106744 | 55501 | 0 | 192087 |
| Total loss at farm level | 320145 | 1111606 | 609892 | 102439 | 2101462 |
| Weighted traders loss | 8191 | 27845 | 30186 | 2937 | 69361 |
| Grand Total | 328354 | 1139213 | 640109 | 105376 | 2170824 |

Table 4.3: Weighted Use of Seed and Feed, Post-harvest Milling, Transportation, Storage and Marketing Losses of Rice as Percentage of production in Bangladesh (Weighted)*

| Item Descriptions : | Aus | Aman | Boro | Total |
|---|---|---|---|---|
| Production (in metric tons) | 2990799 | 8664802 | 3934187 | 14989788 |
| Seed used % of production | 2.89 | 1.80 | 0.89 | 1.78 |
| Feed as % of production | 0.68 | 0.50 | 0.46 | 0.53 |
| Field Stacking Loss | 0.41 | 1.09 | 0.87 | 0.90 |
| Carrying loss | 1.00 | 0.62 | 0.82 | 0.75 |
| Beating loss | 0.63 | 0.68 | 0.61 | 0.65 |
| Bull threshing | 0.27 | 0.25 | 0.02 | 0.19 |
| Beating after threshing | 0.23 | 0.31 | 0.13 | 0.25 |
| Paddle threshing | 0.13 | 0.16 | 0.16 | 0.15 |
| Other threshing | 0.00 | 0.03 | 0.00 | 0.02 |
| Winnowing | 0.69 | 0.82 | 0.50 | 0.71 |
| Drying (birds, goats etc.) | 0.68 | 0.43 | 0.65 | 0.54 |
| Bad weather | 0.13 | 0.00 | 0.11 | 0.05 |
| Total post harvest loss | 4.18 | 4.39 | 3.88 | 4.21 |
| Parboiling loss | 0.95 | 2.14 | 1.86 | 1.83 |
| Milling loss | 1.05 | 1.22 | 1.32 | 1.21 |
| Handling loss | 0.45 | 0.49 | 0.32 | 0.44 |
| Transportation loss | 0.23 | 0.38 | 0.26 | 0.32 |
| Storage loss | 2.44 | 1.16 | 0.90 | 1.35 |
| Total loss at farm level | 12.87 | 12.08 | 9.89 | 11.67 |
| Weighted traders loss | 0.33 | 0.30 | 0.49 | 0.36 |
| Grand Total | 13.20 | 12.38 | 10.38 | 12.03 |

* Total average rice production (1983-84 to 1987-88) was 14989788 metric tons of which 2990799 was Aus, 8664802 was Aman and 3934187 was Boro. The corresponding weight was 0.20 for Aus, 0.54 for Aman and 0.26 for Boro.




A : Seed

B : Feed

C : Total Post-harvest Loss

D : Parboiling Loss

E : Milling Loss

F : Handling Loss in Marketing Process

G : Transportation Loss

H : Storage Loss

I : Loss at Traders Level

Fig. 4.2 Seed, Feed and Post-harvest Loss as Percentage of Total Production of Different Foodgrain Crops in 1989–90

Estimated foodgrains used as seed, feed and Post-harvest Loss in the present study appears to be 1.5% higher than the thumb rule of (10%) used by the Ministry of Food. There is no literature available to justify the basis of such 10 % foodgrain loss as seed, feed and post-harvest wastage. This is only a thumb rule. The other study carried out earlier in South-East Asia by Mallick (1981) in Nepal and Pandua 1978 and PICARRD 1984 in the Philippines and FAO in Bangladesh estimated 22%, 18%, 23% and 13% loss respectively as post-harvest loss. Our estimate is 11.58% for seed, feed and post-harvest loss which is most reasonable according to Bangladesh condition.

FAO (1986) reported that about 13% of foodgrain production are lost during post-harvest operations (from field staking to storing) in Bangladesh. However, our estimate is 1.5% less than that of FAO's (1986) study. The difference in the rate of loss estimation in two studies is probably due to several agro-socio-economic and statistical factors. One of the factors might be the sample size. In our study a larger sample spreading all over the country was used. In FAO study, only 35 villages of Dhaka, Sylhet, Comilla, Bogra and Rajshashi Greater Districts were considered. Moreover the FAO study was conducted during 1983-84 cropping seasons when the share of MV to the total foodgrains production was less than the present study period. Modern variety requires lower seed rate for cultivation than the local variety. Again, our sampling was stratified on the basis of agro-ecological zones and sampling units were distributed on the basis of total rice area intensity of modern variety which was more scientific to be representative sample to give a better estimate.

Post-harvest processing loss in the present study was 4.14% against the total foodgrain production. This is a closer estimate to Haque et.al (1984) who stated that above 5% of foodgrains were lost during the Post-harvest processing (from field stacking up to storing at the farmers level). ARDICOL (1988) and BRRI (1985) also revealed a closer estimate to our study but FAO (1986) indicated a 6% loss during these operations.

In the present study use of seed was 1.73% against total production. There was no country wide previous studies in Bangladesh regarding total seed requirement for foodgrain production. IRRI (1988) indicated that the proportion of seed relative to total production of rice ranged between 1.5% to 4% depending on the variety and methods of sowing. Hasem (1986) estimated that about 3% of foodgrains are required as seed to plant total rice area of Bangladesh.

Estimation of foodgrains as feed in the present study (0.51%) were similar to Dicky and Haque (1986) made in Bangladesh.

## 4.1 SEED

### 4.1.1 Foodgrains Used as Seed

Total paddy and wheat used as seed by the sample households were 1.6 and 5.73 percent respectively of the total production (Paddy production 5456247 kg. and wheat production 174637 kg) in 1989-90. The weighted mean (rice equivalent to paddy seed and wheat) was 1.73 percent of the total foodgrain production (Table 4.1.1).

The quantity of seed used during Aus production was 2.89 percent of the total Aus production. Out of the total quantity of Aus seed used, Broadcast (B) Aus represented 4.12 percent and Transplant (T) Aus 1.70 percent of the total production .

The quantity of Aman seed used was 1.80 percent of the total Aman production. Out of the total Aman seed used, Broadcast (B) Aman represented 3.91 percent and Transplant (T) Aman 1.53 percent of the total production.

The quantity of the seed used during Boro season was 0.89 percent of the total Boro production of the sample households. Boro crops were all transplanted whereas wheat was line sown or broadcast (Table 4.1.1).

In paddy production, seed used for modern varieties constituted 1.25 percent of the total production of the modern varieties (almost all modern varieties were transplanted and had high yield potential). On the other hand, seed used for local varieties constituted 2.57 percent of the total production of the local varieties (a considerable proportion of local varieties having low yield potential were broadcast). Region wise distribution of seed used by the sample household, in different crops is presented in Appendix 4.1.1

### 4.1.2 Seed Rate of Foodgrain Crops

Average Seed rate of T. Aus was 44 kg./ha compared to 71 kg./ha for B. Aus. Average seed rate of T. Aman was 46 kg./ha and B. Aman (all local varieties) was 73 kg./ha.

Average seed rate of Boro was 37 kg./ha. (all transplanted). Average seed rate of Wheat was 86 kg./ha. for modern varieties grown under broadcast or line sown methods (Table 4.1.1). Similar seed rate was also reported by BRRI and BARI. Average germination percentage of seed (from laboratory test) was found to be 82 percent (Appendix 4.1.2).

Table 4.1.1 Seed Used and Seed Rate of the Sampled Households in 1989-90

| Crops | Seed Used (kg) | % of Production | Seed Rate kg/ha |
|---|---|---|---|
| TOTAL AUS : | 20452 | 2.89 | 59.98 |
| Transplanted | 6111 | 1.70 | 44.38 |
| MV | 5619 | 1.67 | 44.07 |
| LV | 492 | 2.25 | 48.24 |
| Broadcast | 14341 | 4.12 | 70.54 |
| MV | 2686 | 3.85 | 81.64 |
| LV | 11655 | 4.19 | 68.40 |
| TOTAL AMAN : | 48425 | 1.80 | 50.67 |
| Transplanted | 36826 | 1.53 | 46.25 |
| MV | 24720 | 1.45 | 48.94 |
| LV | 12106 | 1.74 | 41.59 |
| Broadcast | | | |
| MV | - | - | - |
| LV | 11599 | 3.91 | 72.72 |
| TOTAL BORO : | 18259 | 0.89 | 36.53 |
| Transplanted | 18259 | 0.89 | 36.53 |
| MV | 16980 | 0.89 | 37.34 |
| LV | 1279 | 0.86 | 28.36 |
| TOTAL PADDY : | 87136 | 1.60 | 48.52 |
| MV | 50005 | 1.25 | 44.65 |
| LV | 37131 | 2.57 | 54.93 |
| Weighted (Paddy) | - | 1.78 | - |
| WHEAT : | | | |
| Broadcast/ Line Sown | | | |
| MV | 10006 | 5.73 | 86.11 |
| LV | - | - | - |
| Weighted (Overall) | - | 1.73 | - |

Note : Conversion ratio, Paddy to Rice 0.676

### 4.1.3 Area Under Foodgrain Crops

Total area under Paddy production of the sample households was 1796 ha. i.e. 1.53 ha./household in three cropping seasons (Table 4.1.2). Total area under Aus crop of the sample households was 341 hectares. Among them 137.7 ha. was under T. Aus and 203.3 ha under B. Aus or mixed Aus-Aman. Among the Aus, about 47% area was under modern varieties and 53 % was under local varieties. Total area under Aman crop of the sample households was 956 hectares of which about 53% was under modern varieties and the rest under local varieties. Area under Boro crop was about 500 hectares of which 91 percent area were under modern varieties. About 62 percent of paddy area of the sample households comprise of modern varieties (including pajam) and 38 percent area under local varieties. Of

the area under Paddy cultivation of the sample households, 19 percent was under Aus, 53 percent under Aman and 28 percent was under Boro Crops. These results are in agreement with BBS figures of the area under different rice varieties. Total area under wheat production was 116 hectares, all of which were under modern varieties.

### 4.1.4 Foodgrains Production

Total foodgrain production of the sample households were 5630884 kg. of which 5456247 kg. was paddy (3710248 kg. rice equivalent) and 174637 kg. was wheat. Of the paddy production 707405 kg. was Aus ( 58% modern and 42% local varieties), 2697527 kg. was Aman (63% modern and 37% local varieties). Total production of Boro was 2051315 kg. of which 93% was modern and 7% was local varieties. Total production of Wheat was 174637 kg. (all modern varieties) (Table 4.1.2). Average yield of paddy of the sample households was 3038 kg./ha. Average yield of modern T.Aman was 3374 kg./ha., local T. Aman was 2393 kg./ha. and B. Aman (all local) was 1859 kg./ha. Average yield of Boro was 4104 kg/ha which was the highest among the three crops. The yield of modern Boro was 4183 kg/ha and local Boro was 3310 kg/ha. (Table 4.1.2). Average yield of wheat was 1503 kg/ha (Table 4.1.2). These results are in accordance with the results of BRRI and BARI.

### 4.1.5 Estimated Seed Requirement

Applying the ratio of foodgrain production and seed (sample households) to the foodgrain production of 1989-90, the estimated seed requirement of the country came to be about half a million tons (Table 4.1.3). Out of the total quantity of seed, about 431 thousand tons were paddy and 51 thousand tons were wheat. The paddy seed estimate is 21 percent less than Hasem (1986) and 18 percent less than our own hypothetical estimate (based on the 10- year, 1979-1988, average area under foodgrain production in Bangladesh and recommended seed rate of different foodgrain crops, presented in Chapter II). The estimate of wheat seed is also 8 percent less than the hypothetical estimate, presented in Chapter II.

Table 4.1.2 Total Area and Production of Foodgrains of the Sampled Households in 1989-90

| Crops | Area (ha) | | % | Production (kg) | | % | Yield kg/ha |
|---|---|---|---|---|---|---|---|
| AUS : | 341.0 | 100.0 | (19.0) | 707405 | 100.0 | (13.0) | 2075 |
| Transplanted | 137.7 | 40.4 | | 359301 | 50.8 | | 2609 |
| MV | 127.5 | 37.4 | | 337105 | 47.7 | | 2646 |
| LV | 10.2 | 3.0 | | 21896 | 3.1 | | 2147 |
| Broadcast* | 203.3 | 59.6 | | 348014 | 49.2 | | 1712 |
| MV | 32.9 | 9.6 | | 69800 | 9.9 | | 2122 |
| LV | 170.4 | 50.0 | | 278214 | 39.3 | | 1633 |
| AMAN : | 955.7 | 100.0 | (53.2) | 2697527 | 100.0 | (49.4) | 2823 |
| Transplanted | 796.2 | 83.3 | | 2400965 | 89.0 | | 3016 |
| MV | 505.1 | 52.8 | | 1704233 | 63.2 | | 3374 |
| LV | 291.1 | 30.5 | | 696732 | 25.8 | | 2393 |
| Broadcast** | | | | | | | |
| MV | - | - | | - | - | | - |
| LV | 159.5 | 16.7 | | 296562 | 11.0 | | 1859 |
| BORO : | 499.8 | 100.0 | (27.8) | 2051315 | 100.0 | (37.6) | 4104 |
| Transplanted | 499.8 | 100.0 | | 2051315 | 100.0 | | 4104 |
| MV*** | 454.7 | 91.0 | | 1902024 | 92.7 | | 4183 |
| LV | 45.1 | 9.0 | | 149291 | 7.3 | | 3310 |
| .TOTAL PADDY: | 1796.0 | 100.0 | (100.0) | 5456247 | 100.0 | (100.0) | 3038 |
| MV | 1120.0 | 62.4 | | 4013462 | 73.6 | | 3584 |
| LV | 676.0 | 37.6 | | 1442785 | 26.4 | | 2134 |
| WHEAT : | 116.2 | 100.0 | (100.0) | 174637 | 100.0 | (100.0) | 1503 |
| Broadcast/ Line Sown | | | | | | | |
| MV | 116.2 | | | 174637 | | | 1503 |
| LV | - | | | - | | | - |

* Included Aus part of the Mixed Aus - Aman Crop
** Included Aman part of the Mixed Aus - Aman Crop
*** MV (Modern Variety) includes Pajam

Note : (1) Figure in parentheses are the percentage of total.
(2) Conversion ratio, Paddy to Rice 0.676

Variation between the two estimates and also with Hashem (1986) was probably due to use of recommended seed rate in the hypothetical estimate in Chapter II. Most farmers in the country generally do not use recommended seed rate due to lack of knowledge on improved production practices which is reflected in the present study. Moreover, in recent years, more area was brought under cultivation of modern variety having higher average yield and lower seed requirement than the local varieties. This would have contributed lowering total seed requirement in paddy production of the sample households under study and thereby to the

national estimate. A lower estimate of wheat seed requirement in the present study than the hypothetical estimate is probably due to decline in area under wheat cultivation and average yield in the country in recent years.

Table 4.1.3. Estimated Seed Used (1989-90)in Bangladesh

| Crops | Production* (000) tons | % Seed Requirement (Present study) | Estimated Seed Requirement tons |
|---|---|---|---|
| A. Rice : | | | |
| Aus | 2487 | 2.89 | 71890 |
| Aman | 9202 | 1.80 | 165637 |
| Boro | 6167 | 0.89 | 54884 |
| Sub Total | 17856 | - | 292411 |
| Paddy Equivalent | | | 431285 |
| B. Wheat | 890 | 5.73 | 50997 |
| Total | 18746 | - | 482282 |

* BBS finalized this estimate in the month of March, 1991.

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## 4.2 FEED

### 4.2.1 Livestock and Poultry Population

In order to estimate the total quantity of foodgrains used as feed it is imperative to know the total number of livestock and poultry in the country. Out of 1175 households 1059 (about 90%) reported having livestock and poultry birds. Table 4.2.1 shows that the average heads of cattle, goats, sheep, chicken, ducks and other birds per household were 3.0, 1.03,0.10, 9.10,2.02 and 0.20 respectively. The density of cattle and poultry population as per present study corroborated almost closely with those reported in earlier studies (FAO/World Bank 1983), except density of poultry population in Jessore-Kushtia- Khulna region which showed a sharp rise. FAO/World Bank (1983) reported that there were approximately 6.85 million holdings owning livestock and poultry in Bangladesh. It was thus calculated (Table 4.2.2) that there were 20.55 million cattle and buffaloes, 7.06 million goats, 0.69 million sheep, 62.34 million chicken and 13.84 million ducks, and 1.37 million other birds (pigeon, etc.). In addition there were about 0.4 million heads of poultry in the specialized farms. The findings of the present study in respect of livestock and poultry population were in conformity with those of earlier studies. ( Agriculture Census, 1983-4 as well as Livestock Survey, 1983-84 ). The present study indicated also that the population of cattle, buffaloes, sheep and goats declined to some extent whereas that of chicken and ducks went up slightly in domestic farms but appreciably in specialized farms.

### 4.2.2 Paddy Used as Livestock and Poultry Feed

Paddy as such is rarely used as livestock and poultry feed in Bangladesh. Paddy is occasionally used in the form of boiled rice for feeding milch cows and buffaloes, and broken rice in the ration of chicks and ducklings. Sometimes, the food grains which become unfit for human consumption, are used as feed for livestock and poultry. The study revealed that in Bangladesh grains were not available beyond two months during every crop season(Aman, Boro, and Aus). It is evident from the Table 4.2.3 that the consumption of Aman Paddy was highest and that of Aus Paddy was lowest. Household survey indicated that 13488 kg. of Aman paddy, 9436 kg Boro paddy, 4810 kg. Aus paddy (Tables 4.2.4, 4.2.5 and 4.2.6) were used as feed representing 0.50, 0.46 and 0.68 percent of Aman, Boro and Aus production respectively. In other words, approximately, 87351 tons of Aman, 61109 tons of Boro and 31136 tons of Aus Paddy were used in Bangladesh as livestock and poultry feed (Tables 4.2.8, 4.2.9, 4.2.10, and 4.2.11).

Table 4.2.1.: Livestock and Poultry Population by Region

| AEZ | Av. No. of holdings | Cattle and buffaloes | Goats | Sheep | Chicken | Ducks | Other birds |
|---|---|---|---|---|---|---|---|
| Chittagong and Noakhali | 145 | 443.00 | 67.00 | 11.00 | 1058.00 | 217.00 | 0.00 |
| | Av/holding | 3.06 | 0.46 | 0.07 | 7.03 | 1.50 | 0.00 |
| Mymensingh, Kishoregonj and Jamalpur | 215 | 607.00 | 194.00 | 1.00 | 1838.00 | 189.00 | 1.11 |
| | Av/holding | 2.82 | 0.90 | 0.005 | 8.52 | 0.88 | 0.52 |
| Dhaka and Tangail | 85 | 315.00 | 63.00 | 43.00 | 678.00 | 221.00 | 4.00 |
| | Av/holding | 3.70 | 0.74 | 0.51 | 7.98 | 2.60 | 0.05 |
| Comilla and Sylhet | 126 | 246.00 | 51.00 | 3.00 | 995.00 | 280.00 | 0.00 |
| | Av/holding | 1.95 | 0.40 | 0.02 | 7.89 | 2.22 | 0.00 |
| Rajshahi, Bogra and Pabna | 113 | 379.00 | 87.00 | 7.00 | 1158.00 | 224.00 | 50.00 |
| | Av/holding | 3.35 | 0.77 | 0.06 | 10.25 | 1.48 | 0.44 |
| Rangpur and Dinajpur | 182 | 709.00 | 333.00 | 22.00 | 1972.00 | 378.00 | 41.00 |
| | Av/holding | 3.90 | 1.83 | 0.12 | 10.84 | 2.08 | 0.23 |
| Jessore, Kushtia and Khulna | 93 | 300.00 | 204.00 | 22.00 | 1249.00 | 444.00 | 5.00 |
| | Av/holding | 3.23 | 2.19 | 0.24 | 13.43 | 4.77 | 0.05 |
| Barisal, | 100 | 175.00 | 93.00 | 0.00 | 692.00 | 188.00 | 0.00 |
| Faridpur and Patuakhali | Av/holding | 1.75 | 0.93 | 0.00 | 6.92 | 1.88 | 0.00 |
| Total | 1059 | 3174.00 | 1092.00 | 109.00 | 9640.00 | 2141.00 | 211.00 |
| Av/holding | | 3.00 | 1.03 | 0.10 | 9.10 | 2.02 | 0.20 |

Table 4.2.2 : Summary of Livestock and Poultry Population

| Total Households owning livestock in Bangladesh* (Million) | Species | Heads/ Holding** | Total (Million) |
|---|---|---|---|
| 6.85 | Cattle and buffaloes | 3.00 | 20.55 |
| " | Goats | 1.03 | 7.06 |
| " | Sheep | 0.10 | 0.69 |
| " | Chicken | 9.10 | 62.34 |
| " | Ducks | 2.02 | 13.84 |
| " | Other Birds (Pigeon etc.) | 0.20 | 1.37 |

* FAO/World Bank 1983. Bangladesh Livestock Development Pilot Project No. 60/83 BGD. 37 Rome

** Present Study.

### 4.2.3 Wheat Used as Livestock and Poultry Feed

It is apparent from the present study (Table 4.2.7) that in Bangladesh wheat was not used as feed for goats or sheep. The use of wheat as cattle and poultry feed was also very limited, and it was used as feed only during the crop season of the year. It was found from the household survey that the total quantity of wheat used as feed for 3174 heads of cattle, 9640 chickens, 2141 ducks and 211 other birds (pigeon etc.) were 80 kg., 272 kg., 48 kg. and 2 kg. per month, respectively, which means feeding of 0.05 kg., 0.056 kg., 0.045 kg. and 0.019 kg. of wheat per head per year for cattle, chicken, ducks and other birds, respectively. Calculation was done on the basis of feeding for two months in a year (Table 4.2.7). It was found that 804 kg of wheat was used as feed representing 0.46 percent of the total production (174637 kg). The use of wheat in the specialized poultry farms was not included in the above calculation. The total quantity of wheat used as feed annually in the rural areas of Bangladesh comes to approximately 5173 tons (Table 4.2.12).

Table 4.2.3: Foodgrains (Paddy and Wheat) Used as Livestock and Poultry Feed in Holdings Surveyed in 8 AEZ.

| Name of Animal | Total No.of Livestock & Poultry in holdings surveyed | PADDY | | | WHEAT | Total Grains used as Feed | Total Prod. | Feed as % of total prod. |
|---|---|---|---|---|---|---|---|---|
| | | Aman (kg.) | Boro (kg.) | Aus (kg.) | (kg.) | (kg.) | (kg.) | |
| Cattle | 3174 | 5128 | 3716 | 1686 | 160 | | | |
| Goats & Sheep | 1201 | 63 | 166 | - | - | | | |
| Chicken | 9640 | 6092 | 4052 | 2576 | 544 | | | |
| Ducks | 2141 | 2147 | 1414 | 524 | 96 | | | |
| Other Birds (Pigeon etc.) | 211 | 58 | 88 | 24 | 4 | | | |
| Total | | 13488 | 9436 | 4810 | 804 | 28538 | 5630884 | 0.51 |

Note : Conversion ratio, Paddy to Rice 0.676

Table 4.2.4: Aman Paddy Used as Livestock and Poultry Feed in Holdings Surveyed in 8 AEZ.

| Name of Animal | Total No.of Livestock & Poultry in holdings surveyed | kg/Month | kg/Year on the basis of 2 months /year | kg/head year | Total Aman used as Feed | Total Prod. (kg.) | Feed as % of total prod. |
|---|---|---|---|---|---|---|---|
| Cattle | 3174 | 2564.0 | 5128 | 1.616 | 5129 | | |
| Goats & Sheep | 1201 | 31.5 | 63 | 0.052 | 63 | | |
| Chicken | 9640 | 3046.0 | 6092 | 0.632 | 6092 | | |
| Ducks | 2141 | 1073.5 | 2147 | 1.003 | 2147 | | |
| Other Birds (Pigeon etc.) | 211 | 29.0 | 58 | 0.275 | 58 | | |
| Total | | 6744.0 | 13488 | | 13488 | 2697527 | 0.50 |

Note : Conversion ratio, Paddy to Rice 0.679

Table 4.2.5: Boro Paddy Used as Livestock and Poultry Feed in Holdings Surveyed in 8 AEZ.

| Name of animal | Total No.of Livestock & Poultry in holdings surveyed | kg/Month | kg/Year on the basis of 2 months /year | kg/head year | Total Boro used as Feed | Total Prod. (kg.) | Feed as % of total prod. |
|---|---|---|---|---|---|---|---|
| Cattle | 3174 | 1858 | 3716 | 1.171 | 3716 | | |
| Goats & Sheep | 1201 | 83 | 166 | 0.138 | 166 | | |
| Chicken | 9640 | 2026 | 4052 | 0.420 | 4052 | | |
| Ducks | 2141 | 707 | 1414 | 0.660 | 1414 | | |
| Other Birds (Pigeon etc.) | 211 | 44 | 88 | 0.417 | 88 | | |
| Total | | 4718 | 9436 | | 9436 | 2051315 | 0.46 |

Note : Conversion ratio, Paddy to Rice 0.678

Table 4.2.6: Aus Paddy Used as Livestock and Poultry Feed in Holdings Surveyed in 8 AEZ.

| Name of animal | Total No.of Livestock & Poultry in holdings surveyed | kg/Month | kg/Year on the basis of 2 months /year | kg/head year | Total Aus used as Feed | Total Prod. (kg.) | Feed as % of total prod. |
|---|---|---|---|---|---|---|---|
| Cattle | 3174 | 843 | 1686 | 0.531 | 1686 | | |
| Goats & Sheep | 1201 | - | - | - | - | | |
| Chicken | 9640 | 1288 | 2576 | 0.267 | 2576 | | |
| Ducks | 2141 | 262 | 524 | 0.245 | 524 | | |
| Other Birds (Pigeon etc.) | 211 | 12 | 24 | 0.114 | 24 | | |
| Total | | 2405 | 4810 | - | 4810 | 707405 | 0.68 |

Note : Conversion ratio, Paddy to Rice 0.674

Table 4.2.7: Wheat Used as Livestock and Poultry Feed in Holdings Surveyed in 8 AEZ.

| Name of animal | Total No.of Livestock & Poultry in holdings surveyed | kg/Month | kg/Year on the basis of 2 months /year | kg/head year | Total Wheat used as Feed | Total Prod. (kg.) | Feed as % of total prod. |
|---|---|---|---|---|---|---|---|
| Cattle | 3174 | 80 | 160 | 0.050 | 160 | | |
| Goats & Sheep | 1201 | - | - | - | - | | |
| Chicken | 9640 | 272 | 544 | 0.056 | 544 | | |
| Ducks | 2141 | 48 | 96 | 0.045 | 96 | | |
| Other Birds (Pigeon etc.) | 211 | 2 | 4 | 0.019 | 4 | | |
| Total | - | 402 | 804 | - | 804 | 174637 | 0.46 |

As reported by Dicky and Haque (1986) 0.2 Million heads of poultry are reared by specialized farms consuming 45-50 percent grains (wheat) in the ration. As stated by the Deputy Director L.S., and other relevant personnel that this number has increased at least by two times, which means that there are approximately 0.4 million heads of poultry in the existing specialized poultry farms in the country. It is evident from the survey of 15 poultry farms in the 8 AEZ (Table 4.2.13) that 52.67 gms. of wheat per head per day or 19.226 kg. of wheat per head per year was used in the poultry feed, which means that a quantity of 7690.40 tons of wheat was used as feed in the specialized poultry farms of the

country/year. The daily per head consumption of wheat in the specialized poultry farms agrees with the previous statement referred in the review chapter.

### 4.2.4 Foodgrain Used in the Specialized Farms

From the survey of specialized Dairy Farms it was found that foodgrains were not used as feed for cattle (Appendix 4.2.1). It was also noticed that in the specialized poultry farms the use of wheat as feed was common and the use of paddy as feed was practically nil.

### 4.2.5 Feed Mills

From the survey of Feed Mills (Appendix 4.2.2) it was observed that food grains were not included as ingredients of feed mixture prepared by the cattle feed mills, whereas the poultry feed mills used invariably wheat (approximately 50%) as a component of the feed formulation.

### 4.2.6 Storage Loss in Feed Mills

From the study of storage loss of foodgrains used as feed it was learnt that in livestock and poultry farms the prepared feeds were not usually stored for long time, and as such storage loss was insignificant. In poultry feed mills only wheat had to be stored occasionally and that also for not more than two months at a time resulting in storage loss of approximately one percent of wheat stored (Appendix 4.2.3)

### 4.2.7 Summary

Paddy and wheat used as the feed were calculated on the basis of two months in each of the three seasons. During rest of the year (6 months) grains were not available as feed. The summary is given below :

Paddy and Wheat used as Feed in the holdings surveyed in 8 AEZ:

| | |
|---|---|
| Aman Paddy | : 13488 kg |
| Boro Paddy | : 9436 " |
| Aus Paddy | : 4810 " |
| Total | : 27734 kg (18859 kg Rice equivalent) |
| Total Production | : 5456247 kg. (3710248 kg Rice equivalent) |
| Wheat | : 804 kg. |
| Total wheat production | : 174637 kg |

Total Production (Paddy and Wheat): 5630884 kg.
Total feed used : 28538 kg.
Feed as percent of production : 0.51

It may be mentioned here that use of grains in the specialised poultry farms was not included in the above calculation.

Paddy used as feed (Countrywise) :

| | | |
|---|---|---|
| Aman Paddy | : 87351 | tons |
| Boro Paddy | : 61109 | " |
| Aus Paddy | : 31136 | " |
| Total | :179596 | tons |
| | 118338 | " (Rice equivalent) |

Wheat used as Feed (Countrywise):

| | |
|---|---|
| Domestic Farms | : 5172.58 tons |
| Specialized Poultry Farms | : 7690.40 tons |
| Total | : 12862.98 tons |
| Grand Total (Paddy and Wheat) | : 192458.98 tons |

Thus it was estimated that about 192.5 thousand tons of foodgrains were available to the livestock and poultry feeding during 1989-90. This observation is in conformity with the statement of Dicky and Haque (1986) indicating the availability of 190 thousands tons of grains as feed, but the trend is slightly upward.

Table 4.2.8: Food Grains (Paddy and Wheat) Used as Livestock and Poultry Feed per Year.

| Name of animal | Livestock and Poultry in Bangladesh | Paddy (kg) | | | Wheat (kg) |
|---|---|---|---|---|---|
| | | Aman | Boro | Aus | |
| Cattle & Buffaloes | 20562000 | 33228192 | 24078102 | 10918422 | 1028100 |
| Goats & Sheep | 7745020 | 402741 | 1068813 | - | - |
| Chickens | 62371400 | 39418724 | 26195988 | 16653164 | 3492798 |
| Ducks | 13845080 | 13886615 | 9137753 | 3392045 | 623029 |
| Other birds | 1507880 | 414667 | 628786 | 171898 | 28650 |
| Sub-total Poultry in specialized farms | 400000 | 87350939 - | 61109442 - | 31135529 - | 5172577 7690400 |
| Total (kg) | | 87350939 | 61109442 | 31135529 | 12862977 |
| Total (ton) | | 87350.94 | 61109.44 | 31135.53 | 12862.98 |

Grand Total (Paddy and Wheat ) : 192.5 thousand tons

Table 4.2.9 : Aman Paddy used as Livestock and Poultry Feed.

| Name of animal | Total No. of Livestock & Poultry in holding surveyed in 8 AEZ | kg/month | kg/year on the basis of 2 month/yr. | kg/Head/ Year | Total No. of Livestock & Poultry in Bangladesh | Total Aman Paddy used as feed in Bangladesh |
|---|---|---|---|---|---|---|
| Cattle & Buffaloes | 3174 | 2564 | 5128 | 1.616 | 20562000 | 33228192 |
| Goat & Sheep | 1201 | 31.5 | 63 | 0.052 | 7745020 | 402741 |
| Chickens | 9640 | 3046.0 | 6092 | 0.632 | 62371400 | 39418724 |
| Ducks | 2141 | 1073.5 | 2147 | 1.003 | 13845080 | 13886615 |
| Other birds (Pigeon etc.) | 211 | 29.0 | 58 | 0.275 | 1507680 | 414667 |
| Total | | 6744 | 13488 | - | 106031380 | 87350939 |

Note : Conversion ratio, Paddy to Rice 0.679

Table 4.2.10 : Boro Paddy Used as Livestock and Poultry Feed

| Name of animal | Total No. of Livestock & Poultry in holdings surveyed in 8 AEZ | kg/month | kg/year on the basis of 2 month/yr. | kg/Head/Year | Total No. of Livestock & Poultry in Bangladesh | Total Boro Paddy used as feed in Bangladesh |
|---|---|---|---|---|---|---|
| Cattle | 3174 | 1858 | 3716 | 1.171 | 20562000 | 24078102 |
| Goat & Sheep | 1201 | 83 | 166 | 0.138 | 7745020 | 1068813 |
| Chickens | 9640 | 2026 | 4052 | 0.420 | 62371400 | 26195988 |
| Ducks | 2141 | 707 | 1414 | 0.660 | 13845080 | 9137753 |
| Other birds (Pigeon etc.) | 211 | 44 | 88 | 0.417 | 1507880 | 628786 |
| Total | | 4718 | 9436 | - | 106031380 | 61109442 |

Note : Conversion ratio, Paddy to Rice 0.678

Table 4.2.11 : Aus Paddy Used as Livestock and Poultry Feed

| Name of animal | Total No. of Livestock & Poultry in holdings surveyed in 8 AEZ | kg/month | kg/year on the basis of 2 month/ year | kg/Head/Year | Total No. of Livestock & Poultry in Bangladesh | Total Aus Paddy used as feed in Bangladesh |
|---|---|---|---|---|---|---|
| Cattle and Buffaloes | 3174 | 843 | 1686 | 0.531 | 20562000 | 10918422 |
| Goat & Sheep | 1201 | - | - | - | 7745020 | - |
| Chicken | 9640 | 1288 | 2576 | 0.267 | 62371400 | 16653104 |
| Ducks | 2141 | 262 | 524 | 0.245 | 13845080 | 3392045 |
| Other birds (Pigeon etc.) | 211 | 12 | 24 | 0.114 | 1507880 | 171898 |
| Total | | 2405 | 4810 | - | 106031380 | 31135529 |

Note : Conversion ratio, Paddy to Rice 0.674

Table 4.2.12 : Wheat Used as Livestock and Poultry Feed

| Name of animal | Total No. of Livestock & Poultry in holdings surveyed in 8 AEZ | kg/month | kg/year on the basis of 2 month/ year | kg/Head/ Year | Total No. of Livestock & Poultry in Bangladesh | Total Wheat used as feed in Bangladesh |
|---|---|---|---|---|---|---|
| Cattle and Buffaloes | 3174 | 80 | 160 | 0.050 | 20562000 | 1028100 |
| Goat & Sheep | 1201<br>109 | - | - | - | 7745020 | - |
| Chickens | 9540 | 272 | 544 | 0.056 | 62371400 | 3492798 |
| Ducks | 2141 | 48 | 96 | 0.045 | 13845080 | 623029 |
| Other birds (Pigeon etc.) | 211 | 2 | 4 | 0.019 | 1507880 | 28650 |
| Total | | 402 | 804 | - | 106031380 | 5172577 |

Table 4.2.13 : Wheat Used in Specialized Poultry Farms

| Poultry in farms surveyed in 8 AEZ | kg/Yr | Gms/ head/ day | kg/ head/ Yr | Total poultry in specialized farms in Bangladesh | Total wheat used in feed (kg.) |
|---|---|---|---|---|---|
| 105993 in 15 farms | 2037857 | 52.67 | 19.226 | 400000* | 7690400 |
| | | | | | i.e. 7690.40 tons |

* Dicky and Haque estimated in 1986 a number of 0.2 million heads of poultry in specialized poultry farms in Bangladesh. As stated by the Deputy Director, L.S., Poultry and relevant personnel (personal communication) that this number has increased at least by two times at present.

## 4.3. POST HARVEST LOSS (PHL) OF FOODGRAINS

Loss of foodgrains in the post harvest operation begins from cutting of the crop in the field upto marketing. Losses of foodgrains varied widely from one stage to another stage and from one crop to another crop.

The PHL of foodgrain was estimated by a simple equation as enumerated in the methodology. The following equations reveal the loss of grains in the PH operations by different methods of threshing. It may be mentioned that except threshing, all the remaining factors were held constant. As mentioned earlier there exists no standardized method for threshing of the foodgrains and the method applied has been defined in chapter 2 (Review of Literature). The following equations show the loss estimate of a particular crop during the PH operation :

(1) $L_1 = S+C+(T+B)+W+D+WR$
(2) $L_2 = S+C+BT+W+D+WR$
(3) $L_3 = S+C+PT+W+D+WR$
(4) $L_4 = S+C+OT+W+D+WR$

Where

$L_1$ represents PHL estimation, where threshing was done by hitting the paddy on hard surface followed by threshing with bullocks;

$L_2$ represents PHL estimation where threshing was done by bullock;

$L_3$ represents PHL estimation where threshing was done by paddle thresher;

$L_4$ represents PHL estimation where threshing was done by other method e.g., flailing or beating of the crop with a stick;

S for stack loss;

C for carrying loss;

T for threshing by hitting on a hard surface;

B for threshing with bullock after hitting;

BT for threshing by bullock;

PT for paddle threshing;

OT for other threshing loss i.e. beating or flailing on the crop with a stick;

W for winnowing and cleaning loss;

D for drying loss and

WR for bad weather loss.

In the following paragraphs the findings of PHL have been discussed by crops i.e., Aus, Aman, Boro and Wheat. While discussing the individual crop details of PHL are also enumerated.

### 4.3.1 Aus Crops

Inserting the values of the variables mentioned in section 4.3 the estimated PHL of Aus crop by different process of threshing from the sample HH are shown below:

(1) $LA_1$ = 2918+7089+(4458+1662)+4895+4841+919 = 26782

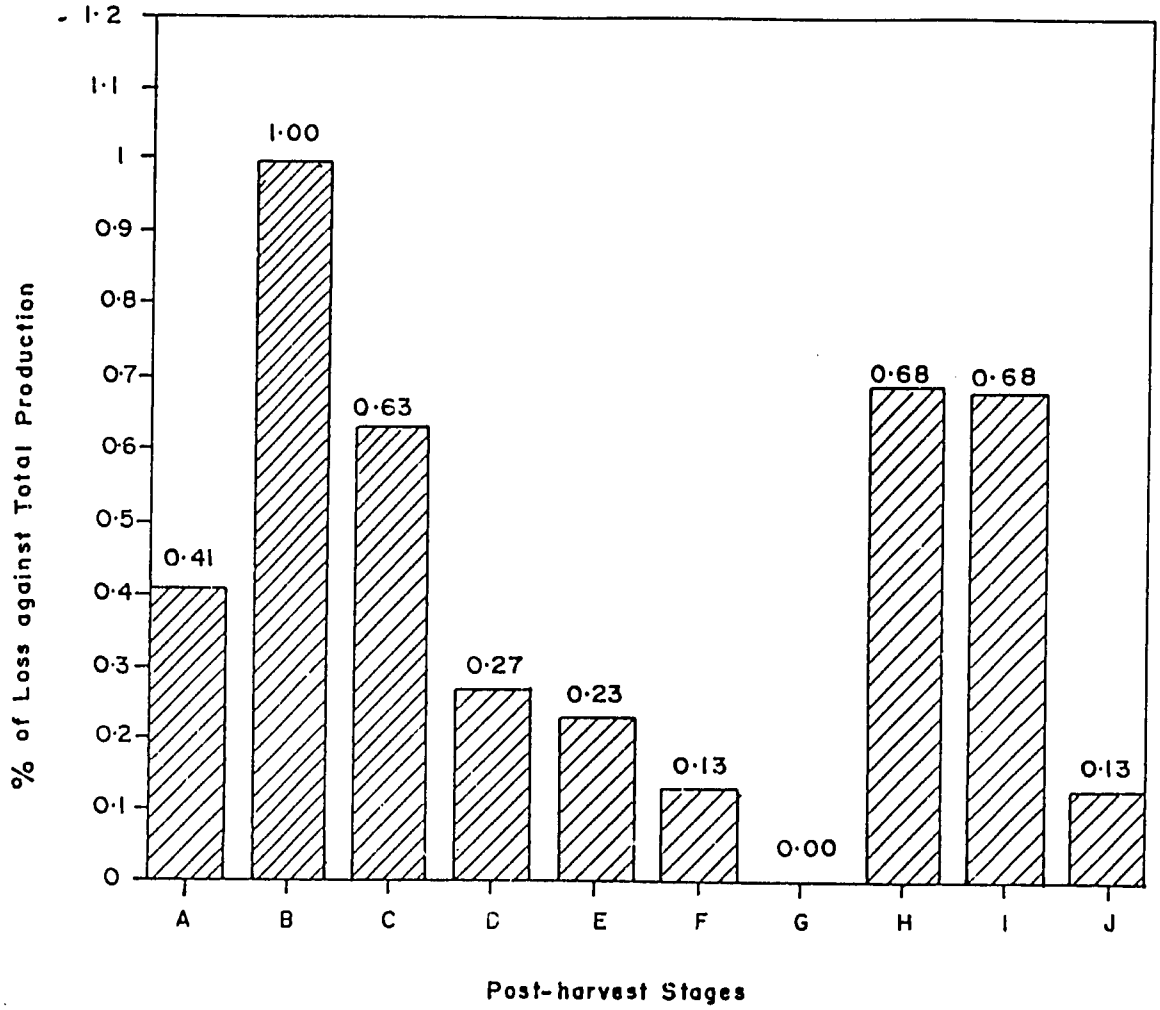
(2) $LA_2$ = 2918+7089+1917+4895+4841+919 = 22579

(3) $LA_3$ = 2918+7089+900+4895+4841+919 = 21562

(4) $LA_4$ = 2918+7089+2+4895+4841+919 = 20664

Where $L_A$ represents post-harvest loss for Aus crop by different threshing methods.

The above equations revealed that loss of foodgrain occurred maximum while threshing the crops by hitting the paddy on hard surface followed by threshing with bullocks ($LA_1$). Conversely there occurs less loss when the crop was threshed by paddle threshing ($LA_3$). Threshing loss by other method was insignificant compared to others so it was not taken into account. PICARRD (1984) stated that mechanical threshing was more economical and significantly less time consuming than manual harvesting. The findings of this study indicate that with a mechanical thresher PHL could be reduced, taking less time and labor and the cost could be invariably minimized. For estimating PHL one has to select the equation for a region depending on the method of threshing. Post harvest loss as percent of total production of Aus crops is diagramatically shown in Figure 4.3.1.




A : Field Staking Loss

B : Loss during Carrying

C : Loss during Beating (hitting on hard surface )

D : Loss during Threshing with Bullock

E : Loss due to Beating followed by Threshing with Bullock

F : Loss due to Paddle Threshing

G : Other Threshing Losses

H : Winnowing and Cleaning Losses

I : Loss due to Drying

J : Loss due to Bad Weather.

Fig. 4·3·1 Post-harvest Loss as Percentage of Total production of Aus Crops in 1989-90

Table 4.3.1 revealed that the highest loss of grains occurred while carrying the paddy from field to farm yard. It was to the tune of 1.00% against total production. PHL of Aus crop was 4.18% against total production. Detailed PHL by regions and upazilas at different stages can be seen at Appendix 4.3.1 and 4.3.2 respectively. The loss of foodgrains estimated by Pandua (1978) during harvesting, handling and threshing ranged from 5 to 18 percent. Our finding on Aus crop revealed a loss estimation of less than 5% on the similar activities.

Table 4.3.1 : Loss of Aus Crops in the PH Stages (in percentage)

| Loss due to | Loss against total production |
|---|---|
| 1. Stack loss | 0.41 |
| 2. Loss during carrying | 1.00 |
| 3. Loss during beating (hitting on hard surface) | 0.63 |
| 4. Loss during threshing with bullock | 0.27 |
| 5. Loss due to beating followed by threshing with bullock | 0.23 |
| 6. Loss due to paddle threshing | 0.13 |
| 7. Other threshing losses | - |
| 8. Winnowing & cleaning losses | 0.69 |
| 9. Drying loss | 0.68 |
| 10. Loss due to bad weather | 0.13 |
| Total Loss | 4.18 |

Drying loss was the third highest loss of Aus crop during its PH operation. In Bangladesh the most popular and traditional method of drying foodgrain was sun drying. Farmers dry their paddy on the open "Katcha" or unmetalled farm yards, roads, mats, etc. The quantitative losses in sun drying of the paddy in the open space result from spillage and foraging by animals such as cattle, chicken, ducks, goats and others. Grains are also lost in the cracks of the farm yard and weather hazards.

Table 4.3.2 indicated that the maximum loss of Aus paddy during the PH operations occurred at Jessore-Kushtia-Khulna region. The loss was 4.63% against total production. Percentage of loss against total production after Jessore-Kushtia-Khulna region was Barisal-Faridpur-Patuakhali region (4.42%), which was higher than the average (4.18%) of all regions. Lowest loss of PH operation occurred at Dhaka -Tangail region which was 2.93% against total production.

Table 4.3.2 : Post-harvest Loss of Aus Crop Against Total Production by Regions (in Percentage).

| Region | Loss against total production |
|---|---|
| Chittagong-Noakhali | 4.00 |
| Mymensingh-Kishoregonj-Jamalpur | 4.42 |
| Dhaka-Tangail | 2.93 |
| Comilla-Sylhet | 3.83 |
| Rajshahi-Bogra-Pabna | 3.92 |
| Rangpur-Dinajpur | 3.71 |
| Jessore-Kushtia-Khulna | 4.63 |
| Barisal-Faridpur-Patuakhali | 4.42 |
| All Regions | 4.18 |
| S.E. Mean | 0.19 |

The Aus production by varieties as conceived from the household Survey, indicated the share of local varieties at 42.42% and modern varieties at 57.58% of the total production. PHL by LV was 43.79% and by MV 56.21%. Amongst all the factors, loss of paddy while carrying was the highest. Figure 4.3.2 reveals the Lorenz curve showing concentration of total PHL of sampling HH from Aus Crop in 1989-90. The Gini's coefficient ratio of 0.44 indicates that the post-harvest loss is more or less spread over all types of households without concentrating to a particular group of households.

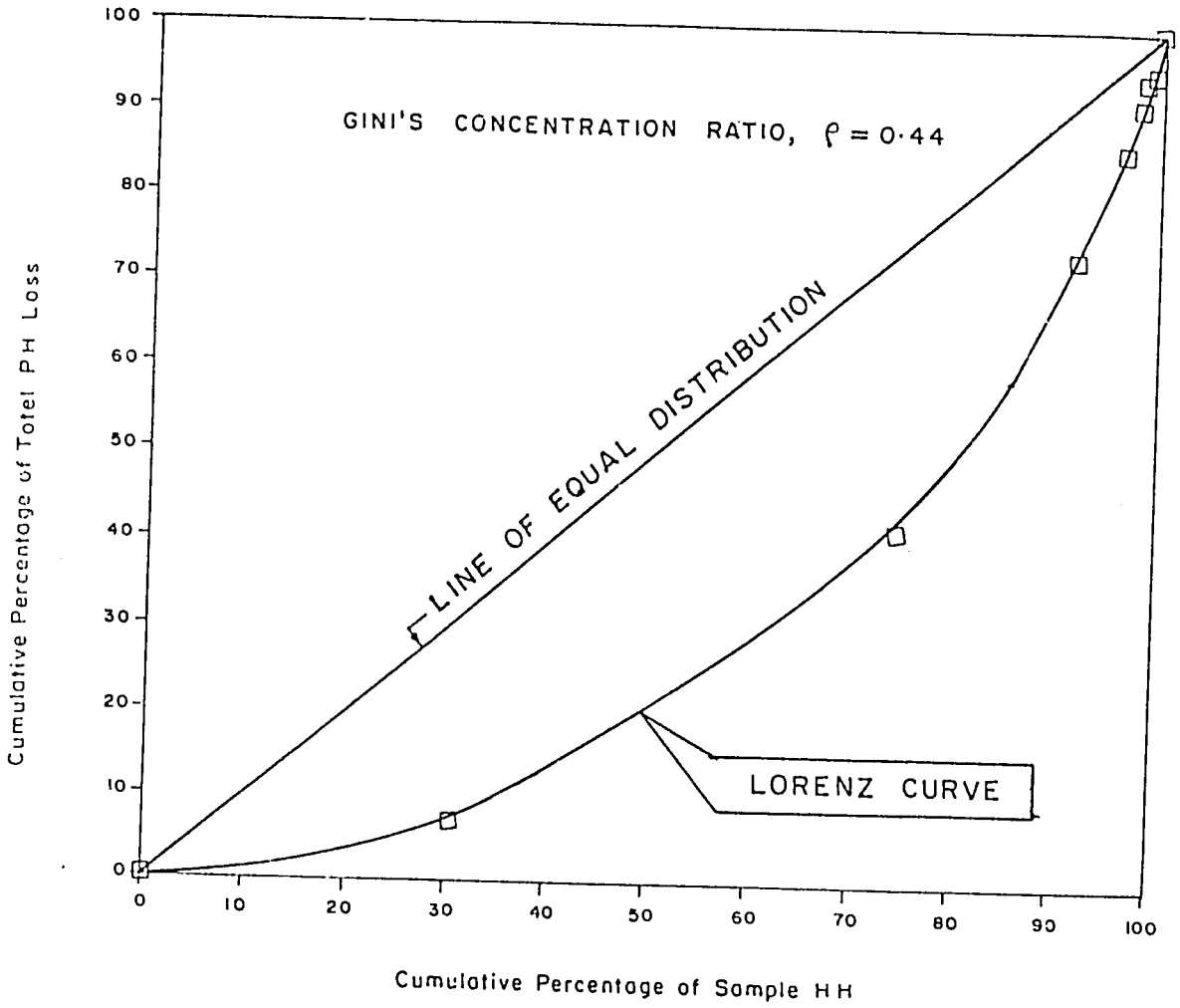



Fig. 4.3.2 Lorenz Curve Showing Concentration of Total PH Loss for Sample HH of Aus Crop in 1989-90

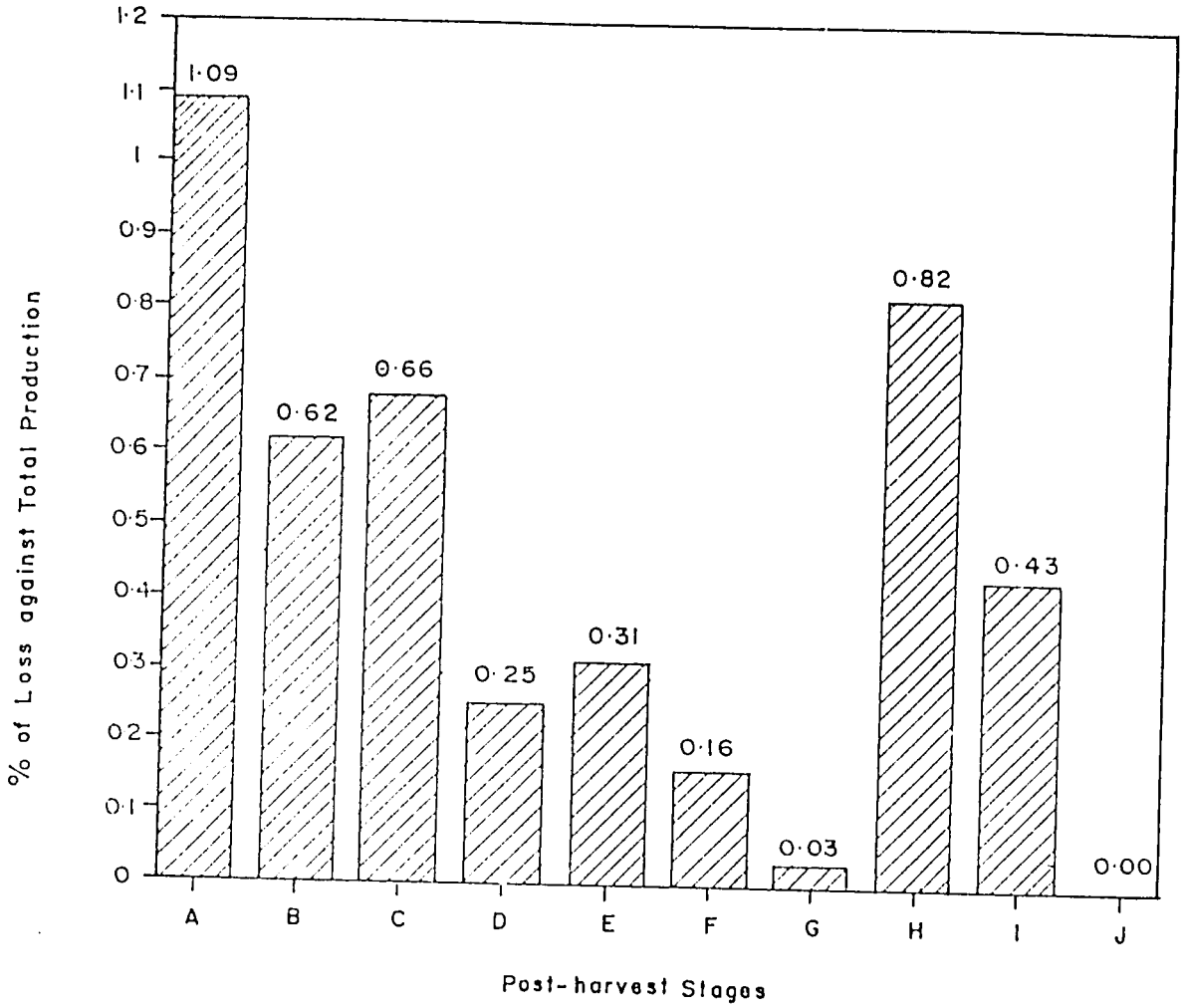
### 4.3.2 Aman Crops

Post-harvest loss of Aman crop was found maximum than Aus, Boro or Wheat crops, both in terms of quantity and percentages. PH loss of Aman crop was 4.39% of the total production. In Aman, stack loss was highest (1.09%) followed by winnowing (0.82%); threshing by hitting on hard surface (0.68%), carrying loss (0.62%) and drying loss (0.43%) which comprises more than 80% against total loss.

Table 4.3.3 shows PHL of Aman crop against total production during PH stages in percentages. About 25% of the loss has occurred due to stacking which is on the high side where the loss could be minimized. Details of PHL by regions and upazilas at different stages of PH operations can be seen at Appendices 4.3.4 and 4.3.5 respectively. Figure 4.3.3 shows PHL of foodgrain as percentage of production of Aman crop in 1989-90.

Table 4.3.3 : PHL of Aman Paddy Against Total Production.
(in percentage)

| Loss due to | Loss against total production |
|---|---|
| 1. Stack loss | 1.09 |
| 2. Loss during carrying | 0.62 |
| 3. Loss during beating(hitting on hard surface). | 0.68 |
| 4. Loss during threshing with bullock | 0.25 |
| 5. Loss due to beating followed by threshing with bullock | 0.31 |
| 6. Loss due to paddle threshing | 0.16 |
| 7. Other threshing loss | 0.03 |
| 8. Winnowing and cleaning loss | 0.82 |
| 9. Drying loss | 0.43 |
| 10. Loss due to bad weather | - |
| Total Loss | 4.39 |




A : Field Staking Loss

B : Loss during Carrying

C : Loss during Beating (hitting on hard surface)

D : Loss during Threshing with Bullock

E : Loss due to Beating followed by Threshing with Bullock

F : Loss due to Paddle Threshing

G : Other Threshing Losses

H : Winnowing and Cleaning Losses

I : Loss due to Drying

J : Loss due to Bad Weather

Fig. 4·3·3 Post-harvest Loss as Percentage of Total Production of Aman Crops in 1989-90.

Table 4.3.4 shows percentage of PH loss of Aman crops by region against total production.

Table 4.3.4 : PHL of Aman Crop Against Total Production.
(in percentage)

| Region | Loss against production |
|---|---|
| Chittagong-Noakhali | 5.12 |
| Mymensingh-Kishore-Jamalpur | 4.14 |
| Dhaka-Tangail | 3.77 |
| Comilla-Sylhet | 4.76 |
| Rajshahi-Bogra-Pabna | 3.95 |
| Rangpur-Dinajpur | 4.39 |
| Jessore-Kushtia-Khulna | 4.10 |
| Barisal-Faridpur-Patuakhali | 3.69 |
| Average | 4.39 |
| S.E. Mean | 0.17 |

Table 4.3.4 indicated PHL against total production. Chittagong-Noakhali region showed the maximum loss of 5.12% followed by Comilla-Sylhet with 4.76% , Rangpur-Dinajpur with 4.39%, Mymensingh-Kishoregonj-Jamalpur with 4.14%, Jessore-Kushtia-Khulna with 4.10% and so on. The lowest loss occurred in Dhaka-Tangail region (3.77%).

Table 4.3.5 indicated that among all the varieties highest loss occurred with modern varieties of T. Aman. Percentage against a total loss of T. Aman (MV) was 65.58 compared to 23.30 and 9.83 of T. Aman (LV) and B. Aman respectively. Among the item of loss in T.Aman (MV); highest loss items occurred while threshing the crop by bullocks but in terms of quantity highest loss occurred while stacking in the farm yard.

The stack loss may be attributable to (1) the fact that during the Aman harvesting season almost all the farm yards, open spaces were either occupied or were busy for threshing. So, immediately after the harvesting the crop could not be threshed due to lack of threshing space. As a result the crops were stacked in fields and farm yards without any protection. Surrounding the stack there were losses due to (a) rat infestation (b) consumption by poultry (c) pulling out by bullocks and cows and such others. (2) possibility of damage to occuring if the stack remains for a long period and if precipitation occurs. (3) Fungus infection, etc.

Proper measures and appropriate technology if applied loss could be minimized. It may be mentioned that with the use of

mechanical thresher, carrying and threshing losses could be reduced to a greater extent.

PH Loss of Aman Crops by varieties :

Aman crop comprises B. Aman, mixed Aus-Aman, T.Aman (LV) and T.Aman (MV). Table 4.3.5 shows the PH loss of Aman crops by varieties. Details of PH loss operation by different stages can be seen at Appendix 4.3.6.

Table 4.3.5 : Percentage PHL of Aman Crop by Varieties by type of loss.

| Type of Loss | B.Aman | Mixed Aus-Aman* | T.Aman (LV) | T.Aman (MV) | Total |
|---|---|---|---|---|---|
| Stack loss | 7.23 | 1.69 | 29.43 | 61.65 | 100 |
| Loss during carrying | 16.32 | 1.58 | 27.56 | 54.54 | 100 |
| Loss during beating (hitting on hard surface) | 1.65 | 0.31 | 26.25 | 71.79 | 100 |
| Loss during threshing with bullock | 27.85 | 4.11 | 19.63 | 48.40 | 100 |
| Loss due to beating followed by threshing with bullock | 3.68 | 0.12 | 20.05 | 76.15 | 100 |
| Loss during paddle thresher | 10.04 | 0.35 | 2.22 | 87.39 | 100 |
| Other threshing loss | 47.54 | - | - | 52.46 | 100 |
| Winnowing loss | 8.20 | 0.88 | 19.45 | 71.47 | 100 |
| Drying loss | 14.23 | 1.89 | 18.32 | 65.56 | 100 |
| Loss due to bad weather | 38.64 | - | 11.36 | 50.00 | 100 |
| Total loss | 9.83 | 1.29 | 23.30 | 65.58 | 100 |

* Aman part of the mixed Aus-Aman crop.

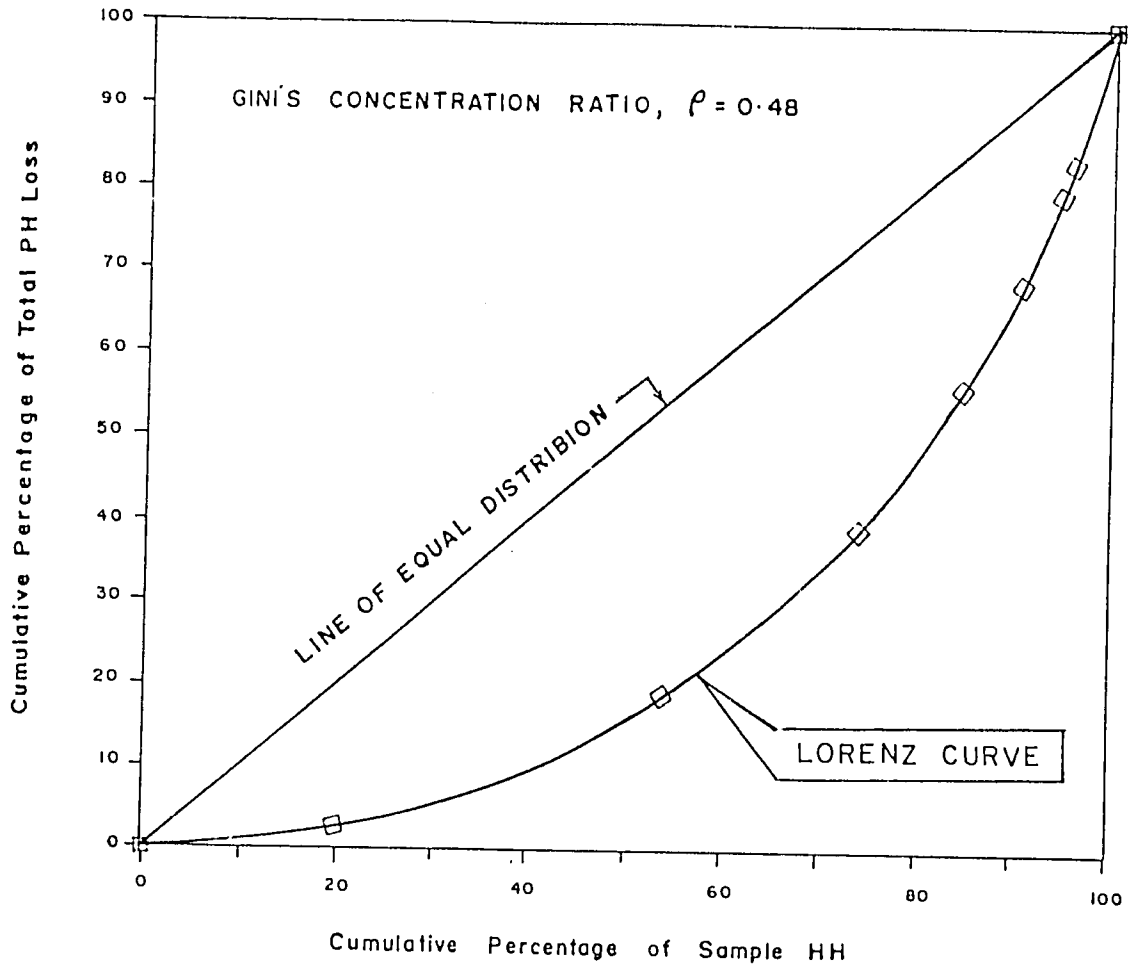



Fig. 4·3·4 Lorenz Curve Showing Concentration of Total PH Loss for Sample HH of Aman Crop in 1989-90

Of the total loss 65.58% was by T. Aman (MV), 23.30% by T. Aman (LV) and 9.83% by B. Aman. T. Aman (MV) comprises about 63% of the total Aman production.

Inserting the value of the variables mentioned in section 4.3 the estimated PHL of Aman crop by different processes of threshing from the sample HH are shown below :

(5) $L_{AM1}$ = 29364+16744+(18447+8289)+22231+11579+45 = 106699
(6) $L_{AM2}$ = 29364+16744+6618+22231+11579+45 = 86581
(7) $L_{AM3}$ = 29364+16744+4283+22231+11579+45 = 84246
(8) $L_{AM4}$ = 29364+16744+873+22231+11579+45 = 80836

Where $L_{AM}$ represents post-harvest loss for Aman crop by different threshing methods.

In the above equations PHL of Aman crop was found highest when it was threshed by hitting on the hard surface followed by threshing with bullocks. Threshing loss in terms of quantity was one of the highest, found in Aman crop. PH operation with proper attention and improved methods if applied this loss could be invariably reduced. This may lead to more availability of foodgrains in the country.

### 4.3.3 Boro Crops

More than 90% of the Boro crop comprises of modern varieties. It is transplanted during January-February and harvested during May -June. During April nor wester hits the country and from June onwards the south-west monsoon rainfall begins.

Inserting the values of the variables mentioned in section 4.3 estimated PHL of Boro crop by different processes of thresshing from the sample HH are shown below:

(9) $L_{B1}$ = 17922+16916+(12524+2671)+10327+13281+2232 = 75873
(10) $L_{B2}$ = 17922+16916+343+10327+13281+2232 = 61021
(11) $L_{B3}$ = 17922+16916+3379+10327+13281+2232 = 64057
(12) $L_{B4}$ = 17922+16916+45+10327+13281+2232 = 60723

Where $L_B$ represents post-harvest loss of Boro crop by different threshing methods.

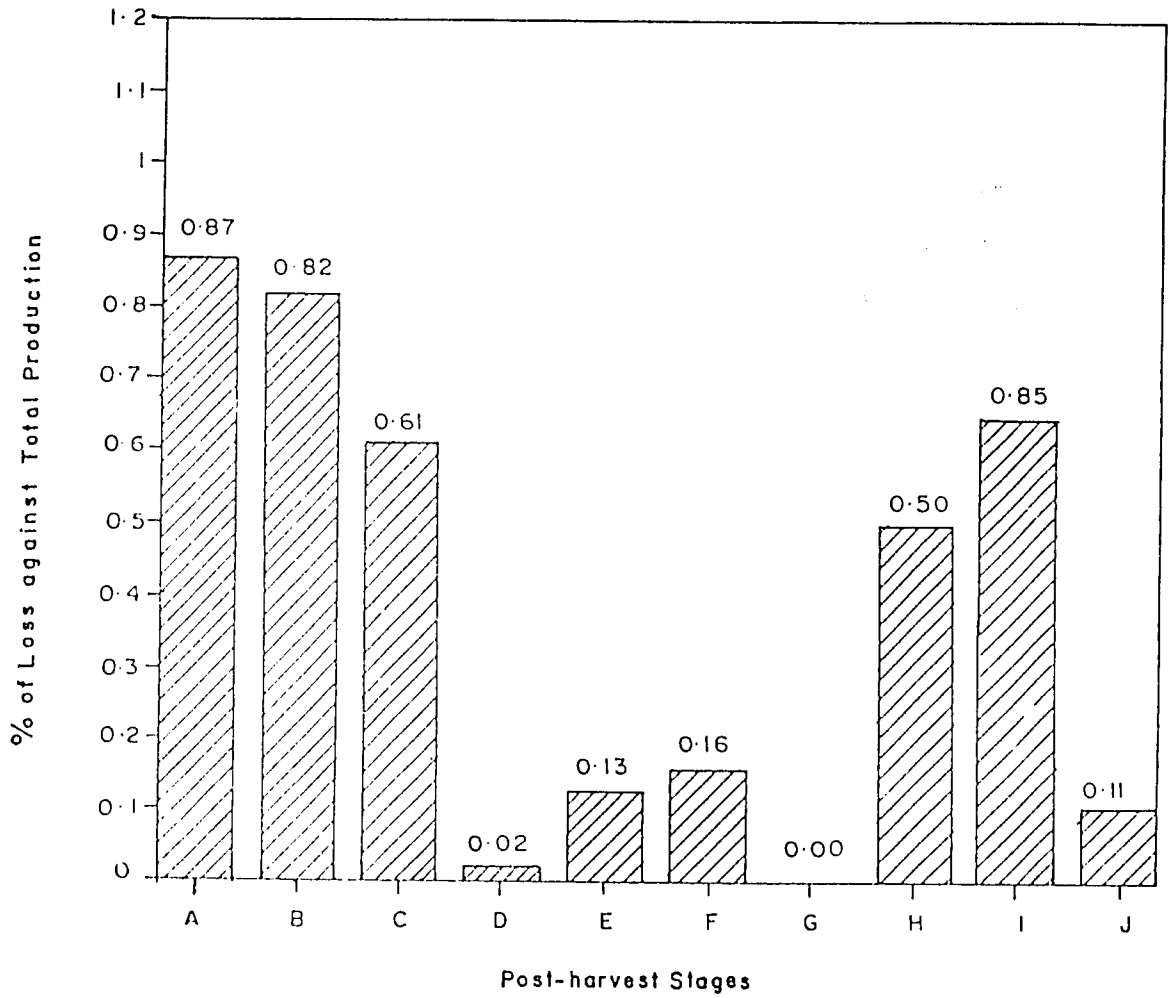
The above equations revealed that loss of Boro paddy during the PH operation was highest when it was threshed by hitting the crop on a hard surface before threshing by bullocks, the next in order was threshing by paddle thresher and threshing by bullock. It needs to be mentioned that stack loss, loss while carrying, winnowing and drying were also higher.

Table 4.3.6 represents loss estimation by stacking, carrying, threshing, winnowing, drying and loss due to bad weather. Diagramatically the PHL of Boro crops are shown in Figure 4.3.5.

Table 4.3.6 : Post-harvest Loss of Boro Crops of 1989-90 from HH sample survey (in percentage).

| Loss due to | Loss against total production |
|---|---|
| Stack loss | 0.87 |
| Loss during carrying | 0.82 |
| Loss during beating (hitting on hard surface) | 0.61 |
| Loss during threshing with bullock | 0.02 |
| Loss due to beating followed by threshing with bullock | 0.13 |
| Loss due to paddle threshing | 0.16 |
| Other threshing losses | - |
| Winnowing and cleaning losses | 0.50 |
| Drying loss | 0.65 |
| Loss due to bad weather | 0.11 |
| Total | 3.88 |

Table 4.3.6 indicated that stacking, carrying, drying, hitting the crop on a hard surface and winnowing losses were the major component of PH loss of Boro crop against total loss. The PHL by the above mentioned factors were 0.87%, 0.82%, 0.65%, 0.61% and 0.50% respectively, totaling about 90% of the PH losses. In all the above mentioned activities, appropriate mechanism may be developed to reduce the losses. Figure 4.3.6 represents Lorenz curve showing concentration of total PHL from sample HH of Boro crop during 1989-90. The Gini's coefficient ratio of 0.46 indicates that the post-harvest loss is more or less spread over all types of households without concentrating to a particular group of households.




A : Field Staking Loss

B : Loss during Carrying

C : Loss during Beating (hitting on hard surface)

D : Loss during Threshing with Bullock

E : Loss due to Beating followed by Threshing with Bullock

F : Loss due to Paddle Threshing

G : Other Threshing Losses

H : Winnowing and Cleaning Losses

I : Loss due to Drying

J : Loss due to Bad Weather

Fig. 4·3·5 Post-harvest Loss as Percentage of Total Production of Boro Crops in 1989-90

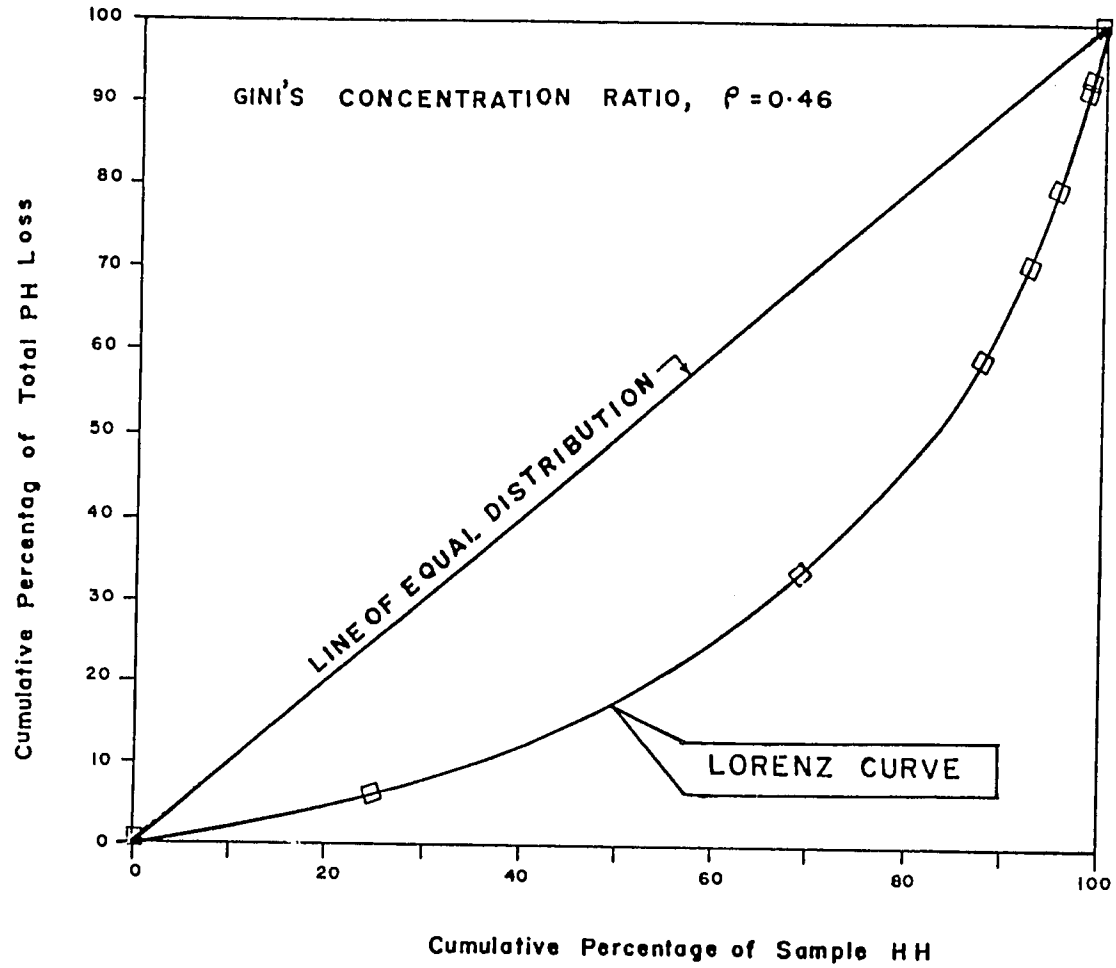



Fig. 4·3·6 Lorenz Curve Showing Concentration of Total PH Loss for Sample HH of Boro Crops in 1989-90

Table 4.3.7 showed that loss in terms of percentage against total production by region was found highest in Rangpur-Dinajpur region (5.03%) followed by Jessore-Kushtia-Khulna (4.25%), Dhaka-Tangail (4.24%), Chittagong-Noakhali (3.83%), Comilla-Sylhet (3.76%), Mymensingh-Kishoregonj-Jamalpur (3.55%), Barisal-Faridpur-Patuakhali (3.39%) and Rajshahi-Bogra-Pabna region (2.75%).

The PHL of Boro crop by regions, factors and upazilas can be seen at Appendix 4.3.7 and 4.3.8. Loss of foodgrain of Boro during PH operation by varieties can be seen at Appendix 4.3.9.

Total production of Boro crop in 1988-89 was 5.83 million metric tons and 3.88% of the total Boro production was about 226 thousand tons. It could be inferred that with appropriate measures and technology this huge quantity of foodgrain loss could be minimized. However, Pandua (1978) stated a PH loss (Harvesting, handling and threshing) of rice crops from 5% to 18% depending on environmental conditions and methods of operation. The PH loss in Boro crop in the present study was found less than the minimum loss stated by Pandua.

Table 4.3.7 Percentage of PH Loss of Boro Crops by Regions.

| Region | Loss against production |
|---|---|
| Chittagong-Noakhali | 3.83 |
| Mymensingh-Kishoregonj-Jamalpur | 3.55 |
| Dhaka-Tangail | 4.24 |
| Comilla-Sylhet | 3.76 |
| Rajshahi-Bogra-Pabna | 2.75 |
| Rangpur-Dinajpur | 5.03 |
| Jessore-Kushtia-Khulna | 4.25 |
| Barisal-Faridpur-Patuakhali | 3.39 |
| Total | 3.88 |
| S.E. Mean | 0.23 |

### 4.3.4 Wheat

Like rice crops, the estimation of PH operation losses of wheat under different methods of threshing were made keeping other variables constant.

Inserting the values of the variables mentioned in section 4.3 estimated PHL of Wheat by diiferent processes of threshing from the sample HH are shown below :

(13) LW1 = 943+994+(1145+41)+1103+833+57 = 5116
(14) $L_{W2}$ = 943+994+90+1103+833+57 = 4020
(15) $L_{W3}$ = 943+994+8+1103+833+57 = 3938
(16) $L_{W4}$ = 943+994+95+1103+833+57 = 4025

Where $L_W$ represents post-harvest loss of Wheat crop by different threshing methods.

The above equations revealed that maximum loss of wheat occurred when it was threshed by hitting on a hard surface followed by threshing with bullocks (Equation-13). In terms of quantity threshing loss by paddle thresher was at minimum (Equation -15).

Table 4.3.8 depicts the major factors of PHL of wheat from the household surveys which are :

1. Drying ;
2. Carrying;
3. Stacking;
4. Winnowing and
5. Threshing (hitting on a hard surface)

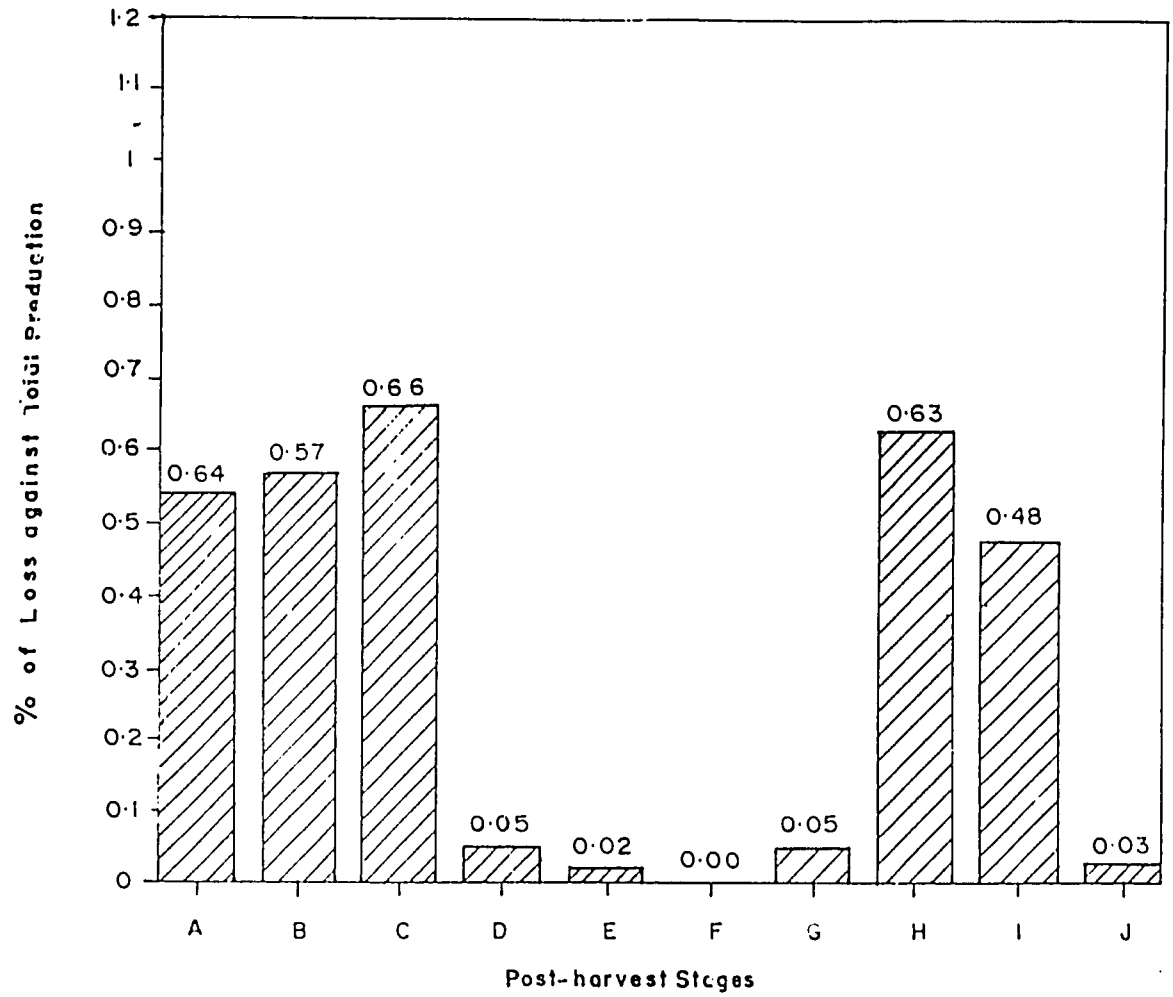
The total of above mentioned factors reveals PHL by more than 95% of the total wheat production. Loss by threshing was maximum (0.66%) followed by winnowing (0.63%); carrying (0.57%); stacking (0.54%); drying (0.48%) and others, against total production. Figure 4.3.7 shows PHL as percentage of wheat production in 1989-90.

Table 4.3.8 : Post-harvest Loss of Wheat Crop (in percentage)

| Type of Loss | Loss against total production |
|---|---|
| Stack loss | 0.54 |
| Loss during carrying | 0.57 |
| Loss during threshing (hitting on hard surface) | 0.66 |
| Loss during threshing with bullock | 0.05 |
| Loss due to beating followed by threshing with bullock | 0.02 |
| Loss due to paddle threshing | - |
| Other threshing losses | 0.05 |
| Winnowing and cleaning losses | 0.63 |
| Drying loss | 0.48 |
| Loss due to bad weather | 0.03 |
| Total | 3.04 |

Detailed PHL of wheat by regions and upazilas at different stages are shown in Appendix 4.3.10 and 4.3.11 respectively. Appendix 4.3.12 showed PHL of wheat by varieties. Figure 4.3.8 reveals a Lorenz curve showing concentration of total PHL from sample HH of wheat during 1989-90. The Gini's coefficient ratio of 0.42 indicates that the post-harvest loss is more or less spread over all types of households without concentrating to a particular group of households.

It may be noted that the factors responsible for loss may markedly be improved if appropriate measures are applied. Use of mechanical thresher may help in reducing the loss in PH operation.




A : Field Staking Loss

B : Loss during Carrying

C : Loss during Beating (hitting on hard surface)

D : Loss during Threshing with Bullock

E : Loss due to Beating followed by Threshing with Bullock

F : Loss due to Paddle Threshing

G : Other Threshing Losses

H : Winnowing and Cleaning Losses

I : Loss due to Drying

J : Loss due to Bad Weather

Fig. 4·3·7 Post-harvest Loss as Percentage of Total Production of Wheat Crops in 1989-90

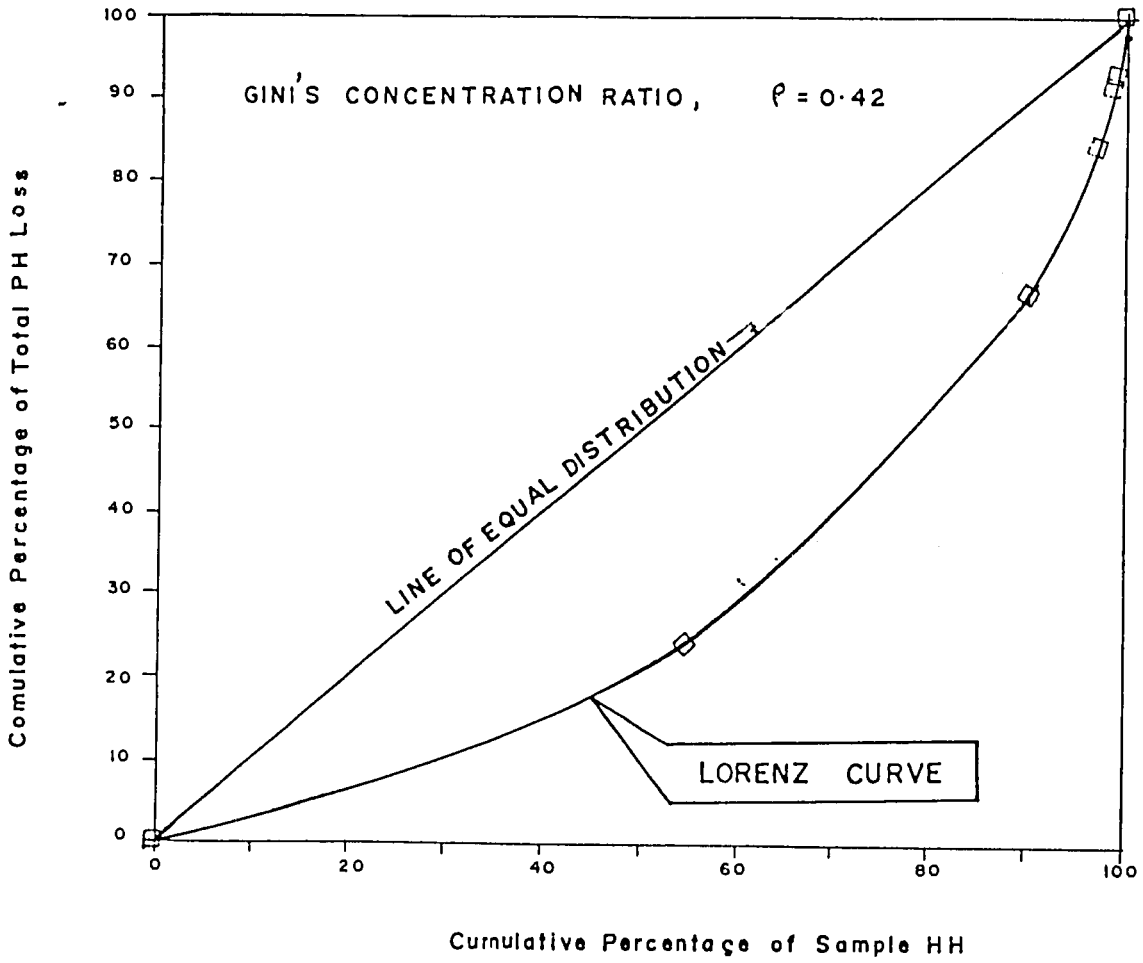



Fig. 4·3·8 Lorenz Curve Showing Concentration of Total PH Loss for Sample HH of Wheat in 1989-90

### 4.3.5 Foodgrain Loss During PH operations

Table 4.3.9 depicts the PHL of all foodgrain crops (Aus, Aman, Boro and Wheat) at different stages of its operation.

Table 4.3.9 : PHL of Foodgrain by different factors in percentage by the present study

| Factors | Aus | Aman | Boro | Wheat | Weighted Average |
|---|---|---|---|---|---|
| Stack loss | 0.41 | 1.09 | 0.87 | 0.54 | 0.91 |
| Loss during carrying | 1.00 | 0.62 | 0.82 | 0.57 | 0.74 |
| Loss during beating(hitting on hard surface). | 0.63 | 0.68 | 0.61 | 0.66 | 0.65 |
| Loss during threshing with bullock | 0.27 | 0.25 | 0.02 | 0.05 | 0.16 |
| Loss due to beating followed by threshing with bullock | 0.23 | 0.31 | 0.13 | 0.02 | 0.23 |
| Loss due to paddle threshing | 0.13 | 0.16 | 0.16 | - | 0.15 |
| Other threshing losses | - | 0.03 | - | 0.05 | 0.02 |
| Winnowing and cleaning losses | 0.69 | 0.82 | 0.50 | 0.63 | 0.68 |
| Drying loss | 0.68 | 0.43 | 0.65 | 0.48 | 0.54 |
| Loss due to bad weather | 0.13 | - | 0.11 | 0.03 | 0.06 |
| Total loss | 4.18 | 4.39 | 3.88 | 3.04 | 4.14 |

The average highest PHL of foodgrains (Aus, Aman, Boro and Wheat) estimated during the study period was by threshing (all methods) to the tune of 29.09% followed by stack loss (21.95%), carrying (17.92%), winnowing and cleaning (16.55%), drying (13.10%). The above mentioned five factors contributed 99% of the total PH loss. Motorized thresher was not seen at any of the household at the survey time. If a motorized thresher is used in the field then the losses in the process of stacking, carrying threshing and winnowing could be reduced to a greater extent. Only threshing loss was about 30% of the total post-harvest operations loss.

The highest loss was found in Aman crop 4.39%, followed by Aus 4.18%, Boro 3.88% and Wheat 3.04% against total production. The weighted average loss of the foodgrain was 4.14%. Figure 4.3.9 shows the bar diagram indicating the PHL by all the foodgrain crops.

Table 4.3.10 reveals the target of foodgrain production for Aus, Aman, Boro and wheat as set by FPMU for the FY 1990-91. Estimation of PHL from the targeted production for 1990-91 are also shown.

Table 4.3.10: Target of Foodgrain Production for 1990-91 and the PHL on the Basis of the Present Study.

| Crops | Target ( 000 metric tons) | % of loss (present study) | Expected loss (000 metric tons) |
|---|---|---|---|
| Aus | 2400 | 4.18 | 100.32 |
| Aman | 9200 | 4.39 | 403.88 |
| Boro | 6800 | 3.88 | 263.84 |
| Wheat | 1100 | 3.04 | 33.44 |
| Total crops | 19500 | 4.14 | 801.48 |

On the targeted foodgrain production of 19.5 million metric tons for 1990-91 the PHL would be about 801 thousand tons, equivalent to food for 4.84 million people for one year at the rate of 16 oz (or 453 gm) per person per day. This is about 4% of the people of Bangladesh. Loss by Aman crop both in terms of percentage and in actual was the highest. On the basis of the above findings and from a production target of 19.5 Million tons, detail loss by factors during 1990-91 are shown in Table 4.3.11 (by quantity).

Table 4.3.11 indicated that losses of food grains were maximum in the process of threshing by different methods (1.21%). In terms of quantity it would be 236 thousand tons with a production target of 19.5 million tons. The next most important factor in foodgrain loss was stacking. Average loss was 0.91% in carrying. The winnowing losses were also higher. Total loss in carrying was 0.74%, winnowing 0.68% and drying 0.54% of total production.

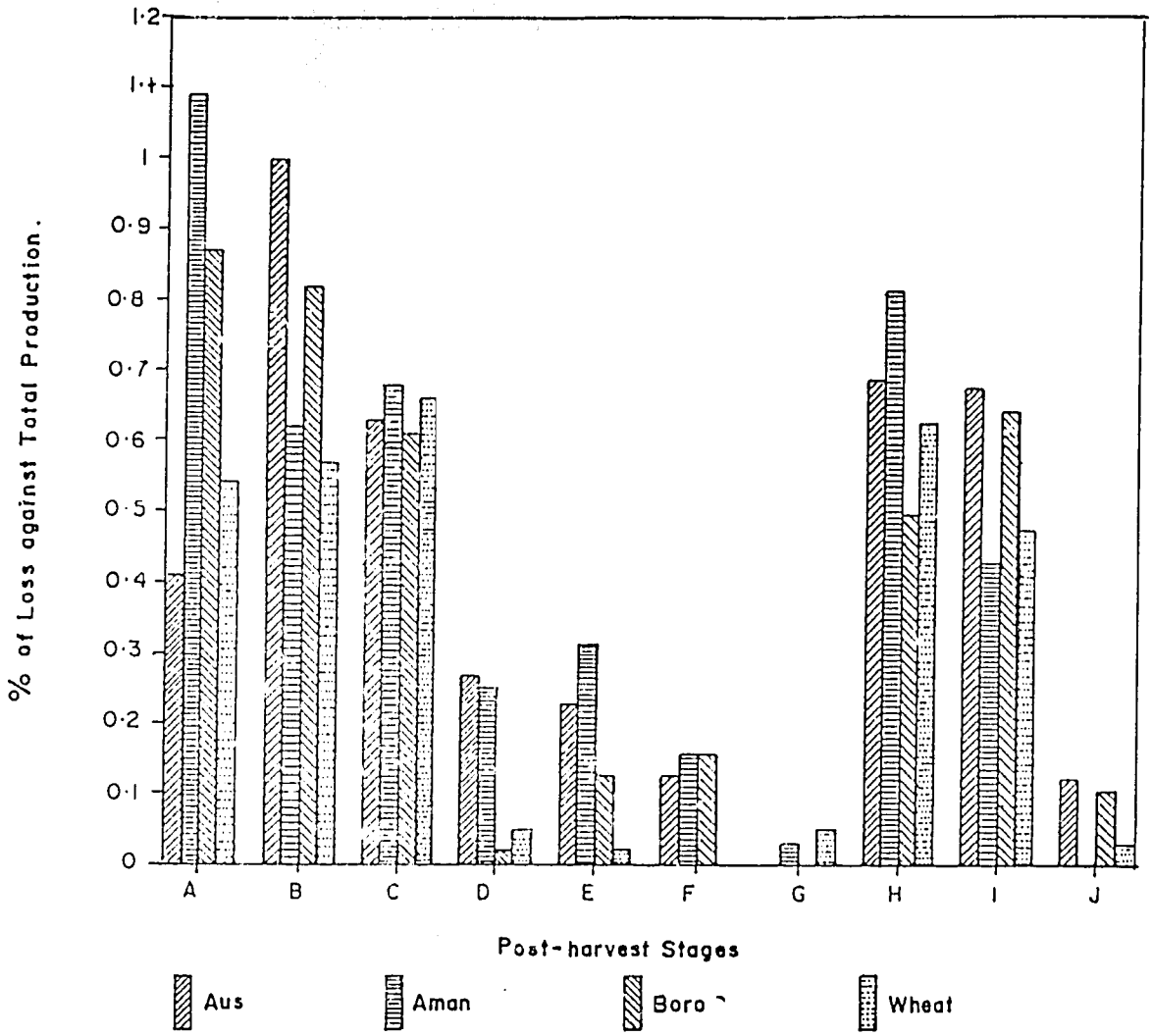
Table 4.3.11 : Projected PHL of Foodgrains (Rice & Wheat) during 1990-91 based on the p-esent study.

(in 000 metric tons)

| Factors | Aus | Aman | Boro | Wheat | Average |
|---|---|---|---|---|---|
| 1. Stack loss | 9.84 | 100.28 | 59.16 | 5.94 | 177.45 |
| 2. Loss during carrying | 24.00 | 57.04 | 55.76 | 6.27 | 144.30 |
| 3. Loss during beating(hitting on hard surface). | 15.12 | 62.56 | 41.48 | 7.26 | 126.75 |
| 4. Loss during threshing with bullock | 6.48 | 23.00 | 1.36 | 0.55 | 31.20 |
| 5. Loss due to beating followed by threshing with bullock | 5.52 | 28.52 | 8.84 | 0.22 | 44.85 |
| 6. Loss due to paddle threshing | 3.12 | 14.72 | 10.88 | - | 29.25 |
| 7. Other threshing losses | - | 2.76 | - | 0.55 | 3.90 |
| 8. Winnowing and cleaning losses | 16.56 | 75.44 | 34.00 | 6.93 | 132.60 |
| 9. Drying loss | 16.32 | 39.56 | 43.20 | 5.28 | 105.30 |
| 10. Loss due to bad weather | 3.12 | - | 7.48 | 0.33 | 11.70 |
| Total loss | 100.32 | 403.88 | 263.84 | 33.33 | 807.30 |
| Total Production* (Target) | 2400 | 9200 | 6800 | 1100 | 19500 |

* FPMU.

Foodgrain loss of 4.14% against total foodgrain production in the PH operation was certainly in the high side for a country like Bangladesh. Losses in the PH operation may be invariably reduced if improved methodologies and technologies are followed or technologies and methodologies for minimization of losses be immediately pursued. This calls for a stronger extension program ; improved post-harvest technology of foodgrain crops.




A : Field Staking Loss

B : Loss during Carrying

C : Loss during Beating (hitting on hard surface)

D : Loss during Threshing with Bullock

E : Loss due to Beating followed by Threshing with Bullock

F : Loss due to Paddle Threshing

G : Other Threshing Losses

H : Winnowing and Cleaning Losses

I : Loss due to Drying

J : Loss due to Bad Weather

Fig. 4.3.9 Post-harvest Loss as Percentage of Total Production of Different Foodgrain Crops in 1989–90.

## 4.4 MILLING LOSS

### 4.4.1 Parboiling and Drying : Farmers Level

Parboiling of rice before milling is practiced in all areas of Bangladesh except in the greater Sylhet, Chittagong and Chittagong Hill Tract districts. Detailed foodgrain loss due to parboiling has been presented in Appendices 4.4.1 to 4.4.3 for Aus, Aman and Boro paddy respectively. The summary of these findings is given in Table 4.4.1.

From Table 4.4.1 it is evident that maximum paddy loss occurred in case of Aman, the average of which was 2.14%, followed by Boro which was 1.86%, the next was Aus, which was 0.95%. From Table 4.4.1., in all cases it can be seen that during parboiling and drying, maximum loss occurred during soaking, followed by eating by poultry birds. Loss due to stray cattle and goat came next. Loss due to other reasons like handling during parboiling and drying, was insignificant.

It was observed that drying of parboiled paddy usually takes 1 to 3 days depending on availability of sunshine, temperature, day length and type of surface of the drying yards (ARDICOL, 1988). In winter it took about 2 days for drying of Aman crop. Drying of Aus crop is usually completed in one day with full sunshine of summer. In wet summer it takes longer period for drying Boro paddy. As Aman paddy required maximum handling period (1 to 3 days ), the loss in parboiling and drying systems was also highest. For Aus crop the post-harvest operation was faster, since the volume of the crop was smaller than Aman.

For Aus crop region-wise parboiling and drying loss was maximum (1.37%) in Chittagong/Noakhali region and minimum (0.65%) in Jessore/ Kushtia/Khulna region. Soaking loss was highest in all AEZ's except Rajshahi/Bogra/Pabna region, Mymensingh/Kishoreganj/Jamalpur region and Dhaka/Tangail region. In Rajshahi/Bogra/Pabna the soaking loss was only 0.18% against the maximum loss of 0.82% in Chittagong/Noakhali region. In Rajshahi/Bogra/Pabna region loss due to poultry eating was maximum (0.66%) whereas in Rangpur/Dinajpur it was minimum (0.17%). Loss due to cattle eating was comparatively very small, the maximum being 0.13% in Dhaka/Tangail region. In all AEZs, loss due to other reasons such as handling during parboiling and drying was negligible. Losses in cases of Aman and Boro crops also followed more or less the same pattern. Combined parboiling and drying losses of all paddy was 1.86% out of which 1.06% in soaking, 0.71% eaten by poultry birds, 0.06% eaten by stray cattle and goat and 0.03% was lost by other reasons.

Table 4.4.1 : Loss During Parboiling and Drying of Paddy.

| Crops | Total quantity before Parboiling and Drying | Total quantity after Parboiling and Drying | Average total loss due to | | | | Average total loss |
|---|---|---|---|---|---|---|---|
| | | | Soaking | Eaten by | | Other | |
| | | | | Poultry Birds | Stray Cattle and Goat | | |
| Aus (kg) | 356345 | 352955 | 1644 | 1462 | 169 | 115 | 3390 |
| Percentage | 100 | 99.05 | 0.46 | 0.41 | 0.05 | 0.03 | 0.95 |
| Aman (kg) | 1168067 | 1143021 | 14161 | 9647 | 824 | 414 | 25046 |
| Percentage | 100 | 98.66 | 1.21 | 0.83 | 0.07 | 0.03 | 2.14 |
| Boro (kg) | 802966 | 788070 | 8813 | 5517 | 360 | 206 | 14896 |
| Percentage | 100 | 98.14 | 1.10 | 0.69 | 0.04 | 0.03 | 1.86 |
| Total (kg) | 2327378 | 2284046 | 24618 | 16628 | 1353 | 735 | 43332 |
| Percentage | 100 | 98.14 | 1.06 | 0.71 | 0.06 | 0.03 | 1.86 |

Note : Conversion ratio, Paddy to Rice 0.676

## 4.4.2 Parboiling and Drying : Millers Level

Parboiling and drying losses of Paddy at millers level were surveyed both by region and by upazila basis for Aus, B.Aman, T.Aman and Boro for both local and modern varieties. The results of the survey are shown in Appendices 4.4.4 and 4.4.5. From the result it is revealed that the total average loss of paddy due to parboiling and drying was 1.03%, the maximum being 0.67%, for soaking, 0.25% due to poultry eating, 0.09% due to cattle eating, and 0.02% due to other reasons such as handling during parboiling and drying. Among the reasons, maximum loss 1.49% was found in Chittagong/Noakhali region and the minimum loss 0.32% in Mymensingh/Kishoregonj/Jamalpur region. In upazila basis the maximum loss of 1.49% was occurred in Feni upazila and the minimum 0.32% loss in Sarisabari upazila.

On crop basis the maximum loss 1.77% was observed for modern T.Aman in Feni upazila of Chittagong/Noakhali region and the minimum loss 0.32% for Boro (Modern variety) in Sharisabari upazila in Mymensingh/Kishoregonj/Jamalpur region.

## 4.4.3 Milling Loss : Farmers Level

The findings on the recovery of grains processed in Dheki and Small mills have been shown in Appendices 4.4.6 to 4.4.8 for Aus, Aman and Boro Paddy respectively. Regionwise recovery percentage of rice in 1989-90 is presented in Appendix 4.4.11. Summary of these compilations has been tabulated in Table 4.4.2. On an average, the recovery of Aus rice in Dheki was 67.53% varying from

61.35% to 69.00%. The average recovery of husk, broken rice and bran was 31.93% varying from 30.72 to 37.42%. The lowest recovery of rice was obtained in the Dhaka - Tangail region, which was only 61.35%. The average loss in Dheki process was 0.54%, the maximum being 1.23% in Dhaka - Tangail region, and the minimum being 0.27% in Jessore - Kushtia - Khulna region (Appendix 4.4.6).

Regarding Aman paddy processing by Dheki the average recovery (Appendix - 4.4.7) was 70.10% with a process loss of 0.53%. The maximum recovery was 71.25% in Mymensingh - Kishoregonj - Jamalpur region and minimum recovery was 64.75% in Jessore - Kushtia - Khulna region. The maximum process loss was 1.47% in Dhaka - Tangail region and the minimum process loss was 0.25% in Barisal - Faridpur - Patuakhali region (Appendix 4.4.7).

The result of the Boro crop processing by Dheki has been compiled in Appendix - 4.4.8. The average recovery was 69.37% with a process loss of 0.52%. The maximum recovery was 73.97% in Jessore - Kushtia - Khulna region, and the minimum recovery was 64.39% in Rajshahi - Bogra - Pabna region. The maximum process loss was 1.37% in Jessore - Kushtia - Khulna region and the minimum process loss was 0.42% both in Chittagong - Noakhali.

Table - 4.4.2 indicated that the overall average recovery of Aus, Aman and Boro rice by Dheki processing in all the regions surveyed was 69.50% with a process loss of 0.53%. The maximum recovery was 70.10% in case of Aman, and the minimum recovery of 67.53% was for Aus. The maximum process loss was 0.54% for Aus and the minimum 0.52% for Boro paddy.

Similarly the results of farmers level small rice mills have been compiled in Appendices 4.4.6 to 4.4.8 and final results summarised in Table - 4.4.2.

The results of Aus milling have been compiled in Appendix - 4.4.6. The average recovery in surveyed area was 67.72% with a process loss of 0.51%. The maximum recovery was 69.82% in Biracial - Faridpur - Patuakhali region and minimum recovery was 63.63% in Dhaka - Tangail region. The maximum process loss was 1.33% in Dhaka - Tangail region and the minimum process loss was 0.18% in Mymensingh - Kishoregonj - Jamalpur region.

The results of the Aman milling have been compiled in Appendix - 4.4.7. The average recovery of rice was 68.13% with a process loss of 0.69%. The maximum was 69.40% in Barisal - Faridpur - Patuakhali region and the minimum recovery of 66.48% in Comilla - Sylhet region. The maximum process loss was 1.31% in Dhaka - Tangail region, and the lowest process loss was 0.28% in Barisal - Faridpur - Patuakhali region.

The results of Boro milling have been compiled in Appendix - 4.4.8. The average recovery of rice was 68.28% with a process loss of 0.79%. The maximum recovery was 72.31% in Jessore - Kushtia - Khulna region, and the minimum recovery was 66.03% in Dhaka - Tangail region. The maximum process loss was 1.48% in Dhaka -

Tangail region, and the minimum process loss was 0.43% in Chittagong - Noakhali region.

Table - 4.4.2 presents the summarised results. The overall average recovery of rice in all surveyed areas was 68.11% with a process loss of 0.70%. The maximum recovery of rice was 68.28% in case of Boro paddy, and the minimum recovery of rice was 67.72% in case of Aus paddy. The maximum process loss was 0.79% in case of Boro paddy and the minimum process loss was 0.51% in case of Aus paddy. Maximum recovery of rice also gave maximum process loss and the minimum recovery of paddy also gave minimum process loss. This was due to variation in recovery of husk, broken rice and bran (Table - 4.4.2). Aus gave maximum quantity (31.77%) of husk, broken rice and bran and the Boro gave lowest quantity (30.93%) of husk, broken rice and bran.

Table 4.4.2 : Milling Loss in Dheki and Rice Huller (Small Mills)

| Crops | Total quantity before Dheki | Total quantity after Dheki | Total husk,bran & broken grains in Dheki | Total loss in Dheki process | Total quantity before milling | Total quantity after milling | Total husk of broken grains in mill | Total loss in milling |
|---|---|---|---|---|---|---|---|---|
| Aus(kg) | 18630 | 12581 | 5948 | 101 | 379213 | 256806 | 120478 | 1929 |
| Percentage | 100 | 67.53 | 31.93 | 0.54 | 100 | 67.72 | 31.77 | 0.51 |
| Aman(kg) | 77026 | 53993 | 22622 | 411 | 844176 | 575134 | 263218 | 5824 |
| Percentage | 100 | 70.10 | 29.37 | 0.53 | 100 | 68.13 | 31.18 | 0.69 |
| Boro(kg) | 71711 | 49745 | 21591 | 375 | 789046 | 538738 | 244013 | 6293 |
| Percentage | 100 | 69.37 | 30.11 | 0.52 | 100 | 68.28 | 30.93 | 0.79 |
| Total(kg) | 167367 | 116319 | 50161 | 887 | 2012435 | 1370678 | 627711 | 14046 |
| Percentage | 100 | 69.50 | 29.97 | 0.53 | 100 | 68.11 | 31.19 | 0.70 |

### 4.4.4 Milling Loss : Millers Level

Milling losses of local and modern varieties of all crops i.e. Aus, Aman, and Boro paddy and Wheat by regions are shown in Appendix 4.4.9. The average total milling loss of all types of paddy and wheat was 0.67%, maximum loss was 1.39% in Jessore/Kushtia/Khulna region and minimum loss was 0.42% in Mymensigh/Kishoregonj/Jamalpur region. Regarding individual crops, maximum 1.51% milling loss was in case of local Aus in Jessore/Kushtia/Khulna region and minimum 0.20% milling loss was in case of Boro (MV) in Mymensingh /Kishoregonj /Jamalpur region. A summarized crushing loss of wheat (MV) has been given in Table 4.4.3.

Table 4.4.3 : Crushing Loss of Wheat (MV) by region.

| AEZ | | Total quantity crushed | Total quantity of Ata recovered | Total loss in crushing | Total % of crushing Loss |
|---|---|---|---|---|---|
| Chittagong/ Noakhali | (kg) | 3000 | 2959 | 41 | 1.37 |
| | % | 100 | 98.63 | | |
| Mymensingh/Kishore-gonj/Jamalpur | (kg) | 215695 | 214164 | 1531 | 0.71 |
| | % | 100 | 99.29 | | |
| Dhaka/ Tangail | (kg) | 29856 | 29491 | 365 | 1.22 |
| | % | 100 | 98.78 | | |
| Comilla/ Sylhet | (kg) | 106512 | 105212 | 1300 | 1.22 |
| | % | 100 | 98.78 | | |
| Rajshahi/Bogra Pabna | (kg) | 22022 | 21800 | 222 | 1.00 |
| | % | 100 | 98.99 | | |
| Rangpur/ Dinajpur | (kg) | 115952 | 115312 | 640 | 0.55 |
| | % | 100 | 99.45 | | |
| Jessore/Khustia Khulna | (kg) | 345639 | 340949 | 4690 | 1.36 |
| | % | 100 | 98.14 | | |
| Barisal/Faridpur Patuakhali | (kg) | 25000 | 24866 | 134 | 0.54 |
| | % | 100 | 99.46 | | |
| Total | (kg) | 863676 | 854753 | 8923 | 1.03 |
| Percentage | | 100 | 98.97 | | |

Result of Table 4.4.3 indicates that the total quantity of wheat in all regions were crushed in wheat crushers and not in any modern mills. The products was 'Ata' or unrefined flour and the brans were separated by the owners of the wheat by themselves. Maximum crushing loss was recorded as 1.37% in Chittagong/Noakhali region, and minimum milling loss was recorded as 0.54% in Barisal/Faridpur/Patuakhali region. The average recovery of 'Ata' was 98.97%.

Milling losses for paddy has been summarized in Table 4.4.4.

Table 4.4.4 : Milling losses of Paddy at Millers level.

| AEZ | | Total quantity milled | Recovery of Rice | Quantity of brans etc. | Total loss in milling | Total % of milling loss |
|---|---|---|---|---|---|---|
| Chittagong/ | (kg) | 1935298 | 1320354 | 605552 | 9392 | 0.49 |
| Noakhali | % | 100 | 68.22 | 31.29 | | |
| Mymensingh/Kishore- | (kg) | 2797102 | 1920131 | 865837 | 11033 | 0.39 |
| gonj/Jamalpur | % | 100 | 68.65 | 30.95 | | |
| Dhaka/ | (kg) | 3015647 | 2038874 | 954504 | 22269 | 0.74 |
| Tangail | % | 100 | 67.61 | 31.61 | | |
| Comilla/ | (kg) | 7178797 | 4915902 | 2221939 | 40955 | 0.57 |
| Sylhet | % | 100 | 68.48 | 30.95 | | |
| Rajshahi/Bogra | (kg) | 245314 | 161883 | 82319 | 1112 | 0.45 |
| Pabna | % | 100 | 65.99 | 33.56 | | |
| Rangpur/ | (kg) | 5899154 | 3981727 | 1870984 | 46443 | 0.79 |
| Dinajpur | % | 100 | 67.49 | 31.72 | | |
| Jessore/Kushtia | (kg) | 868952 | 635252 | 221543 | 12157 | 1.40 |
| Khulna | % | 100 | 73.11 | 25.49 | | |
| Barisal/Faridpur | (kg) | 169000 | 114887 | 53271 | 843 | 0.50 |
| Patuakhali | % | 100 | 67.98 | 31.52 | | |
| Total | (kg) | 22109264 | 15089111 | 6875949 | 144204 | 0.65 |
| Percentage | | 100 | 68.25 | 31.10 | 0.65 | |

In the study area the total average milling loss of paddy was 0.65% , maximum being 1.40% in Jessore/Kushtia/Khulna region, and the minimum 0.39% in Mymensingh/Kishoregonj/Jamalpur region. The average recovery of rice was 68.25% and the average proportion yield of husk, bran and broken rice was 31.10%. The maximum recovery of rice was 73.11% in Jessore/Kushtia/Khulna region, and the minimum recovery was 65.99% in Rajshahi/Bogra/Pabna region. The process loss was also 0.45% which was comparatively low but the yield of husk, bran and broken rice was 33.56%, which was higher.

### 4.4.5 Crushing Loss in Wheat

At farm level, the farmers bring their wheat to small crushers nearer to their abodes and take back their produce crushed after paying fixed charges to the miller. The process loss of such milling was studied at 429 points of the 8 AEZ's has been represented in Appendix - 4.4.10. It was observed that the average milling loss in 429 cases in surveyed areas was 1.48%. The maximum, 2.30% milling loss was observed in Dhaka/Tangail region. In Chittagong /Noakhali region 2.00%, in Barisal/Faridpur/Patuakhali 1.87%, in Rangpur/Dinajpur region 1.54%, in Jessore/Kushtia/Khulna 1.53%, in Comilla/Sylhet 1.37%, in Rajshahi/Bogra/Pabna 1.26% and in Mymensingh/Kishoreganj/Jamalpur region 1.04%.

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## 4.5 STORAGE LOSS

### 4.5.1 Farmers Level

Post-harvest loss in storage of foodgrains due to high moisture content, rat infestation, insects, fungus, and other reasons have been shown in Tables 4.5.1, to 4.5.3.

Table 4.5.1 shows the results of storage loss of Aus crop by region for an average period of 3.87 months. It was observed that the total storage loss on an average over all the regions was 2.44%, the maximum was due to higher moisture content (1.28%) followed by rat infestation (0.78%) and the minimum loss was due to fungus attack (0.06%). Moisture loss was maximum in Mymensingh/Kishoregonj/Jamalpur region (2.12%) and the minimum in Barisal/Faridpur/Patuakhali region (0.15%). Loss due to rat infestation was maximum in Barisal/Faridpur/Patuakhali region (1.54%), and the minimum in Jessore/Kushtia/Khulna region (0.52%). Loss due to fungus was maximum in Mymensingh/ Kishoregonj/Jamalpur region (0.13%) followed by Rangpur/Dinajpur region (0.09%). In other regions it was quite negligible or nil.

Table 4.5.2 shows the survey results of Aman crop for an average period of 4.73 months. The average storage loss over all the regions was 1.16% having the maximum for moisture loss (0.65%) followed by rat infestation (0.32%). Loss due to insect was 0.14%. Moisture loss of Aman paddy was maximum in Rajshahi/Bogra/Pabna region (1.73%) and minimum in Barisal/ Faridpur/Patuakhali region (0.23%).

Table 4.5.3 indicates the storage loss of Boro crop. The average total loss for all the regions was 0.90% for an average storage period of 3.24 months. The maximum loss was due to moisture content (0.48%) and minimum was due to fungus. Loss due to moisture content was maximum in Chittagong/Noakhali region (0.62%), and minimum in Mymensingh/Kishoreganj/Jamalpur region (0.25%).

From the Tables 4.5.1, 4.5.2 and 4.5.3, it is observed that in all cases losses due to moisture content was maximum and losses due to fungus was minimum. Storage loss was maximum (2.44%) in Aus crop and minimum (0.90%) in Boro crop. The results of all the 3 crops are summarized in Table 4.5.4.

Table 4.5.1 : Post-harvest Loss (Kg) in Storage of Aus Crop by Region during 1989-90

| Region | Quantity Stored | Months Stored | Moist-ure Loss | Eaten by Rat | Loss due to Insect | Loss due to Fungus | Loss due to Other Reasons | Quantity Released | Total Loss |
|---|---|---|---|---|---|---|---|---|---|
| Chittagong-Noakhali | 95607 | 434 | 1427 | 682 | 202 | 53 | 147 | 93096 | 2511 |
| Mean | 965.73 | 4.38 | 14.41 | 6.89 | 2.04 | .54 | 1.48 | 940.36 | 25.3635 |
| % | 100 | | 1.49 | 0.71 | 0.21 | 0.06 | 0.15 | 97.37 | 2.63 |
| Mymensingh-Kishore-gonj-Jamalpur | 140453 | 344 | 2973 | 1043 | 415 | 182 | 147 | 135693 | 4760 |
| Mean | 1337.65 | 3.28 | 28.31 | 9.93 | 3.95 | 1.73 | 1.40 | 1292.31 | 45.3333 |
| % | 100 | | 2.12 | 0.74 | 0.30 | 0.13 | 0.10 | 96.61 | 3.39 |
| Comilla-Sylhet | 42976 | 295 | 416 | 360 | 32 | 11 | 100 | 42059 | 919 |
| Mean | 417.26 | 2.86 | 4.04 | 3.50 | .31 | .11 | .97 | 408.34 | 8.9223 |
| % | 100 | | 0.97 | 0.84 | 0.07 | 0.03 | 0.23 | 97.86 | 2.14 |
| Rajshahi-Bogra-Pabna | 56051 | 202 | 436 | 591 | 141 | 1 | 4 | 54878 | 1173 |
| Mean | 800.73 | 2.89 | 6.22 | 8.44 | 2.02 | .01 | .06 | 783.97 | 16.7500 |
| % | 100 | | 0.78 | 1.05 | 0.25 | 0.00 | 0.01 | 97.91 | 2.09 |
| Rangpur-Dinajpur | 57197 | 95 | 955 | 509 | 335 | 52 | 30 | 55316 | 1881 |
| Mean | 1845.06 | 3.06 | 30.81 | 16.42 | 10.81 | 1.68 | 0.97 | 1784.39 | 60.6800 |
| % | 100 | | 1.67 | 0.89 | 0.59 | 0.09 | 0.05 | 96.71 | 3.29 |
| Jessore-Kushtia-Khulna | 96293 | 725 | 181 | 507 | 96 | 0 | 10 | 95499 | 794 |
| Mean | 718.60 | 5.41 | 1.35 | 3.78 | .72 | 0.00 | .07 | 712.68 | 5.9254 |
| % | 100 | | 0.19 | 0.52 | 0.10 | 0.00 | 0.01 | 99.18 | 0.82 |
| Barisal-Faridpur-Patuakhali | 12897 | 283 | 18 | 199 | 1 | 0.00 | 0 | 12679 | 218 |
| Mean | 179.13 | 3.93 | 0.25 | 2.76 | .01 | 0.00 | 0.00 | 176.10 | 3.0278 |
| % | 100 | | 0.15 | 1.54 | 0.01 | 0.00 | 0.00 | 98.31 | 1.69 |
| Total | 501476 | 2378 | 6406 | 3890 | 1223 | 299 | 438 | 489220 | 12256 |
| Mean | 816.74 | 3.87 | 10.43 | 6.34 | 1.99 | 0.49 | 0.71 | 796.78 | 19.9600 |
| % | 100 | | 1.28 | 0.78 | 0.24 | 0.06 | 0.09 | 97.56 | 2.44 |

Note : For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.5.2. : Post-harvest Loss (kg) in Storage of Aman Crop by Region during 1989-90

| Region | Quantity Stored | Months Stored | Quantity released | Moist-ure loss | Eaten by rat | Loss due to insect | Loss due to fungus | Loss due to other | Total loss in kg |
|---|---|---|---|---|---|---|---|---|---|
| Chittagong-Noakhali | 191966 | 908 | 189114 | 1652 | 617 | 451 | 31 | 102 | 2852 |
| Mean | 1184.98 | 5.60 | 1167.37 | 10.20 | 3.81 | 2.78 | .19 | .63 | 17.61 |
| % | 100 | | 98.51 | 0.86 | 0.32 | 0.23 | 0.03 | 0.05 | 1.49 |
| Mymensingh-Kishore-gonj-Jamalpur | 98257 | 1009 | 97395 | 423 | 196 | 126 | 28 | 90 | 862 |
| Mean | 534.01 | 5.48 | 529.32 | 2.30 | 1.07 | .68 | .15 | .49 | 4.68 |
| % | 100 | | 99.12 | 0.43 | 0.20 | 0.13 | 0.03 | 0.09 | 0.88 |
| Dhaka-Tangail | 112843 | 348 | 112085 | 275 | 369 | 64 | 27 | 22 | 758 |
| Mean | 1085.03 | 3.34 | 1077.74 | 2.64 | 3.55 | .62 | .26 | .21 | 7.29 |
| % | 100 | | 99.33 | 0.24 | 0.33 | 0.06 | 0.02 | 0.02 | 0.67 |
| Comilla-Sylher | 42807 | 690 | 42311 | 212 | 176 | 50 | 25 | 33 | 496 |
| Mean | 339.74 | 5.48 | 335.80 | 1.68 | 1.40 | .40 | .20 | .26 | 3.94 |
| % | 100 | | 98.84 | 0.49 | 0.41 | 0.12 | 0.06 | 0.08 | 1.16 |
| Rajshahi-Bogra-Pabna | 21305 | 120 | 20630 | 369 | 182 | 124 | 1 | 0 | 675 |
| Mean | 507.25 | 2.86 | 491.18 | 8.78 | 4.33 | 2.94 | .02 | 0.00 | 16.07 |
| % | 100 | | 96.83 | 1.73 | .85 | .58 | 0.01 | 0.00 | 3.17 |
| Rangpur-Dinajpur | 62952 | 94 | 62260 | 284 | 209 | 143 | 45 | 12 | 692 |
| Mean | 2331.56 | 3.48 | 2305.93 | 10.52 | 7.74 | 5.28 | 1.65 | .44 | 25.63 |
| % | 100 | | 98.90 | 0.45 | 0.33 | 0.23 | 0.07 | 0.02 | 1.10 |
| Jessore-Kushtia-Khulna | 284299 | 598 | 281073 | 2175 | 847 | 204 | 0 | 0 | 3226 |
| Mean | 2429.91 | 5.11 | 2402.33 | 18.59 | 7.24 | 1.74 | 0.00 | 0.00 | 27.57 |
| % | 100 | | 98.87 | 0.77 | 0.29 | 0.07 | 0.00 | 0.00 | 1.12 |
| Barisal-Faridpur-Patuakhali | 32394 | 255 | 32157 | 76 | 95 | 44 | 19 | 4 | 237 |
| Mean | 368.11 | 2.89 | 365.41 | .86 | 1.08 | .50 | .22 | .05 | 2.70 |
| % | 100 | | 99.27 | 0.23 | 0.29 | 0.14 | 0.06 | 0.01 | 0.73 |
| Total | 846823 | 4022 | 837024 | 5464 | 2692 | 1205 | 175 | 262 | 9799 |
| Mean | 996.26 | 4.73 | 984.73 | 6.43 | 3.17 | 1.42 | .21 | .31 | 11.53 |
| % | 100 | | 98.84 | 0.65 | 0.32 | 0.14 | 0.02 | 0.03 | 1.16 |

Note : For AEZ wise conversion ratio, paddy to rice, please see appendix 4.4.11

Table 4.5.3 : Post-harvest Loss (kg) in Storage of Boro Crop by Region during 1989-90

| Region | Quantity Stored | Months Stored | Quantity Released | Moist-ure loss | Eaten by rat | Loss due to insect | Loss due to fungus | Loss due to other reasons | Total loss in kg |
|---|---|---|---|---|---|---|---|---|---|
| Chittagong-Noakhali | 95648 | 270 | 94789 | 595 | 118 | 112 | 15 | 19 | 859 |
| Mean | 1062.75 | 3.00 | 1053.21 | 6.61 | 1.31 | 1.24 | .17 | .21 | 9.54 |
| % | 100 | | 99.10 | 0.62 | 0.12 | 0.12 | 0.02 | 0.02 | 0.90 |
| Mymensingh-Kishore-gonj-Jamalpur | 139983 | 616 | 139139 | 353 | 265 | 132 | 80 | 14 | 844 |
| Mean | 804.50 | 3.54 | 799.65 | 2.03 | 1.52 | .76 | .46 | .08 | 4.85 |
| % | 100 | | 99.40 | 0.25 | 0.19 | 0.09 | 0.06 | 0.01 | 0.60 |
| Dhaka-Tangail | 136513 | 208 | 135085 | 667 | 285 | 142 | 103 | 232 | 1428 |
| Mean | 1870.04 | 2.86 | 1850.48 | 9.14 | 3.90 | 1.94 | 1.41 | 3.17 | 19.56 |
| % | 100 | | 98.95 | 0.49 | 0.21 | 0.10 | 0.08 | 0.17 | 1.05 |
| Comilla-Sylhet | 47576 | 397 | 47101 | 289 | 104 | 32 | 14 | 36 | 475 |
| Mean | 406.63 | 3.39 | 402.57 | 2.47 | .89 | .27 | .12 | .30 | 4.06 |
| % | 100 | | 99.00 | 0.61 | 0.22 | 0.07 | 0.03 | 0.07 | 1.00 |
| Rajshahi-Bogra-Pabna | 226240 | 433 | 224294 | 931 | 545 | 331 | 69 | 71 | 1947 |
| Mean | 1549.59 | 2.97 | 1536.26 | 6.38 | 3.73 | 2.27 | .47 | .49 | 13.33 |
| % | 100 | | 99.14 | 0.41 | 0.24 | 0.15 | 0.03 | 0.03 | 0.86 |
| Rangpur-Dinajpur | 182950 | 407 | 181162 | 895 | 397 | 256 | 80 | 160 | 1788 |
| Mean | 1355.19 | 3.01 | 1341.94 | 6.63 | 2.94 | 1.89 | .59 | 1.19 | 13.24 |
| % | 100 | | 99.02 | 0.49 | 0.22 | 0.14 | 0.04 | 0.09 | 0.98 |
| Jessore-Kushtia-Khulna | 262029 | 510 | 259528 | 1520 | 692 | 270 | 14 | 5 | 2501 |
| Mean | 2201.92 | 4.29 | 2180.91 | 12.77 | 5.82 | 2.27 | .12 | .04 | 21.02 |
| % | 100 | | 99.05 | 0.58 | 0.26 | 0.10 | 0.01 | 0.00 | 0.95 |
| Barisal-Faridpur-Patuakhali | 72676 | 194 | 72013 | 311 | 140 | 73 | 66 | 75 | 663 |
| Mean | 865.19 | 2.32 | 857.30 | 3.70 | 1.66 | .86 | .78 | .89 | 7.89 |
| % | 100 | | 99.09 | 0.43 | 0.19 | 0.10 | 0.09 | 0.10 | 0.91 |
| Total | 1163614 | 3036 | 1153110 | 5561 | 2545 | 1347 | 441 | 611 | 10504 |
| Mean | 1240.53 | 3.24 | 1229.33 | 5.93 | 2.71 | 1.44 | .47 | .65 | 11.20 |
| % | 100 | | 99.10 | 0.48 | 0.22 | 0.11 | 0.04 | 0.05 | 0.90 |

Note : For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.5.4 : Post-Harvest Loss (kg) in Storage of Aus, Aman and Boro Crops by Region During 1989-90.

| Crops | Quantity Stored (kg.) | Storage Period (in months) | Quantity Released | Moisture Loss | Eaten by Rat | Loss due to insect | Loss due to fungus | Loss due to other reasons | Total Loss |
|---|---|---|---|---|---|---|---|---|---|
| Aus Paddy | 501476 | 3.87 | 489220 | 6406 | 3890 | 1223 | 299 | 438 | 12256 |
| Percentage | 100 | | 97.56 | 1.28 | 0.78 | 0.24 | 0.06 | 0.09 | 2.44 |
| Aman Paddy | 846823 | 4.73 | 837024 | 5464 | 2692 | 1205 | 175 | 262 | 9799 |
| Percentage | 100 | | 98.84 | 0.65 | 0.32 | 0.14 | 0.02 | 0.03 | 1.16 |
| Boro Paddy | 1163614 | 3.24 | 1153110 | 5561 | 2545 | 1347 | 441 | 611 | 10504 |
| Percentage | 100 | | 99.10 | 0.48 | 0.22 | 0.11 | 0.04 | 0.05 | 0.90 |
| Total | 2511913 | 3.95 | 2479354 | 17431 | 9127 | 3775 | 915 | 1311 | 32559 |
| Total Loss (Percentage) | | | | 0.69 | 0.36 | 0.15 | 0.04 | 0.05 | 1.30 |

Note : Conversion ratio, Paddy to Rice 0.676

Table 4.5.4 indicates that on storing 501.48 tons of Aus paddy for an average period of 3.87 months, the total storage loss at farm level was found to be 2.44%. Storage loss of Aman crop for an average period of 4.73 months was found 1.16%, and the storage loss of Boro crop for an average period of 3.24 months was 0.90%. In other words on storing 2.51 thousand tons of Aus, Aman and Boro paddy on an average period of 3.95 months the total storage loss was found to be 1.30%.

Table 4.5.5 shows the post harvest loss in storage of Aus at farm level by container during 1989-90. The Gunny bags, motka, dole, gola and other types were used as containers. The average period of storage was 3.87 months and the average quantity of storage loss was 2.44%. Highest storage loss was 4.19% when the crops were stored in other type of containers like Tin pot, Drum. The second highest (3.05%) storage loss was observed when the crop was stored in dole. This was followed by gunny bags (2.69%), gola (2.23%) and then motka (1.91%). Among the containers minimum storage loss was observed by motka. In these containers, storage losses due to moisture, rat infestation, insect and fungus attack and other reasons were nominal.

Regarding Aman crop (Table 4.5.6) the average storage loss in all types of containers were 1.16%, for an average period of 4.73 months the highest being 1.45% in case of gunny bags and the lowest (1.12%) in case of 'gola', 1.19% loss was observed in both the cases of motka and dole. Loss due to storing in other types of container like tin pot, drum etc. was 1.18%. Causes of loss also followed the same pattern as indicated in Table 4.5.2 with reasons explained therein.

Regarding Boro crop (Table 4.5.7), the average loss in all types of containers was 0.90% for an average storage period of 3.24 months, the maximum being 1.59% in case of other type of containers like tin pot, drum etc. 1.05% in 'dole' and 'motka', 0.92% in

'gola' and 0.54% in gunny bags. The loss in gunny bags was the lowest. Here the causes of loss followed the same pattern as shown in Table 4.5.3 with reasons explained therein.

Table 4.5.5 : Post-harvest Loss (kg) in Storage of Aus by Container during 1989-90

| Container | Quantity stored | Months stored | Quantity released | Moisture loss | Eaten by rat | Loss due to insect | Loss due to fungus | Loss due to other reasons | Total loss in kg |
|---|---|---|---|---|---|---|---|---|---|
| Gunny bag | 17255 | 176 | 16791 | 198 | 187 | 25 | 3 | 51 | 464.00 |
| Mean | 253.75 | 2.60 | 246.93 | 2.91 | 2.75 | .37 | .04 | .75 | 6.82 |
| % | 100.00 | | 97.31 | 1.15 | 1.08 | .14 | .02 | .30 | 2.69 |
| Motka | 50726 | 861 | 49757 | 522 | 286 | 131 | 10 | 20 | 969.00 |
| Mean | 291.53 | 4.95 | 285.96 | 3.00 | 1.65 | .75 | .06 | .12 | 5.56 |
| % | 100.00 | | 98.09 | 1.03 | .56 | .26 | .02 | .04 | 1.91 |
| Dole | 126228 | 585 | 122387 | 1904 | 1283 | 405 | 97 | 153 | 3841.00 |
| Mean | 738.17 | 3.42 | 715.71 | 11.13 | 7.50 | 2.37 | .57 | .89 | 22.46 |
| % | 100.00 | | 96.95 | 1.51 | 1.02 | .32 | .08 | .12 | 3.05 |
| Gola | 300912 | 676 | 294196 | 3588 | 2124 | 608 | 187 | 209 | 6716.00 |
| Mean | 1709.73 | 3.84 | 1671.57 | 20.39 | 12.07 | 3.45 | 1.06 | 1.19 | 38.1591 |
| % | 100.00 | | 97.77 | 1.19 | .71 | .20 | .06 | .07 | 2.23 |
| Others | 6355 | 80 | 6089 | 194 | 10 | 55 | 2 | 5 | 266.00 |
| Mean | 254.20 | 3.20 | 243.56 | 7.76 | .40 | 2.20 | .08 | .20 | 10.6400 |
| % | 100.00 | | 95.81 | 3.05 | .16 | .87 | .03 | .08 | 4.19 |
| Total | 501476 | 2378 | 489220 | 6405 | 3890 | 1223 | 299 | 438 | 12256.00 |
| Mean | 816.74 | 3.87 | 796.78 | 10.43 | 6.34 | 1.99 | .49 | .71 | 19.96 |
| % | 100.00 | | 97.56 | 1.28 | .78 | .24 | .06 | .09 | 2.44 |

Note : Conversion ratio, Paddy to Rice 0.674

Table 4.5.6 : Post-harvest Loss (kg) in Storage of Aman by Container during 1989-90

| Container | Quantity stored | Months stored | Quantity released | Moisture loss | Eaten by rat | Loss due to insect | Loss due to fungus | Loss due to other reasons | Total loss in kg |
|---|---|---|---|---|---|---|---|---|---|
| Gunny bag | 29731 | 423 | 29300 | 232 | 137 | 45 | 13 | 4 | 431 |
| Mean | 291.48 | 4.15 | 287.25 | 2.28 | 1.35 | .44 | .12 | .04 | 4.22 |
| % | 100 | - | 98.55 | 0.79 | 0.46 | 0.15 | 0.04 | 0.01 | 1.45 |
| Motka | 94578 | 1322 | 93455 | 578 | 301 | 214 | 25 | 5 | 1123 |
| Mean | 355.56 | 4.97 | 351.34 | 2.17 | 1.13 | .80 | .09 | .02 | 4.22 |
| % | 100 | - | 98.81 | 0.60 | 0.32 | 0.23 | 0.03 | 0.01 | 1.19 |
| Dool | 233026 | 1069 | 230259 | 1243 | 1089 | 314 | 64 | 56 | 2766 |
| Mean | 935.85 | 4.29 | 924.74 | 4.99 | 4.37 | 1.26 | .26 | .23 | 11.11 |
| % | 100 | - | 98.81 | 0.54 | 0.47 | 0.13 | 0.03 | 0.02 | 1.19 |
| Gola | 482411 | 946 | 478005 | 3366 | 1150 | 623 | 71 | 197 | 5407 |
| Mean | 2627.23 | 5.14 | 2597.85 | 18.29 | 6.25 | 3.39 | .39 | 1.07 | 29.38 |
| % | 100 | - | 98.88 | 0.70 | 0.24 | 0.13 | 0.01 | 0.04 | 1.12 |
| Others | 6077 | 262 | 6005 | 46 | 15 | 9 | 2 | 0 | 72 |
| Mean | 124.02 | 5.35 | 122.55 | .94 | .31 | .18 | .05 | 0.00 | 1.47 |
| % | 100 | - | 98.82 | 0.75 | 0.25 | 0.15 | 0.03 | 0.00 | 1.18 |
| Total | 846823 | 4022 | 837024 | 5464 | 2692 | 1205 | 175 | 262 | 9799 |
| Mean | 966.26 | 4.73 | 984.73 | 6.43 | 3.17 | 1.42 | 0.21 | 0.31 | 11.53 |
| % | 100 | - | 98.84 | 0.65 | 0.32 | 0.14 | 0.02 | 0.03 | 1.16 |

Note : Conversion ratio, Paddy to Rice 0.679

Table 4.5.7 : Post-harvest Loss (kg) in Storage of Boro by Container during 1989-90.

| Container | Quantity stored | Months stored | Quantity released | Moist-ure loss | Eaten by rat | Loss due to insect | Loss due to fungus | Loss due to other reasons | Total loss in kg |
|---|---|---|---|---|---|---|---|---|---|
| Gunny bag | 177892 | 571 | 176922 | 445 | 318 | 110 | 41 | 56 | 970 |
| Mean | 1052.14 | 3.38 | 1046.88 | 2.63 | 1.88 | .65 | .24 | .33 | 5.74 |
| % | 100 | | 99.46 | 0.25 | 0.18 | 0.06 | 0.02 | 0.03 | 0.54 |
| Motka | 100515 | 577 | 99464 | 499 | 279 | 169 | 53 | 51 | 1051 |
| Mean | 564.69 | 3.24 | 558.79 | 2.80 | 1.57 | .95 | .30 | .29 | 5.91 |
| % | 100 | | 98.95 | 0.50 | 0.28 | 0.17 | 0.05 | 0.05 | 1.05 |
| Dole | 225310 | 799 | 222940 | 1150 | 597 | 279 | 159 | 185 | 2370 |
| Mean | 869.92 | 3.08 | 860.77 | 4.44 | 2.31 | 1.08 | .61 | .71 | 9.15 |
| % | 100 | | 98.95 | 0.51 | 0.27 | 0.12 | 0.07 | 0.08 | 1.05 |
| Gola | 654113 | 968 | 648091 | 3430 | 1328 | 767 | 181 | 317 | 6022 |
| Mean | 2144.63 | 3.17 | 2124.89 | 11.24 | 4.35 | 2.51 | .59 | 1.04 | 19.74 |
| % | 100 | | 99.08 | 0.52 | 0.20 | 0.12 | 0.03 | 0.05 | 0.92 |
| Others | 5784 | 120 | 5693 | 38 | 23 | 22 | 7 | 2 | 92 |
| Mean | 222.46 | 4.63 | 218.96 | 1.46 | .87 | .83 | .27 | .09 | 3.52 |
| % | 100 | | 98.41 | 0.66 | 0.40 | 0.38 | 0.12 | 0.03 | 1.59 |
| Total | 1163614 | 3036 | 1153110 | 5561 | 2545 | 1347 | 441 | 611 | 10504 |
| Mean | 1241.85 | 3.24 | 1230.64 | 5.93 | 2.72 | 1.44 | 0.47 | 0.65 | 11.21 |
| % | 100 | | 99.10 | 0.48 | 0.22 | 0.11 | 0.04 | 0.05 | 0.90 |

Conversion ratio, Paddy to Rice 0.678

## 4.5.2 Primary and Secondary Trader Levels

Data regarding storage loss at traders level have been collected from primary and secondary traders.

Table 4.5.8 shows the storage loss at primary traders level. The average total loss of foodgrains at primary traders level was found to be 0.35%, which were due to evaporation, eating by rodent, damage by insects, fungus loss and losses due to handling during loading and unloading. In Chittagong/Noakhali region, the average total loss was found 0.35% (Appendix 4.5.1). The highest 0.14% loss occurred due to evaporation, 0.08% was due to eating by rodent, insect loss was 0.05%, fungus loss was 0.04% and handling loss was 0.03%. In all regions, the losses followed the same pattern as was the case of Chittagong/Noakhali region. In all these regions, the average storage period was 3.10 months varying from 1 month in Jessore/Kushtia/Khulna region to 3.78 months in Chittagong/Noakhali region. It was observed that the storage loss did not correlate with the storage period. It is likely that it varied with the quality of grain stored and with the condition of storing. If the grain contains more moisture, the evaporation would be more leading to higher loss. Loss due to eating by rodent, depends on population of rodent in that particular region and the facility of their access to stored foodgrains.

Out of 18 selected Upazilas, the average storage loss at primary traders level was 0.35%. In Comilla/Sylhet region, the average loss due to evaporation was 0.27%. On Upazila basis, the

highest loss of 0.82% due to evaporation occurred in Chandpur Upazilla and the total storage loss in the same Upazila was 0.96% (Appendix 4.5.2). The results followed the same pattern as indicated by region in Appendix 4.5.1.

At primary traders level foodgrains were stored mainly in gunny bags and gola. Tables 4.5.8 and 4.5.9 show the type of grains and containers used for storing foodgrains at primary traders level. It was observed from the survey regions that rice was stored in gunny bags and gola, and paddy was stored only in gunny bags. Survey included 20 cases, out of which 18 were for paddy and 2 for rice. Again gunny bag was studied in one place and gola in one place. Here also the total average process loss was 0.35% and the losses followed the same pattern as mentioned in Appendices 4.5.1 and 4.5.2.

Storage losses at secondary traders level are shown by regions in Table 4.5.10; for rice, paddy and wheat by upazila in Appendix 4.5.3, by type of foodgrains in Appendix 4.5.4 and by container only in Appendix 4.5.5.

Table 4.5.10 indicates that storage loss at secondary traders level by region was conducted in 34 places indicating average storage loss at 0.36% for an average storage period of 2.65 months. Here also the highest storage loss was due to higher moisture content. Causes of storage loss almost followed the same pattern as was indicated at primary traders level (Appendices 4.5.1 & 4.5.2). By Upazila basis the results followed the same pattern as in Appendix 4.5.3. Gunny bag was only used for storing foodgrains at secondary traders level (Appendix 4.5.5), for storing rice, paddy and wheat (Appendix 4.5.4). These results were also the same and followed the same pattern as indicated in Appendix 4.5.3.

Table 4.5.8 : Storage Loss (Kg) at Primary Traders Level by Type of Foodgrain

| Type of foodgrain | Type of Container | Quantity stored in kg. | Period of storage in months | Quantity released in kg. | Evaporation loss in kg | Eaten by rodent in kg. | Insect loss in kg. | Fungus loss in kg. | Other loss in kg | Total loss due to all reason |
|---|---|---|---|---|---|---|---|---|---|---|
| Rice | Gunny bag | 480 | 1 | 478 | 2 | 1 | 0 | 0 | 0 | 2 |
| | Mean | 480.00 | 1.00 | 478.00 | 1.50 | .50 | 0.00 | 0.00 | 0.00 | 2.00 |
| | % | | | | .31 | .10 | 0.00 | 0.00 | 0.00 | .41 |
| | Gola | 6705 | 1 | 6685 | 16 | 3 | 0 | 0 | 1 | 20 |
| | Mean | 6705.00 | 1.00 | 6685.00 | 16.00 | 3.00 | 0.00 | 0.00 | 1.00 | 20.00 |
| | % | | | | .24 | .04 | 0.00 | 0.00 | .01 | .29 |
| Sum | | 7185 | 2 | 7163 | 18 | 4 | 0 | 0 | 1 | 22 |
| Mean | | 3592.50 | 1.00 | 3581.50 | 8.75 | 1.75 | 0.00 | 0.00 | .50 | 11.00 |
| % | | | | | .24 | .05 | 0.00 | 0.00 | .01 | .30 |
| Paddy | Gunny bag | 4785158 | 60 | 4768348 | 6912 | 3787 | 2577 | 2069 | 1465 | 16810 |
| | Mean | 265842.1 | 3.33 | 264908.2 | 384.03 | 210.36 | 143.17 | 114.92 | 81.39 | 933.86 |
| | % | | | | .14 | .08 | .05 | .04 | .03 | .34 |
| Sum | | 4785158 | 60 | 4768348 | 6912 | 3787 | 2577 | 2069 | 1465 | 16810 |
| Mean | | 265842.1 | 3.33 | 264908.2 | 384.03 | 210.36 | 143.17 | 114.92 | 81.39 | 933.86 |
| % | | | | | .14 | .08 | .05 | .04 | .03 | .34 |
| Total | | 4792343 | 62 | 4775511 | 6930 | 3790 | 2577 | 2069 | 1466 | 16832 |
| Mean | | 239617.1 | 3.10 | 238775.6 | 346.50 | 189.50 | 128.85 | 103.43 | 73.30 | 841.58 |
| % | | | | | .14 | .08 | .05 | .04 | .03 | .35 |

Note : Conversion ratio, paddy to rice 0.676

Table 4.5.9 : Storage Loss (Kg) at Primary Traders Level by Container.

| Type of container | Quantity stored in kg. | Period of storage in months | Quantity released in kg | Evaporation loss | Eaten by rodent | Insect loss | Fungus loss | Other loss | Total loss |
|---|---|---|---|---|---|---|---|---|---|
| Gunny bag | 4785638 | 61 | 4768826 | 6914 | 3787 | 2577 | 2069 | 1465 | 16812 |
| Mean | 251875.7 | 3.21 | 250990.9 | 363.89 | 199.32 | 135.63 | 108.87 | 77.11 | 884.82 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .34 |
| Gola | 6705 | 1 | 6685 | 16 | 3 | 0 | 0 | 1 | 20 |
| Mean | 6705.00 | 1.00 | 6685.00 | 16.00 | 3.00 | 0.00 | 0.00 | 1.00 | 20.00 |
| % | | | | .24 | .04 | 0.00 | 0.00 | .01 | .29 |
| Total | 4792343 | 62 | 4775511 | 6930 | 3790 | 2577 | 2069 | 1466 | 16832 |
| Mean | 239617.1 | 3.10 | 238775.6 | 346.50 | 189.50 | 128.85 | 103.43 | 73.30 | 841.58 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .35 |

Conversion ratio, paddy to rice 0.676

Table 4.5.10 : Storage loss (Kg) at secondary traders level by region

| Region | Quantity stored in kg. | Period of storage in months | Quantity released in kg | Evaporation loss | Eaten by rodent | Insect loss | Fungus loss | Other loss | Total loss |
|---|---|---|---|---|---|---|---|---|---|
| Chittagong-Noakhali | 2963403 | 38 | 2952701 | 5154 | 3617 | 946 | 588 | 397 | 10702 |
| Mean | 296340.3 | 3.80 | 295270.1 | 515.40 | 361.70 | 94.60 | 58.80 | 39.70 | 1070.20 |
| Validn | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| % | | | | .17 | .12 | .03 | .02 | .01 | .36 |
| Dhaka-Tangail | 141816 | 7 | 141514 | 130 | 121 | 30 | 5 | 16 | 302 |
| Mean | 47272.00 | 2.33 | 47171.33 | 43.33 | 40.33 | 10.00 | 1.67 | 5.33 | 100.67 |
| Validn | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .09 | .09 | .02 | .00 | .01 | .21 |
| Comilla-Sylhet | 266925 | 9 | 266143 | 413 | 306 | 55 | 3 | 5 | 782 |
| Mean | 29658.33 | 1.00 | 29571.44 | 45.89 | 33.94 | 6.11 | .39 | .50 | 86.89 |
| Validn | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| % | | | | .15 | .11 | .02 | .00 | .00 | .29 |
| Rajshahi-Bogra-Pabna | 10425 | 3 | 10392 | 10 | 20 | 2 | 1 | 0 | 33 |
| Mean | 10425.00 | 3.00 | 10392.00 | 10.00 | 20.00 | 2.00 | 1.00 | 0.00 | 33.00 |
| Validn | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | .10 | .19 | .02 | .01 | 0.00 | .32 |
| Jessore-Kushtia-Khulna | 74165 | 33 | 73635 | 419 | 79 | 32 | 0 | 0 | 530 |
| Mean | 6742.27 | 3.00 | 6694.09 | 38.09 | 7.18 | 2.91 | 0.00 | 0.00 | 48.18 |
| Validn | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| % | | | | .56 | .11 | .04 | 0.00 | 0.00 | .71 |
| Total | 3456734 | 90 | 3444384 | 6126 | 4143 | 1065 | 597 | 418 | 12349 |
| Mean | 101668.6 | 2.65 | 101305.9 | 180.18 | 121.84 | 31.32 | 17.56 | 12.28 | 363.21 |
| Validn | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 33 |
| % | | | | .18 | .12 | .03 | .02 | .01 | .36 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

### 4.5.3 Millers Level

Storage losses of foodgrain at millers level in case of boiler mills were surveyed in all the regions on local and modern varieties of Aus, Aman and Boro. The results have been shown in Appendix 4.5.6.

From the results it was evident that at millers level (in case of boiler mills) all types of foodgrain were stored in gunny bags and no other container was used by such millers. Total average milling loss of paddy in these boiler mills was 1.70% with the maximum loss of 1.44% due to evaporation followed by 0.15% due to eating by rodents, 0.04% due to insect infestation, 0.03% fungus attack and 0.04% due to handling during loading and unloading. This pattern was observed in all the regions in all cases of paddy. The maximum loss was observed in Comilla/Sylhet region. In the same region, modern Boro crop was investigated in 4 cases where the total average loss was 3.66% with the maximum 3.45% loss due to evaporation.

In conclusion, the loss due to evaporation presented in the this section is not a loss of foodgrain during storing. It is only due to evaporation of excess moisture which was retained in the stored foodgrains because of imperfect drying. Therefore, inclusion of evaporation loss (about 1%) may be ignored in the estimation of storage loss.

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## 4.6 TRANSPORTATION LOSS

### 4.6.1 The Overall Picture

In the study area, about 25723 tons of foodgrains were transported for marketing by farmers and the traders in the primary and secondary markets including wholesale markets. This figure is higher than the total production of our sample farmers because traders have procured foodgrains not only from the sample farmers but also from other farmers outside our sample. The shares of transactions by farmers, traders in the primary and secondary markets were 8.0, 28.0 and 64.0 percent respectively of the total production. There was no wide variation of foodgrain loss in these transactions. Transportation loss at the farmer's level was about 0.30 percent while it was 0.23 percent for traders in the primary market and 0.29 percent for traders in the secondary market. The overall loss of foodgrains was 0.27 percent (this is the weighted average of percentage loss due to transportation by farmers and traders of the primary and secondary markets, the weights being the shares of the volume of transportation of these groups in the total volume of transportation of foodgrains).

Mode-wise truck accounted for the major share (52.0 percent) of transportation of all foodgrains (Table 4.6.2). Bullock cart came next with about 22.0 percent. The third important mode of transport of foodgrains was rickshaw van which accounted for about 12.0 percent. All other modes of transport together was accountable for about 14.0 percent of the total foodgrains transportation and the share of the these modes of transport ranges from 0.23 percent for shoulder sling to 0.42 percent for railway. Loss of foodgrains on account of the different means of transport is depicted in Table 4.6.1.

Table 4.6.1 : Loss of Foodgrains by Mode of Transport

| Mode of Transport | Percent Loss |
|---|---|
| Headload | 0.16 |
| Shouldersling | 0.23 |
| Rickshaw Van | 0.22 |
| Bullock Cart | 0.18 |
| Boat | 0.28 |
| Truck | 0.31 |
| Railway | 0.42 |
| All Modes | 0.27 |

Note : Overall loss of 0.27 percent is the weighted average of the figures representing percent loss by different modes of transport. The respective weights are the percentage share of foodgrains transported by various modes in total foodgrains transported.

It can be seen from the Table 4.6.1 that foodgrain loss varies considerably among the various modes of transport. It ranges from 0.16 percent in the case of headload to about 0.42 percent in the case of railway. Between these two extremes, foodgrain loss due to bullock cart, rickshaw van, shoulder sling, boat and truck comes in order with 0.18, 0.22, 0.23, 0.28 and 0.31 percents respectively.

Table 4.6.2 : Loss of Foodgrains by different Mode of Transport.

| Mode of transport | Quantity transported | Quantity received | Distance travelled (km) | Quantity Lost | Qty. lost as percent of Qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 948554 (3.7) | 947002 | 520 | 1552 | 0.16 |
| Shouldersling | 89067 (0.4) | 88859 | 500 | 208 | 0.23 |
| Rickshawvan | 2953526 (11.5) | 2946884 | 2606 | 6642 | 0.22 |
| Bullock cart | 5763835 (22.4) | 5753223 | 1294 | 10612 | 0.18 |
| Boat | 1079426 (4.2) | 1076410 | 261 | 3016 | 0.28 |
| Truck | 13351498 (51.9) | 13309979 | 3008 | 41519 | 0.31 |
| Railway | 1536721 (5.9) | 1530216 | 1094 | 6505 | 0.42 |
| Total | 25722627 | 25652573 | 8932 | 70054 | 0.27 |

Figure in parentheses indicates percentage of total
Conversion ratio, Paddy to Rice 0.677

As to the reasons of foodgrain loss, three factors e.g. use of hooks, pilferage and transhipment were examined. Foodgrain loss due to transhipment was found to be the highest in all modes of transport except trucks where use of hooks was the main factor of foodgrain loss (Table 4.6.3). Since truck accounted for about 60.0 percent of all foodgrain transportation, use of hooks came out to be the main factor of foodgrain loss. It explained 40.0 percent of total loss of foodgrains. After hook came transhipment and pilferage explaining respectively 35.0 and 22.0 percents of total loss. Other factors accounted for 3.0 percent of the loss.

Table 4.6.3: Percentage Loss of Foodgrains due to the use of Hooks, Pilferage and Transhipment in different Modes of Transport at the Primary and secondary trader levels.

| Modes of transport | Percentage Loss due to | | | |
|---|---|---|---|---|
| | use of hooks | Pilferage | Transhipment | Others |
| Headload | 28 | 31 | 41 | - |
| Rickshaw Van | 22 | 25 | 47 | 6.0 |
| Bullock Cart | 26 | 22 | 52 | - |
| Boat | 23 | 30 | 47 | - |
| Truck | 51 | 20 | 28 | 1.0 |
| Railway | 22 | 27 | 40 | 11.0 |
| All Modes | 40 | 22 | 35 | 3.0 |

Broadly, the order of foodgrain loss on account of the various modes of transport conform to the notion made out in the literature review. As conceived, Boat, truck, railway etc. register higher order loss than headload, shouldersling, rickshaw van etc. because the formers involve transportation of greater volumes of foodgrains and require more use of hooks and also entail less personal care. However, the figures representing percentage losses due to boat, railway and particularly truck which is most important mode of transport and account for 64.0 percent of the total volume of foodgrains transportation, are recorded to be lower than the corresponding figures obtained by ARDICOL (1988). One plausible explanation of the phenomenon may be that some improvements of the transportation system and greater awareness among the people as to the value of each grain have helped to reduce foodgrain loss in recent years.

Substantial variations of foodgrains loss can be noted across the regions (Table 4.6.4): It varies from 0.10 percent in Dhaka - Tangail to 0.41 percent in Mymensingh - Kishoregonj - Jamalpur. Areas incurring losses similar to Mymensingh - Kishoregonj - Jamalpur are Comilla - Sylhet and Rangpur - Dinajpur. On the other hand, areas experiencing foodgrain loss of lower orders than the overall 0.27 percent, besides Dhaka - Tangail, are Chittagong - Noakhali and Jessore - Kushtia - Khulna. Information regarding region-wise variation of foodgrains loss is not precisely known. Still, it is rather instructive to note that foodgrains loss appears to be higher in far-flung and relatively backward areas in respect of transportation facilities.

Table 4.6.4 : Overall Transportation Loss of Foodgrains by Region

| Region | Quantity transported (kg) | Quantity received (kg) | Distance travelled (km) | Quantity Lost (kg) | Qty. lost as percent of Qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 9741915 (37.9) | 9720584 | 444 | 21331 | 0.22 |
| Mymensingh-Kishoregonj-Jamalpur | 5663046 (22.0) | 5639657 | 1607 | 23389 | 0.41 |
| Dhaka-Tangail | 3572408 (13.9) | 3568787 | 676.4 | 3621 | 0.10 |
| Comilla-Sylhet | 2325078 (9.0) | 2316398 | 3021.4 | 8680 | 0.37 |
| Rajshahi-Bogra-Pabna | 1241699 (4.8) | 1238491 | 855.2 | 3207 | 0.29 |
| Rangpur-Dinajpur | 1442774 ( 5.6) | 1437082 | 970 | 5692 | 0.36 |
| Jessore-Kushtia-Khulna | 1670442 (6.5) | 1666493 | 1696 | 3950 | 0.24 |
| Barisal-Faridpur-Patuakhali | 65267 (0.30) | 65083 | 274 | 184 | 0.28 |
| All Regions | 257.22627 (100) | 25652573 | 8938 | 70054 | 0.27 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

## 4.6.2 Farmers Level

For assessing foodgrain loss in the course of transportation for sale at the farmers level, Aman, Aus, Boro and Wheat were considered separately and also together. The transportation involved 2067 tons of these crops. Considering the fact that Aman is the main crop, the highest weight was accorded to this crop by providing 43.0 percent of the sample size. Although Aus comes next to Aman in terms of acreage, Boro was given the second highest weight with 35.0 percent of the sample size. This is because of the greater significance of Boro in enhancing agricultural growth and also because Boro has a large share of modern varieties* in its acreage. However, in the case of marketing and hence transportation of foodgrains, Boro entails the highest transaction of a little

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* The rational for attaching the highest weight to modern variety is given in the methodology.

over 50.0 percent of the total volume. This is because Boro is a more market oriented crop than Aman. Aman comes next with about 36.0 percent; Aus and Wheat record respectively 10.2 and 4.3 percents of total volume transported (Table 4.6.5). Between paddy and rice, paddy involved about 99 percent of the total volume of transportation.

Table 4.6.5: Crop-wise Loss of Foodgrains During Transportation by Farmers

| Crop | Quantity transported (Kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Aman | 727636 (35.2) | 724870 | 1830 | 2766 | 0.38 |
| Aus | 217830 (10.5) | 217328 | 756 | 502 | 0.23 |
| Boro | 1032694 (50.0) | 1030013 | 1761 | 2681 | 0.26 |
| Wheat | 88816 (4.3) | 88514 | 343 | 302 | 0.34 |
| All Crops | 2066976 (100.0) | 2060725 | 4690 | 6251 | 0.30 |

Figure in parentheses indicates percentage of total
Conversion ratio, Paddy to Rice 0.676

Percentage loss of total volume of transportation of 2067 tons of foodgrains was recorded to be 0.30. The loss on account of Aman was the highest being 0.38 percent. Wheat came next with 0.34 percent of loss. Boro and Aus recorded less than the overall loss. Percentage loss of these crops were respectively 0.26 and 0.23.

By mode of transport, variation in foodgrain loss was not of great significance. It ranged between 0.18 percent with headload to 0.54 percent in the case of truck (Table 4.6.6).

Table 4.6.6: Transportation Loss of All Foodgrains (Aman+Aus+Boro+Wheat) by Farmers According to the Mode of Transport

| Mode of transport | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 66779 (3.2) | 66657 | 436 (1.9) | 122 | 0.18 |
| Shoulder-Sling | 89067 (4.3) | 88859 | 500 (2.4) | 208 | 0.23 |
| Rickshaw Van | 786054 (38.0) | 783863 | 2138 (2.6) | 2191 | 0.28 |
| Bullock Cart | 954349 (46.2) | 951453 | 1108 (2.6) | 2896 | 0.30 |
| Boat | 50105 (2.4) | 49920 | 214 (3.2) | 185 | 0.37 |
| Truck | 120622 (5.9) | 119973 | 292 (16.2) | 649 | 0.54 |
| All Modes | 2066976 (100.0) | 2060725 | 4747 (2.6) | 6251 | 0.30 |

Figure in parentheses indicates percentage of total

Conversion ratio, Paddy to Rice 0.676

Losses on account of boat and bullock cart were 0.37 and 0.30 percents respectively. Rickshaw van and shoulder sling were next in order with 0.28 and 0.23 percent of loss respectively. The relative stability of foodgrain loss on account of different modes of transport was noteworthy. The bulk of the transport of foodgrains was done by bullock cart and rickshaw van. Together they accounted for about 84.0 percent of all transactions. Since the transportations of foodgrains are for primary markets, the conditions under which they are done could have been more or less similar viz. short distance travel, personal care in handling, similar handling equipments, similar weather conditions etc. These may in part account for the relative stability of foodgrain loss by mode of transport.

Region-wise, substantial variability of foodgrain loss can be noted. The loss varies between 0.17 percent of the transported goods in Dhaka-Tangail region to 0.39 percent in Rajshahi-Bogra-Pabna region (Table 4.6.7).

Table 4.6.7: Region-wise Loss of Foodgrain (Aman+Aus+Boro+Wheat) During Transportation by the Farmers

| Regions | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty.lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 108860 (5.3) | 108575 | 176 (0.41) | 285 | 0.26 |
| Mymensing-Kishore-Jamalpur | 223648 (10.8) | 223119 | 924 (1.4) | 529 | 0.24 |
| Dhaka-Tangail | 232552 (11.2) | 232150 | 411 (1.3) | 402 | 0.17 |
| Comilla-Sylhet | 113666 (5.5) | 113293 | 520 (1.1) | 373 | 0.33 |
| Rajshahi-Bogra-Pabna | 307317 (14.9) | 306129 | 712 (1.9) | 1187 | 0.39 |
| Rangpur-Dinajpur | 680361 (32.9) | 677749 | 779 (1.3) | 2612 | 0.38 |
| Jessore-Kushtia-Khulna | 346283 (16.8) | 345581 | 1008 (3.5) | 702 | 0.20 |
| Barisal-Farid-Patuakhali | 54290 (2.6) | 54129 | 223 (0.65) | 161 | 0.30 |
| All Regions | 2066976 (100.0) | 2060725 | 4753 (1.4) | 6251 | 0.30 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Comilla-Sylhet, and Barisal-Faridpur-Patuakhali regions came up with foodgrain loss of the same order or more than the overall loss; the percentage loss of foodgrains transported in these regions were 0.33, and 0.30 respectively. On the other hand, Chittagong-Noakhali, Mymensing-Kishoreganj-Jamalpur and Jessore-Khulna-Kushtia regions recorded lower values of foodgrain loss than that of the overall value of foodgrain loss; the respective percentage of foodgrain of these regions was 0.26, 0.24 and 0.20. It seems that the variability of foodgrain loss across the regions is somewhat accountable to the condition of transport systems in the regions: far-flung areas with relatively poorer communication system exposed higher values of foodgrain loss.

From Table 4.6.8 substantial variability of foodgrain loss with respect to different modes of transport can be seen for Aman crop. The loss ranges from 0.16 percent of the volume transported with headload to 0.64 percent of the volume carried with boat. Foodgrain loss due to shoulder sling transport of Aman is one of the lowest being 0.25 percent. Other modes of transport record similar order of foodgrain loss viz. 0.28 percent for rickshaw van, 0.42 percent for truck and 0.45 percent for bullock cart.

Table 4.6.8: Transportation Loss of Aman by Farmers According to the Mode of Transport.

| Mode of transport | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 39512 (5.4) | 39450 | 318 | 62 | 0.16 |
| Shoulder-Sling | 57505 (7.9) | 57360 | 332 | 145 | 0.25 |
| Rickshaw Van | 277896 (38.2) | 277131 | 875 | 765 | 0.28 |
| Bullock Cart | 345128 (47.3) | 343565 | 283 | 1563 | 0.45 |
| Boat | 2512 (0.4) | 2496 | 20 | 16 | 0.64 |
| Truck | 5083 (0.7) | 4868 | 10 | 15 | 0.42 |
| All Modes | 727636 (100.0) | 724870 | 1830 | 2766 | 0.38 |

Figure in parentheses indicate percentage of total.
Conversion ratio, Paddy to Rice 0.676

Table 4.6.9: Transportation Loss of Aus of the Farmers by Mode of Transport

| Mode of transport | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 4758 (2.2) | 4748 | 20 | 10 | 0.21 |
| Shoulder-Sling | 9925 (4.6) | 9905 | 32 | 20 | 0.20 |
| Rickshaw Van | 92591 (42.5) | 92379 | 317 | 212 | 0.23 |
| Bullock Cart | 73991 (33.9) | 73846 | 162 | 145 | 0.20 |
| Boat | 27118 (12.5) | 27036 | 151 | 82 | 0.30 |
| Truck | 9447 (4.3) | 9414 | 74 | 33 | 0.35 |
| All Modes | 217830 (100.0) | 217328 | 756 | 502 | 0.23 |

Figure in parentheses indicate percentage of total.
Conversion ratio, Paddy to Rice 0.676

Table 4.6.10: Transportation Loss of Boro of the Farmers by Mode of Transport

| Mode of transport | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 17351 (1.7) | 17321 | 98 | 30 | 0.17 |
| Shoulder-Sling | 17487 (1.7) | 17457 | 94 | 30 | 0.17 |
| Rickshaw Van | 395761 (38.4) | 394629 | 841 | 1132 | 0.29 |
| Bullock Cart | 475568 (45.9) | 474567 | 463 | 980 | 0.21 |
| Boat | 20435 ( 2.0) | 20348 | 41 | 87 | 0.43 |
| Truck | 106092 (10.3) | 105691 | 216 | 401 | 0.38 |
| All Modes | 1032694 (100.0) | 1030013 | 1751 | 2681 | 0.26 |

Figure in parentheses indicates percentage of total

Conversion ratio, Paddy to Rice 0.676

Table 4.6.11: Transportation Loss of Wheat of the Farmers by Mode of Transport

| Mode of transport | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Headload | 5158 (5.81) | 5138 | 62 | 20 | 0.38 |
| Shoulder-Sling | 4151 (4.67) | 4137 | 42 | 13 | 0.32 |
| Rickshaw Van | 19806 | 19724 | 106 | 82 | 0.41 |
| Bullock Cart | 59662 (86.3) | 59475 | 199 | 187 | 0.31 |
| Boat | 40 (0.05) | 40 | 2 | - | - |
| Truck | - | - | - | - | - |
| All Modes | 88816 (100.0) | 88514 | | 302 | 0.34 |

Figure in parentheses indicates percentage of total

Conversion ratio, Paddy to Rice 0.676

For the remaining crops e.g, Aus, Boro and Wheat, the variability of foodgrain loss with respect to different modes of transport was not of much significance. For Aus, the percentage varied from 0.20 with bullock cart to 0.35 with truck; for wheat, it moved from 0.31 with bullock cart to 0.38 with headload; for Boro, however, there was a little more variability with 0.21 percent in the case of bullock cart to 0.43 percent in the case of boat.

In the transportation of a total volume of 2067 tons of all foodgrains , the weight of the combined transaction of Aus, Boro and Wheat is much higher, being about 65.0 percent of the total, than that of Aman. As a result, when all foodgrains are considered, the variability of Aman by mode of transport is somewhat smoothed out by the relative stability of the other crops giving rise to an overall picture which is free from substantial variability of foodgrain loss with respect to different modes of transport.

Regional variations of different crops are displayed in Table 4.6.12 through Table 4.6.14. The broad pattern of variations of foodgrain loss that emerges from these Tables are as follows: Comilla-Sylhet, Rajshahi-Bogra-Pabna, Rangpur- Dinajpur and Barisal-Faridpur-Patuakhali come out to be of higher order loss regions. In more than one crop, these regions showed relatively higher loss of foodgrains relative to other areas. For example, Comilla-Sylhet region in Aus and Boro-wheat crops, Rajshahi-Bogra-Pabna in all the crops, Rangpur-Dinajpur and Barisal-Faridpur-Patuakhali in Aman and Boro-wheat crops. Dhaka-Tangail region which registered the lowest percentage loss of Aman and Boro-wheat recorded the highest loss of 0.67 percent due to transportation of Aus crop. This last result can be considered as spurious because the sample for this region with Aus was too small and accounts for only 0.1 percent of the total volume of transaction of all regions.

Table 4.6.12: Region-wise Loss of Aman During Transportation by the Farmers

| Regions | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty.lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 73401 (10.1) | 73191 | 114 | 210 | 0.29 |
| Mymensing-Kishore-Jamalpur | 53901 (7.4) | 53798 | 351 | 103 | 0.19 |
| Dhaka-Tangail | 6510 (0.9) | 6500 | 75 | 10 | 0.15 |
| Comilla-Sylhet | 59856 (8.2) | 59665 | 241 | 191 | 0.32 |
| Rajshahi-Bogra-Pabna | 21805 (3.0) | 21722 | 154 | 83 | 0 38 |
| Rangpur-Dinajpur | 397792 (54.7) | 395877 | 315 | 1916 | 0.48 |
| Jessore-Kushtia-Khulna | 107846 (14.8) | 107624 | 520 | 222 | 0.21 |
| Barisal-Farid-Patuakhali | 6524 (0.9) | 6494 | 67 | 30 | 0.46 |
| All Regions | 727636 (100.0) | 724870 | 1836 | 2765 | 0.38 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.6.13: Region-wise Loss of Aus During Transportation by the Farmers

| Regions | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty.lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 10621 (4.9) | 10599 | 16 | 22 | 0.21 |
| Mymensing-Kishore-Jamalpur | 83998 (38.6) | 83808 | 265 | 190 | 0.23 |
| Dhaka-Tangail | 150 (0.1) | 149 | 2 | 1 | 0.67 |
| Comilla-Sylhet | 26315 (12.1) | 26242 | 102 | 73 | 0.28 |
| Rajshahi-Bogra-Pabna | 10738 (4.9) | 10689 | 103 | 48 | 0.46 |
| Rangpur-Dinajpur | 32383 (14.8) | 32319 | 68 | 64 | 0.20 |
| Jessore-Kushtia-Khulna | 44031 (20.2) | 43944 | 180 | 87 | 0.20 |
| Barisal-Farid-Patuakhali | 9595 (4.4) | 9578 | 20 | 17 | 0.18 |
| All Regions | 217830 (100.0) | 217328 | 756 | 502 | 0.23 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.6.14: Region-wise Loss of Boro & Wheat During Transportation by the Farmers

| Regions | Quantity transported (kg.) | Quantity sold (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty.lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 24838 (2.2) | 24784 | 46 | 53 | 0.21 |
| Mymensingh-Kishore-Jamalpur | 85749 (7.7) | 85514 | 308 | 236 | 0.28 |
| Dhaka-Tangail | 225892 (20.1) | 225501 | 334 | 391 | 0.17 |
| Comilla-Sylhet | 27495 (2.5) | 27336 | 177 | 109 | 0.40 |
| Rajshahi-Bogra-Pabna | 274774 (24.5) | 273718 | 455 | 1056 | 0.38 |
| Rangpur-Dinajpur | 250186 (22.3) | 249554 | 396 | 632 | 0.25 |
| Jessore-Kushtia-Khulna | 194406 (17.3) | 194014 | 308 | 392 | 0.20 |
| Barisal-Farid-Patuakhali | 38171 (3.4) | 38057 | 136 | 114 | 0.30 |
| All Regions | 1121510 (100.0) | 1118527 | 2161 | 2983 | 0.27 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

## 4.6.3 Primary Traders Level

At the primary traders level, the respondent traders transported a total of 7106.6 tons of foodgrains during 1989-90. Of this quantity, transportation of paddy was 95.4 percent while the respective figures for rice and wheat were 4.0 and 0.6 percent (Table 4.6.15).

Table 4.6.15 : Transportation Loss of Foodgrains by Crop at the Primary Traders Level.

| Type of Crop | Quantity transported (kg.) | Quantity received (kg.) | Quantity travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Rice | 284200 (4.0) | 2839984 | 75 | 217 | 0.08 |
| Paddy | 6776982 (95.4) | 6761304 | 688.5 | 15678 | 0.23 |
| Wheat | 45429 (0.6) | 45245 | 308 | 184 | 0.41 |
| All Crops | 7106612 (100.0) | 7090533 | 1072 | 16079 | 0.23 |

Figure in parentheses indicates percentage of total
Conversion ratio, Paddy to Rice 0.676

Foodgrain loss due to transportation by traders at the primary market was 0.23 percent. With regard to the type of grains, loss varied between 0.08 percent of the quantity transported in the case of rice, 0.23 percent in the case of paddy, and 0.41 percent in case of wheat.

By mode of transport, the lowest loss of 0.11 percent was recorded for headload while loss on account of truck being 0.30 percent was the highest of transportation loss (Table 4.6.16). Other modes like bullock cart, rickshaw van and boat registered respectively 0.12, 0.21 and 0.26 percent loss of the transported grains. It may be noted that truck transportation accounted for the largest share of transport loss. The second largest mode of transport was bullock cart. These two modes accounted for 42.0 and 28.0 percents respectively of the total volume transported. The next in order was boat, rickshaw van and headload, accounting for 13.0, 13.0 and 5.0 percent of total transported grains respectively.

Table 4.6.16 : Transportation Loss of Foodgrains by Mode of Transport at the Primary Traders Level

| Mode of Transport | Quantity Transported (kg) | Quantity Received (kg) | Distance travelled (km) | Quantity lost (kg) | Qty. lost as Percent of Qty transported |
|---|---|---|---|---|---|
| Headload | 356700 | 356298 | 8.0 | 402 | 0.11 |
| Rickshaw Van | 888348 (12.5) | 886446 | 314 | 1902 | 0.21 |
| Bullock Cart | 1974067 (27.8) | 1971684 | 149 | 2383 | 0.12 |
| Boat | 928661 (13.1) | 926246 | 24 | 2415 | 0.26 |
| Truck | 2958836 (41.6) | 2949859 | 930 | 8977 | 0.30 |
| All Modes | 7106612 (100.0) | 7090533 | 1072 | 16079 | 0.23 |

Figure in parentheses indicates percentage of total
Conversion ratio, Paddy to Rice 0.676

The regions involving more than the average loss of foodgrains of 0.23 percent were Mymensingh-Kishoreganj-Jamalpur (0.50 percent), Comilla-Sylhet (0.27 percent), Rajshahi-Bogra- Pabna (0.34 percent), Rangpur-Dinajpur (0.41 percent) and Jessore-Kushtia-Khulna (0.36 percent). Chittagong-Noakhali, Dhaka-Tangail and Barisal-Faridpur-Patuakhali represent areas of lower foodgrain loss. Percentage loss of foodgrains of these areas stood at around 0.20 percent of the transported grains (Table 4.6.17).

Table 4.6.17: Transportation Loss of Foodgrains by Region at the Primary Traders Level

| Region | Quantity transported (kg.) | Quantity received (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 4720402 (66.4) | 4710515 | 99.4 | 9887 | 0.21 |
| Mymen-Kish-Jamal | 263063 (3.7) | 261751 | 85.0 | 1312 | 0.50 |
| Dhaka-Tangail | 1425957 (20.1) | 1423399 | 86.4 | 2558 | 0.18 |
| Comilla-Sylhet | 325940 (4.6) | 325073 | 278.4 | 867 | 0.27 |
| Rajshahi-Bogra-Pabna | 66792 (0.9) | 66568 | 93.2 | 224 | 0.34 |
| Rangpur-Dinajpur | 260704 (3.7) | 259625 | 112.0 | 1079 | 0.41 |
| Jess-Kusht-Khulna | 40778 (0.6) | 40632 | 308.0 | 147 | 0.36 |
| Barisal-Farid-Patua | 2977 (0.04) | 2971 | 11.0 | 6 | 0.20 |
| All Region | 7106612 (100.0) | 7090533 | 1072 | 16079 | 0.23 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

## 4.6.4 Secondary and Wholesale Traders Level

A sample of 86 traders at the secondary market level showed transportation of 16549 tons of foodgrains. As with the farmer and primary market traders, the share of paddy in total foodgrain transportation was the highest being 93.0 percent. The shares of rice and wheat were 6.2 and 0.8 percents respectively (Table 4.6.18).

Table 4.6.18 : Transportation Loss of Foodgrains by Crop at the Secondary Traders Level.

| Type of Crop | Quantity transported (kg.) | Quantity received (kg.) | Distance travelled (Km.) | Quantity lost (Kg) | Qty. lost as percent of qty. transported |
|---|---|---|---|---|---|
| Rice | 1032792 (6.2) | 1030138 | 314 | 2654 | 0.26 |
| Paddy | 15385742 (93.0) | 15341022 | 2662 | 44720 | 0.29 |
| Wheat | 130505 (0.8) | 130156 | 137 | 349 | 0.27 |
| All Crops | 16549039 | 16501316 | 3113 | 47723 | 0.29 |

Figure in parentheses indicates percentage of total
Conversion ratio, Paddy to Rice 0.676

Percentage losses of rice, paddy and wheat in the course of transportation were remarkably close to one another. The respective figures were 0.26, 0.29 and 0.27. The overall loss of foodgrain was 0.29 percent.

By mode of transport, loss of foodgrains showed substantial variation. Boat transportation recorded the highest loss (0.41%), truck, the next highest (0.31%). Headload, rickshaw van and bullock cart showed remarkably closer foodgrain loss of 0.20, 0.20 and 0.19 percent respectively (Table 4.6.19).

Among regions, areas of higher foodgrain loss were experienced by Mymensingh-Kishoregonj-Jamalpur, Comilla-Sylhet and Rangpur-Dinajpur regions showing remarkably similarity of losses.

Table 4.6.19: Transportation Loss of Foodgrains by Mode of Transport at the Secondary Traders Level.

| Mode of Transport | Quantity Transported (kg) | Quantity Received (kg) | Distance travelled (km) | Quantity lost (kg) | Qty lost as Percent of Qty transported |
|---|---|---|---|---|---|
| Headload | 525075 (3.2) | 524047 | 16 | 1028 | 0.20 |
| Rickshaw Van | 1279124 (7.7) | 1276575 | 156 | 2549 | 0.20 |
| Bullock Cart | 2835419 (17.1) | 2830086 | 37 | 5333 | 0.19 |
| Boat | 100660 (6.6) | 100244 | 23 | 416 | 0.41 |
| Truck | 10272040 (62.1) | 10240147 | 1786 | 31893 | 0.31 |
| Others* | 1536721 (9.3) | 1530216 | 1094 | 6505 | 0.42 |
| All Modes | 16549039 (100.0) | 16501316 | 3113 | 47724 | 0.29 |

Figure in parentheses indicates percentage of total
* Include Railway, Trawler etc.
Conversion ratio, Paddy to Rice 0.676

The respective figures were 0.42%, 0.40% and 0.40%. On the other hand areas representing lower levels of loss also showed remarkable similarity in terms of percentage loss of foodgrains. Excepting Dhaka-Tangail region which showed negligible loss, Chittagong-Noakhali, Rajshahi-Bogra-Pabna, Jessore-Kushtia-Khulna and Barisal-Faridpur-Patuakhali came up with 0.23, 0.21, 0.24 and 0.21 percent respectively of loss of foodgrains transported in each region (Table 4.6.20).

Table 4.6.20: Transportation Loss of Foodgrains by Region at the Secondary Traders Level.

| Region | Quantity transported (kg.) | Quantity received (kg.) | Distance travelled (Km.) | Quantity lost (kg.) | Qty. lost as percent of qty. transported (%) |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 4912653 (29.7) | 4901494 | 169 | 11159 | 0.23 |
| Mymen-Kish-Jamal | 5176335 (31.3) | 5154787 | 993 | 21548 | 0.42 |
| Dhaka-Tangail | 1913899 (11.6) | 1913237 | 179 | 662 | 0.04 |
| Comilla-Sylhet | 1885472 (11.4) | 1878032 | 2223 | 7440 | 0.40 |
| Rajshahi-Bogra-Pabna | 867590 (5.2) | 865794 | 50 | 1796 | 0.21 |
| Rangpur-Dinajpur | 501709 (3.0) | 499708 | 79 | 2001 | 0.40 |
| Jess-Kusht-Khulna | 1283381 (7.7) | 1280280 | 380 | 3101 | 0.24 |
| Barisal-Farid-Patua | 8000 (0.1) | 7983 | 40 | 17 | 6.21 |
| All region | 16549039 (100.0) | 16501316 | 3113 | 47723 | 0.29 |

Figure in parentheses indicates percentage of total
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

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## 4.7 MARKETING AND HANDLING LOSS

### 4.7.1 Farmers' Level

Marketing loss occurs when the foodgrains are graded, weighed and packed. Such handling loss takes place at the farm and trader's level in the primary, secondary and wholesale markets. Handling losses at various levels have been estimated and are tabulated below. Handling loss was estimated separately for Aman, Aus and Boro rice. Table 4.7.1 depicts region-wise handling loss at the farm level for Aman rice. Quantity lost during handling has been estimated as the difference between total quantity before and after handling after transaction. Total handling loss was found highest in the Rangpur/Dinajpur region (0.55%); Dhaka/Tangail region experienced the lowest handling loss (0.19%). Handling losses for other regions lay between these two extremes. The weighted average handling loss was estimated to be 0.49%.

Table 4.7.2 reveals the farm level handling loss for Aman paddy desegregated according to varieties. Handling loss was found to be 0.44% for Broadcast Aman; 0.50% for Transplant Aman (LV) and 0.48% for Transplant Aman (MV).

Table 4.7.1 : Handling Loss at Farm by Regions for Aman Crop

| Region | Total Quantity Handled (kg.) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 102135.00 (704.38) | 444.00 (3.06) | 0.43 |
| Mymensingh/Kishoreganj/Jamalpur | 160422.00 (700.53) | 540.00 (2.36) | 0.34 |
| Dhaka/Tangail | 9891.00 (94.20) | 19.00 (0.18) | 0.19 |
| Comilla/Sylhet | 49480.00 (315.16) | 232.00 (1.48) | 0.47 |
| Rajshahi/Bogra /Pabna | 26136.00 (207.43) | 125.00 (0.99) | 0.48 |
| Rangpur/Dinajpur | 430237.00 (2119.39) | 2367.00 (11.66) | 0.55 |
| Jessore/Kushtia /Khulna | 136113.00 (1417.85) | 731.00 (7.62) | 0.54 |
| Barisal/Faridpur /Patuakhali | 9989.00 (87.62) | 30.00 (0.26) | 0.30 |
| Weighted average | | | 0.49 |

Source: Field Survey

Notes: (1) Figures in parentheses are mean values.
(2) Percentage share of a region in grand total quantity handled has been used as that region's weight in calculating weighted average percentage loss.
(3) For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.7.2 : Handling Loss at Farm by Different Varieties of Aman Paddy

| Variety of crop | Total Quantity of Aman Handled (Kg) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Broadcast - Aman | 58403.00 (179.15) | 257.00 (0.79) | 0.44 |
| Transplant Aman Local | 283135.00 (633.41) | 1420.00 (3.18) | 0.50 |
| Transplant Aman Modern | 582867.00 (903.67) | 2811.00 (4.36) | 0.48 |

Source: Field Survey

Diminishing marginal rate of substitution between leisure and income leads us to expect higher rate of handling loss for larger farms with higher production levels compared to smaller farms with lower production levels. In other words, larger farmers with higher production will be less careful in weighing and packing, resulting in higher handling loss compared to smaller farmers. Table 4.7.3 shows this to be more or less true for Aman rice. Thus, the highest rate of handling loss (0.55%) was found in Rangpur/Dinajpur region which also has the largest mean operational holding (about 307 decimals) and highest mean production (about 3819 kg.). The Rangpur/Dinajpur region was followed by Jessore/Kushtia/Khulna region with handling loss of 0.54%, mean operational holding of about 269 decimals and mean production of about 3471 kg. The hypothesis was confirmed in the other regions as well, except Comilla/Sylhet and Rajshahi/Bogra/Pabna region.

Table 4.7.4 shows the estimated handling loss for Aus by region. Handling loss was highest for the Dhaka/Tangail region (0.67%), followed by the Chittagong/Noakhali region (0.43%) and the Rajshahi/Bogra/Pabna region (0.34%). The lowest handling loss of 0.16% was found in the Barisal/Faridpur/Patuakhali region. The weighted average handling loss for Aus was estimated to be 0.22%. The hypothesis of a positive relationship among size of operational holding, production and rate of handling loss was negated for Aus. No systematic relationship existed among these variables in the case of Aus. This is shown in Table 4.7.5.

Table 4.7.3 : Relationship Among size of Operational Holding, Production and Handling Loss at Farm for Aman

| Region | Size of Mean Operational Holding (Decimal) | Mean Production (kg.) | Percentage Handling Loss at farm (%) |
|---|---|---|---|
| Chittagong/Noakhali | 265.52 | 3321.20 | 0.43 |
| Mymensingh/Kishoreganj/Jamalpur | 222.50 | 2321.90 | 0.34 |
| Dhaka/Tangail | 131.97 | 1412.00 | 0.19 |
| Comilla/Sylhet | 126.10 | 1412.20 | 0.47 |
| Rajshahi/Bogra /Pabna | 125.54 | 1194.50 | 0.48 |
| Rangpur/Dinajpur | 307.44 | 3819.20 | 0.55 |
| Jessore/Kushtia /Khulna | 269.19 | 3471.00 | 0.54 |
| Barisal/Faridpur /Patuakhali | 78.82 | 484.46 | 0.30 |

Source: Field Survey & Table 1
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.7.4 : Handling Loss at Farm by Region for Aus

| Region | Total Quantity Handled (kg.) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 16480.00 (113.66) | 71.00 (0.49) | 0.43 |
| Mymensingh/Kishoreganj/Jamalpur | 101267.00 (442.21) | 176.00 (0.77) | 0.17 |
| Dhaka/Tangail | 150.00 (1.43) | 1.00 (0.00) | 0.67 |
| Comilla/Sylhet | 32114.00 (204.55) | 95.00 (0.60) | 0.30 |
| Rajshahi/Bogra /Pabna | 11559.00 (91.74) | 39.00 (0.31) | 0.34 |
| Rangpur/Dinajpur | 33743.00 (166.22) | 62.00 (0.30) | 0.18 |
| Jessore/Kushtia /Khulna | 57111.00 (594.91) | 118.00 (1.23) | 0.21 |
| Barisal/Faridpur /Patuakhali | 10502.00 (92.12) | 17.00 (0.215) | 0.16 |
| Weighted average | | | 0.22 |

Source: Field Survey

Notes: (1) Figures in parentheses are mean values.
(2) Percentage share of a region in grand total quantity handled has been used as that region's weight in calculating weighted average percentage loss.
(3) For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.7 5: Relationship Among size of Operational Holding, Production and Handling Loss at Farm for Aus

| Region | Size of Mean Operational Holding (Decimal) | Mean Production (kg.) | Percentage Handling Loss at farm (%) |
|---|---|---|---|
| Chittagong/Noakhali | 62.41 | 679.45 | 0.43 |
| Mymensingh/Kishoreganj/Jamalpur | 100.68 | 991.04 | 0.17 |
| Comilla/Sylhet | 77.25 | 675.00 | 0.30 |
| Dhaka/Tangail | 59.81 | 293.96 | 0.67 |
| Rajshahi/Bogra /Pabna | 61.29 | 408.74 | 0.34 |
| Rangpur/Dinajpur | 21.73 | 129.71 | 0.18 |
| Jessore/Kushtia /Khulna | 166.11 | 1362.10 | 0.21 |
| Barisal/Faridpur /Patuakhali | 49.39 | 320.23 | 0.16 |

Source: Field Survey & Table 4
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Region-wise farm-level handling loss for Boro was estimated and shown in Table 4.7.6. The highest rate of handling loss (0.52%) was found in the Comilla/Sylhet region while the lowest rate (0.19%) was found in the Chittagong/Noakhali and Dhaka/Tangail regions. The rates of handling loss for other regions were found between these two rates. The weighted average rate of handling loss for Boro was 0.34%.

Table 4.7.6: Handling Loss at Farms by Regions for Boro

| Region | Total Quantity Handled (kg.) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 83931.00 (578.83) | 158.00 (1.09) | 0.19 |
| Mymensingh/Kishoreganj/Jamalpur | 122529.00 (535.06) | 274.00 (1.20) | 0.22 |
| Dhaka/Tangail | 193373.00 (1841.65) | 370.00 (3.52) | 0.19 |
| Comilla/Sylhet | 28177.00 (179.47) | 146.00 (0.93) | 0.52 |
| Rajshahi/Bogra /Pabna | 277956.00 (2206.00) | 1303.00 (10.34) | 0.47 |
| Rangpur/Dinajpur | 252852.00 (1245.58) | 1159.00 (5.71) | 0.46 |
| Jessore/Kushtia /Khulna | 237934.00 (2478.48) | 641.00 (6.67) | 0.30 |
| Barisal/Faridpur /Patuakhali | 43402.00 (380.72) | 92.00 (0.81) | 0.21 |
| Weighted average | | | 0.34 |

Source: Field Survey

Notes: (1) Figures in parentheses are mean values.
(2) Percentage share of a region in grand total quantity handled has been used as that region's weight in calculating weighted average percentage loss.
(3) For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.7.7 shows no systematic relationship among size of operational holding, production and rate of handling loss for Boro.

Table 4.7.7 : Relationship Among size of Operational Holding, Production and Handling Loss at Farm for Boro

| Region | Size of Mean Operational Holding (Decimal) | Mean Production (kg.) | Percentage Handling Loss at farm (%) |
|---|---|---|---|
| Chittagong/Noakhali | 77.37 | 1210.90 | 0.19 |
| Mymensingh/Kishoreganj/Jamalpur | 88.83 | 1381.50 | 0.22 |
| Dhaka/Tangail | 160.01 | 2736.50 | 0.19 |
| Comilla/Sylhet | 37.59 | 526.48 | 0.52 |
| Rajshahi/Bogra /Pabna | 161.52 | 3133.90 | 0.47 |
| Rangpur/Dinajpur | 107.32 | 1785.90 | 0.46 |
| Jessore/Kushtia /Khulna | 195.08 | 3184.10 | 0.30 |
| Barisal/Faridpur /Patuakhali | 73.34 | 1107.90 | 0.21 |

Source: Field Survey & Table 6
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

In the Table 4.7.8, the estimated region-wise farm-level handling loss for all rice is shown. Total quantity handled was the sum of the quantities of Aman, Aus,and Boro handled together. Total handling loss was similarly derived. From the total it was seen that the Rangpur/Dinajpur region had the highest rate of handling loss (0.50%), Next in order was the Rajshahi/Bogra/Pabna region with a handling loss of 0.46%, followed by the Comilla/Sylhet region with handling loss of 0.43%. The lowest rate of handling loss (0.19%) was found in the Dhaka/Tangail region. The estimation of handling loss for all rice for the country as a whole was 0.38%.

Table 4.7.8 : Handling Loss at Farm by Region for All Rice

| Region | Total Quantity Handled (kg.) | Total Handling Loss (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 202546 | 673 | 0.33 |
| Mymensingh/Kishore-ganj/Jamalpur | 384218 | 990 | 0.26 |
| Dhaka/Tangail | 203414 | 390 | 0.19 |
| Comilla/Sylhet | 109771 | 473 | 0.43 |
| Rajshahi/Bogra /Pabna | 315651 | 1467 | 0.46 |
| Rangpur/Dinajpur | 716832 | 3588 | 0.50 |
| Jessore/Kushtia /Khulna | 431158 | 1490 | 0.35 |
| Barisal/Faridpur /Patuakhali | 63893 | 139 | 0.22 |
| Country Average | 2427483 | 9210 | 0.38 |

Source: Tables 1,4 & 6

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Table 4.7.9, by and large, confirms the hypothesis of a positive relationship between (i) the size of operational holding and the rate of handling loss as well as (ii) the level of production and the rate of handling loss.

Table 4.7.9 : Relationship Among size of Operational Holding, Production and Handling Loss at Farm for All Rice

| Region | Size of Mean Operational* Holding (Decimal) | Mean Production** (Kg.) | Percentage Handling Loss at farm (%) |
|---|---|---|---|
| Chittagong/Noakhali | 134.10 | 1737.18 | 0.33 |
| Mymensingh/Kishoreganj/Jamalpur | 137.34 | 1564.81 | 0.26 |
| Dhaka/Tangail | 117.26 | 1480.82 | 0.19 |
| Comilla/Sylhet | 80.31 | 871.23 | 0.43 |
| Rajshahi/Bogra /Pabna | 116.12 | 1579.05 | 0.46 |
| Rangpur/Dinajpur | 145.50 | 1911.60 | 0.50 |
| Jessore/Kushtia /Khulna | 210.13 | 2672.40 | 0.35 |
| Barisal/Faridpur /Patuakhali | 67.18 | 637.53 | 0.22 |

Source: Field Survey & Table 6

Notes: *Unweighted mean of the mean operational holdings for Aus, Aman & Boro rice

**Unweighted mean of the mean productions of Aus, Aman & Boro rice.

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

## 4.7.2 Primary Markets

In addition to analyzing handling loss at the farm level, handling losses at the primary and secondary markets were also estimated . In Table 4.7.10 the estimated rates of handling loss at the primary market by region are reported. It is seen that the highest rate of handling loss (0.38%) took place in the Chittagong/Noakhali region, followed by the Mymensingh/Kishoreganj/Jamalpur region (0.32%) and the Rangpur/Dinajpur region (0.29%). Minimum handling loss occurred in the Dhaka/Tangail region (0.13%). The weighted average rate of handling loss at the primary market was estimated to be 0.28%.

Appendix 4.7.1 showed the estimated handling loss at the primary market level by Upazilas. There was a wide divergence in the handling loss rates among the Upazilas. Thus the highest rate of handling loss was 0.73% and this has taken place in Satkania Upazila. Kaliakair experienced the least handling loss (0.08%). The average handling loss at the primary market level for all surveyed Upazilas taken together was estimated to be 0.31%.

Table 4.7.10 : Handling Loss at Primary Market by Region

| Region | Total Quantity Handled (kg.) | Total Handling Loss (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 5040704.00 (280039.10) | 17924.00 (995.79) | 0.38 |
| Mymensingh/Kishoreganj/Jamalpur | 405011.00 (28929.36) | 1281.00 (91.50) | 0.32 |
| Dhaka/Tangail | 1427492.00 (64886.00) | 1833.00 (83.30) | 0.13 |
| Comilla/Sylhet | 1093272.00 (28770.32) | 600.00 (15.79) | 0.14 |
| Rajshahi/Bogra /Pabna | 1421274.00 (49009.45) | 176.00 (6.07) | 0.22 |
| Rangpur/Dinajpur | 443492.00 (21118.68) | 848.00 (40.39) | 0.29 |
| Jessore/Kushtia /Khulna | 279998.00 (8749.94) | 96.00 (3.01) | 0.24 |
| Barisal/Faridpur /Patuakhali | 128044.00 (12804.40) | 5.00 (0.50) | 0.20 |
| Weighted average | | | 0.28 |

Source: Field Survey
For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11
Notes: (1) Figures in parentheses are mean values.
(2) Percentage share of a region in grand total quantity handled has been used as that region's weight in calculating weighted average percentage loss.

In Table 4.7.11, estimation of handling loss at the primary market level by type of foodgrains is shown. The rate of handling loss was lowest for rice (0.08%) and highest for paddy (0.32%). One possible explanation of this finding could be that traders were more careful in handling rice which is more expensive compared to paddy. The average handling loss for paddy, rice and wheat taken together at the primary market level was found to be 0.31%.

Table 4.7.11 : Handling Loss at Primary Market by Type of Foodgrain

| Foodgrain | Total Quantity Handled (kg.) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Paddy | 9449402.00 (65620.85) | 22461.00 (155.98) | 0.32 |
| Rice | 729441.00 (25153.14) | 226.00 (7.80) | 0.08 |
| Wheat | 60444.00 (5494.93) | 76.00 (6.93) | 0.22 |
| Total | 10239287.00 (55648.30) | 22763.00 (123.71) | 0.31 |

Source: Field Survey
Conversion ratio, Paddy to Rice 0.676

### 4.7.3 Secondary and Wholesale Markets

Handling losses at secondary markets by region are presented in Table 4.7.12. Upazila-wise handling losses at the secondary market level are shown in Appendix 4.7.2. As observed for primary markets, there existed a wide fluctuation in handling loss rates among the Upazilas. Thus, while the rate of handling loss was 0.48% in Kishoreganj, it was only 0.03% in Sarishabari. The average handling loss for all surveyed upazilas taken together was estimated to be 0.30%.

Table 4.7.12 : Handling Loss at Secondary Market by Region

| Region | Total Quantity Handled (kg.) | Total Handling Loss (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Chittagong/Noakhali | 5925975.00 (257651.10) | 21767.00 (946.40) | 0.37 |
| Mymensingh/Kishore-ganj/Jamalpur | 6028304.00 (140193.10) | 19683.00 (457.70) | 0.33 |
| Dhaka/Tangail | 1914612.00 (174055.60) | 1233.00 (112.10) | 0.06 |
| Comilla/Sylhet | 1939741.00 (69276.50) | 3208.00 (114.60) | 0.17 |
| Rajshahi/Bogra /Pabna | 1179435.00 (78629.00) | 3230.00 (215.30) | 0.27 |
| Rangpur/Dinajpur | 773601.00 (45505.90) | 2162.00 (127.20) | 0.28 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11

Handling loss of the surveyed upazilas taken together was estimated at 0.30%. Table 4.7.13 shows estimated handling loss at the secondary market level by type of foodgrains. It can be seen that paddy and rice have the same rate of handling loss, viz.0.30%.The handling loss for wheat was higher, 0.45%. Average handling loss was estimated to be 0.30%.

Table 4.7.13 : Handling Loss at Secondary Market by Type of Foodgrain

| Foodgrain | Total Quantity Handled (kg.) | Quantity Lost in Handling (kg.) | Percentage Loss (%) |
|---|---|---|---|
| Paddy | 17093453.00 (156820.70) | 51167.00 (469.42) | 0.30 |
| Rice | 2005342.00 (46635.86) | 6047.00 (140.63) | 0.30 |
| Wheat | 519521.00 (74217.29) | 2346.00 (335.09) | 0.45 |
| Total | 19618316.00 (123385.60) | 59560.00 (374.59) | 0.30 |

Source: Field Survey
Conversion ratio, Paddy to Rice 0.676

Finally, an attempt was made to estimate the country-average rate of handling loss for all foodgrains in all markets of the country. This is shown in Table 4.7.14. It has been seen that the rates of handling losses at the levels of the farmers, primary markets and secondary markets are 0.38%, 0.31% and 0.30% respectively. The unweighted average handling loss for all markets was found to be 0.28%. The weighted average handling loss for all markets was estimated at 0.31%.

Table 4.7.14 : Average Handling Loss of Foodgrains for Bangladesh

| Type of market | Total Quantity Handled (kg.) | Total Handling Loss (kg) | Percentage Loss (%) |
|---|---|---|---|
| At Farm | 24274883 | 9210 | 0.38 |
| Primary Market | 10239287 | 22763 | 0.31 |
| Secondary Market | 19618316 | 59560 | 0.30 |
| All Markets | 32285086 | 91533 | 0.28 (0.31)* |

Source: Tables 8, 10 and 11
Notes: * Weighted average
Conversion ratio, Paddy to Rice 0.676

Estimation of handling loss at the wholesale market level was carried out in the major rice markets of Dhaka city. Results are shown in Tables 4.7.15, 4.7.16 and 4.7.17 for Aus, Aman and Boro rice respectively. Estimated rates of handling loss have been very similar in all the samples. The percentage of handling loss of Aus, Aman and Boro has been estimated to be 0.15, 0.14 and 0.13 respectively.

Table 4.7.15 : Handling Loss at Traders Level (Wholesale Market) For Aus

| Sample Number | Total Quantity Handled (kg) | Quantity Lost in Handling (kg) | Percentage Loss |
|---|---|---|---|
| 1 | 420000 | 873 | 0.21 |
| 2 | 130000 | 175 | 0.13 |
| 3 | 30240 | 36 | 0.12 |
| 4 | 400000 | 444 | 0.11 |
| 5 | 270008 | 359 | 0.13 |
| 6 | 250500 | 333 | 0.13 |
| Total | 1500740 | 2220 | 0.15 |

Source : Field Survey
Conversion ratio, Paddy to Rice 0.676

Table 4.7.16 : Handling Loss at Traders Level (Wholesale Market) For Aman

| Sample Number | Total Quantity Handled (kg) | Quantity Lost in Handling (kg) | Percentage Loss |
|---|---|---|---|
| 1 | 1008000 | 1950 | 0.19 |
| 2 | 210000 | 225 | 0.11 |
| 3 | 90928 | 86 | 0.09 |
| 4 | 721000 | 961 | 0.13 |
| 5 | 520000 | 578 | 0.11 |
| 6 | 650000 | 754 | 0.12 |
| Total | 3199928 | 4554 | 0.14 |

Source : Field Survey
Conversion ratio, Paddy to Rice 0.676

Table 4.7.17 : Handling Loss at Traders Level (Wholesale Market) For Boro

| Sample Number | Total Quantity Handled (kg) | Quantity Lost in Handling (kg) | Percentage Loss |
|---|---|---|---|
| 1 | 1722000 | 2893 | 0.17 |
| 2 | 411600 | 551 | 0.13 |
| 3 | 60480 | 86 | 0.14 |
| 4 | 932000 | 1035 | 0.11 |
| 5 | 820000 | 820 | 0.10 |
| 6 | 870200 | 1009 | 0.12 |
| Total | 4816280 | 6394 | 0.13 |

Source : Field Survey
Conversion ratio, Paddy to Rice 0.676

In Table 4.7.18 we have estimated the handling loss for all rice taken together. For this purpose we have considered the weighted average of the rates of handling loss for Aus, Aman and Boro, the weight being the percentage share of each variety of rice in the total quantity of rice handled in the 6 samples. The estimated rate of handling loss for all rice was thus found to be 0.137%.

Table 4.7.18 : Handling Loss at Trader's Level (Wholesale Market) For All Rice

| Type of Rice | Percentage Handling Loss (%) |
|---|---|
| Aus | 0.15 |
| Aman | 0.14 |
| Boro | 0.13 |
| Weighted Average (All Rice) | 0.137 |

Source : Tables 4.7.17, 4.7.18 and 4.7.19
Conversion ratio, Paddy to Rice 0.676

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## 4.8. REGRESSION ANALYSIS

Multiple regression was used to estimate the PHL of foodgrains for different crops. Number of cases was 1175 and six parameters were used i.e., family size, level of education, total seed used for the crop, total cultivable land used in decimal, total operating land for the crop and total land owned in decimal. T - test and F - test were used to test the significance of the models. Co-efficient of determination ($R^2$) of each model revealed the percent of variance of the predictor variables.

### 4.8.1 Aus Crop

The variables which appeared to be most significant to estimate the PHL of Aus crop were total seed used, total operating land for Aus crop and total land owned. The most significant independent variables are shown in Table - 4.8.1.

Table 4.8.1 : Multiple Regression Analysis for PHL during Aus Crop.

| Variables | Co-efficient of Regression | Standard Error | t Statistic |
|---|---|---|---|
| TS | 0.21241 | 0.05513 | 3.853* |
| TCL | - 0.06542 | 0.01315 | - 4.974** |
| TOL | 0.29796 | 0.01536 | 19.400** |
| TL | 0.05466 | 0.01208 | 4.526** |

Constant (C) = - 2.05478
$R^2$ = 0.80652

** = Significant at 0.01 level
* = Significant at 0.05 level

TS = Total Seed Used
TOL = Total Operating Land
TCL = Total Cultivable Land
TL = Total Land Owned

Predictor variables such as Total Cultivable Land, Total Operating Land and Total Land Owned were significant at 0.01 level of significance while Total Seed used for Aus Crop was significant at 0.05 level of significance. The co-efficient of regression can be seen in Table 4.8.1. Total Cultivable Land showed a negative relation with PHL estimation. This indicates that with an increase of 0.06545% of the Cultivable Land, there would be one percent decrease in the estimation of PHL of Aus crop. With the increase in Total Seed used for Aus Crop, Total Operating Land and Total Land Owned there would also be an increase in PHL estimation.

This depicts that with the increased use of seed, the value of PHL estimation also increases. Similarly with the increase of TOL and TL their would also be an increase in the PHL estimation. With more land under operation there would be more production. Higher production leads to higher loss estimation due to reduction in care and attention.

The co-efficient of determination measures the predictability of the variables which was equal to 0.80652. This means that about 81% percent of the variation of PHL was contributed by the predictor variables (TS, TCL, TOL and TL). Equation of PHL of Aus crop was as follows:

$$PHL_A = -2.05478 + (0.21241 \times TS) - (0.06542 \times TCL) + (0.29796 \times TOL) + (0.05465 \times TL).$$

Where $PHL_A$ = Post-harvest Loss in Aus Crop
TS = Total Seed used for Aus Crop
TCL = Total Cultivable Land
TOL = Total Operating Land
TL = Total Land Owned

### 4.8.2 Aman Crop

The most significant predictor variables to estimate the PHL loss of Aman crop were Total Operating Land (TOL), Total Land owned (TL) and Total Cultivable Land (TCL). The highly significant variable was Total Operating Land (TOL) which was significant at 0.01 level of significance. The co-efficient of regression (0.046971) was highly significant (t-Statistic = 21.157, $P<0.01$). This reveals that with one unit increase in Total Operating Land there would be an increase of post-harvest loss estimate by 0.47%. The co-efficient of regression, standard error at t- statistic of the significant predictor variables are shown in Table 4.8.2.

Table 4.8.2 : Regression Analysis for PHL of Aman Crop.

| Variables | Co-efficient of Regression | Standard Error | t-Statistic |
|---|---|---|---|
| TOL | 0.46971 | 0.02220 | 21.157** |
| TL | 0.09915 | 0.04701 | 2.109* |
| TCL | - 0.09655 | 0.05071 | -1.904* |
| Constant (C) = 1.53689 t-statistic = 464.39694 $R^2$ = 0.70463 | | | |

** Significant at 0.01 level
* Significant at 0.05 level

Total Cultivable Land showed a negative response in PHL estimation. This means that with the decrease in total cultivated land there would be a decrease in the PHL estimation. With one unit increase of Total Cultivable Land there would be a decrease of PHL by 0.10%.

The co-efficient of determination ($R^2$) was 0.70463 which indicates that 70% of the variations of the PHL was estimated to be contributed by the above mentioned 3 factors. The regression equation for PHL in Aman production is as follows :

$$PHL_{AM} = 1.53789 + (0.46971 \times TOL) + (0.09915 \times TL) - (0.09655 \times TCL)$$

Where $PHL_{AM}$ = Post Harvest Loss Aman Crop
TOL = Total Operating Land
TL = Total Land Owned
TCL = Total Cultivable Land

### 4.8.3 Boro Crop

Multiple regression was used to determine the most significant predictor variables for post-harvest loss estimation in Boro production. The results of the analysis are given in Table 4.8.3.

Table 4.8.3 : Regression Analysis to Estimate PHL of Boro Crop.

| Variables | Co-efficient of Regression | Standard Error | t - statistics |
|---|---|---|---|
| TL | 0.36663 | 0.08156 | 4.495** |
| TOL | 0.28431 | 0.09705 | 2.930** |
| TS | 2.60563 | 0.62722 | 4.154** |
| TCL | - 0.40109 | 0.08979 | - 4.467** |

Constant (C) = - 4.47669 t-statistics = 120.6118**
$R^2$ = 0.38138

** Significant at 0.01 level

Except Total Cultivable Land all the remaining 3 predictor variables showed a positive co-efficient of regression. All the variables were significant at 0.01 level of significance. In the Boro regression TCL showed a negative response. Co-efficient of determination was 0.38138, which determines that 38% of variation has been reflected by the four predictor variables. It may be inferred that Boro is mainly MV crop so the contribution by the exogenous variables were more than the predictor variables (Socio-economical variables) mentioned above.

The regression equation of Boro PHL estimate is given below:

$$PHL_{BO} = -4.47669 + (0.36663 \times TL) + (0.28431 \times TOL) + (2.60503 \times TS) - (0.40109 \times TCL)$$

Where $PHL_{BO}$ = Post-harvest Loss in Boro
TOL = Total Operating Land
TL = Total Land Owned
TS = Total Seed used for Boro Crop
TCL = Total Cultivable Land

The results of these equations were found satisfactory and found very near to actual estimate.

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# Chapter V

# CONCLUSIONS AND RECOMMENDATIONS

## 5.1 FINDINGS AND CONCLUSIONS

The study indicates that the percentage of foodgrains (paddy and wheat) used as seed, feed and wastage during the post- harvest operations of the sample household was 11.58 percent in 1989-90. The seed, feed and wastage in post-harvest operations was 13.20 percent in Aus, 12.38 percent in Aman, 10.38 percent in Boro and in Wheat it was 11.84 percent. Insignificant variation was observed when five years national foodgrains production was used as a weight.

On the basis of above estimate of loss, the total quantity of foodgrains not available for human consumption in Bangladesh in 1989-90 amounted to around 2.17 million tons against the BBS production estimate of 18.75 million tons. This lost quantity was almost equivalent to foodgrains consumption for about 13.13 million people for one year at the rate of 453 grams/person/day.

The volume of foodgrain not available for consumption, but lost in course of operation alone, may be estimated at 1.75 million tons, the value of which at Government procurement price of that year was Tk. 1570.05 crore. The losses of foodgrain during post-harvest operations are estimated at 9.34% ; 1.73% were used as seed and 0.51% were used as feed. The quantity used as seed and feed could be deemed to have been used for economic purpose. However, the rate of PHL appeared to be high and should be reduced by adopting improved post-harvest technology and operational efficiency.

Variations in the loss were observed in different areas. The overall minimum non-availability of foodgrains for human consumption of the sample households was recorded in the Mymensingh/Kishoreganj/Jamalpur region (10.65%) and maximum was recorded in the Dhaka/Tangail region (13.57%). In Chittagong/Noakhali region it was recorded as 10.91%; in Comilla/Sylhet region as 13.02%, Rajshahi/Bogra/Pabna region as 13.01%, in Rangpur/Dinajapur region as 11.97%, in Jessore/Kushtia/Khulna region as 10.91% and Barisal/Faridpur/ Patuakhali region as 12.93%. The variation happened due probably to difference in operational method, milling, storage and seed rate etc.

### Seed

Foodgrains used as seed in 1989-90 was 1.73 percent of the total production of the sample households. In rice it was 1.60 percent and for wheat it was 5.73 percent of their respective production.

The quantity of seed used for Aus crop was 2.89 percent; for Aman 1.80 percent and for Boro 0.89 percent. Higher proportion of seed used in Aus crop was due to its higher seed rate (mostly broadcast) and lower yield potential than the Aman and IRRI/ Boro

crops. Percentage of seed declined in HYV but increased in LVs.

The seed rate varied with crops, varieties and methods of planting. Among the foodgrain crops, seed used (relative to total production) for wheat (5.73%) was higher than that for paddy (1.60%). Again, modern varieties of paddy required less seed (1.25%) than the local varieties (2.57%). Study indicates that about 62 percent paddy area was under modern varieties (including pajam) and 38 percent area under local varieties. Expansion of modern varieties would increase the production and reduce the seed requirement relative to total production.

The percentage of seed used in Aus crop was found to be the highest among all the rice crops (2.89%). The percentage of Aus seed used in Dhaka-Tangail region was found to be the highest and in the Chittagong-Noakhali region it was the lowest.

Highest quantity of Aman seed was used in Barisal-Patuakhali-Faridpur region (4.84%) indicating lower share of modern varieties. The lowest quantity was found in Rangpur-Dinajpur region having a higher share of modern varieties.

The seed used for Boro crop was 0.89% of total production. It varied, according to survey data, from 0.73% in Jessore - Kushtia -Khulna region to 1.09% in Comilla-Sylhet region. The local varieties of Boro crop was found more in the greater Sylhet district than in other areas. Seed rate in local Boro was higher than that of HYV Boro.

Percentage of seed used for wheat was 5.73% of the total production. Wheat crop comprised mostly of modern variety. The Dhaka-Tangail region used highest percentage of wheat seed while the Rajshahi-Bogra-Pabna region used the lowest percentage relative to production.

**Feed**

This study revealed that about ninety percent of the households reported rearing of livestock and poultry birds. Paddy was seldom used as livestock and poultry feed.

The population of cattle, buffaloes, sheep and goats had declined to some extent than what was reported in the Bangladesh Census of Agriculture and Livestock : 1983-84 but that of chickens and ducks had gone up slightly in domestic farms and appreciably in specialized farms in recent years.

It was also observed that in most households, the foodgrains were not available as feed beyond two months during every cropping season. In the areas under study, the quantity of foodgrains used as feed was estimated at 0.51 percent (against the total foodgrains production) of which 0.68 percent was Aus, 0.50 percent was Aman, 0.46 percent was Boro and 0.46 percent was Wheat.

Number of specialized farms compared to the total population of livestock and poultry was insignificant. There are about 47 specialized poultry and livestock farms in the country. In the specialized dairy farms the foodgrains were not directly used as feed. In these farms, nearly 50 percent of the concentrate feed ingredients was wheat but the use of paddy as feed was practically nil.

Loss of foodgrain kept as feed in the stores of specialized farms was insignificant, since the feed was not required to store for a long period.

## Post-harvest Loss (PHL)

Post harvest loss of foodgrain comprises a number of stages in its process. The most significant operating stages are stacking, carrying, threshing, winnowing and drying and storing etc. Total post-harvest loss aggregated to 4.14% of all the crops (compared to total production). Of this, threshing loss was 1.19%; stacking loss was 0.91%; carrying loss was 0.74%; winnowing was 0.68% and drying loss was 0.54%.

The post-harvest loss of Aman crop was the highest (4.39%) followed by Aus (4.18%), Boro (3.88%) and wheat (3.04%). Post-harvest loss of 4.14% (against total production) was considered very high for a country like Bangladesh. The causes of such huge loss were due to weather, un-scientific operation, lack of knowledge and poor economic condition of the farmers who could not afford proper materials in these operations.

## Milling Loss

Loss of paddy during drying and parboiling was 1.86% of which the maximum loss occurred in soaking followed by eating by poultry birds. As for individual crops, the highest loss was 2.14% in Aman, then 1.86% in Boro and 0.95% in Aus. At millers level the average parboiling and drying loss for paddy was 1.03%. In both the cases soaking loss comprised of 57% to 65% of the total loss during this process.

The share of paddy milled by dheki (pounding) and mechanized husking mills would be around 8% and 92% respectively. The recovery percentage of rice in dheki was 69.68% and in husking mill was 67.61%. If all the paddy produced in 1989-90 (about 27055 thousand m. tons) was husked in dheki alone than about 560 thousand m. tons of foodgrain would have been saved. The value of 560 thousand tons of foodgrains is around Tk. 50.82 million at 1989-90 procurement price. Improvement in milling recovery and adoption of traditional husking may significantly reduce the current milling wastage.

Milling loss at farmers' level through Dheki operation was found to be 0.53%, and through rice huller it was 0.70%. Recovery

of rice was 69.68% in Dheki operation, 67.61% in rice huller and 68.00% in big rice mills. This compared to Government allowed rate of recovery of 65% to 65.5% (varying from area to area) for resultant rice from paddy supplied to rice mills. It may be assumed that government received less rice than what was actually recovered by the millers. On an average government received 2.0% to 3.0% less than the average found in the country.

## Storage Loss

Storage loss at farmers' level was 1.03% of which the maximum was due to evaporation of moisture followed by the rodents damage. As regards crop varieties the loss in Aus was 2.44%, in Aman 1.16%; and in Boro it was 0.90%. [Variation of loss in stores in different types of container was also observed].

As against average storage loss of grain at farmers and traders level, the loss at public sector stores was higher although storage condition was much better in public sector. Comparative storage loss at different operators level was found to be as follows :

| Operator | Rate of loss (%) | |
|---|---|---|
| | Paddy | Rice |
| Farmer | 1.03 | - |
| Trader | 0.30 | 0.35 |
| Public Sector * | 1.00 | 0.75 |

* Ministry of Food.

The average loss of foodgrain due to storing at primary traders' level was 0.34% and at secondary traders' level was 0.36%. The average storage loss was found to be 1.70% at millers level. At traders' and millers' level, foodgrains are usually stored in gunny bags for a brief period of 2-3 months where loss due to evaporation was maximum. Evaporation loss was found minimum in Govt. stores where grains at optimum moisture of 12-14% were stored.

Loss due to evaporation during storage may not be considered as a loss of foodgrain since the loss occurred due to imperfect drying.

## Transportation Loss

Foodgrain loss during transportation channel was examined at several levels of transaction : farmers, traders in the primary and the secondary markets including wholesale markets. The survey result revealed that the share of foodgrains transported at the above mentioned levels was 8.0, 28.0 and 64.0 percent

respectively. The overall transportation loss of foodgrain was found at 0.27 percent which was the weighted average at the level of farmers and traders in the primary, secondary and wholesale markets.

Mode-wise transport loss of foodgrain was found to vary from 0.16 percent in case of headload to about 0.42 percent in the case of railways. Between these two extremes, foodgrain loss while carried by rickshaw van, shoulder sling, boat and truck came in order of 0.22, 0.23, 0.28 and 0.31 percent respectively.

Three factors like use of hooks, transshipment and pilferage, causing foodgrain loss were examined. These factors came in the order mentioned above in respect of their significance to foodgrain loss.

Substantial variation of foodgrain loss was found across the regions. It ranged from 0.10 percent in Dhaka-Tangail to 0.41 percent in Mymensingh-Kishoregonj-Jamalpur. It appeared that the regional variation in foodgrain loss was somewhat related to the level of development of transportation system; the loss tended to be higher in far-flung and relatively poor transportation facility areas of the country.

The above findings of transportation loss at farmers' and traders' level in different transport modes compares to Govt.'s allowable transport losses as evidenced from the following table.

| Operator | % of transportation loss | | |
|---|---|---|---|
| | Truck | Railway | River |
| Farmer | 0.54 | - | 0.37 |
| Trader | 0.31 | 0.42 | 0.41 |
| Public Sector* | 0.25 | 1.00 | 0.50 |

* Ministry of Food.

## Marketing Loss

Handling loss was highest at the farmers' level and lowest at the traders' level. On the average, the rate of handling loss at the farmers level was estimated at 0.42% (weighted) while the average rate of handling loss in the wholesale market at Badamtoli Ghat was found to be 0.14%. This difference in the rate of handling loss was probably attributable to differences in the nature of handling in the two stages of marketing. Farmers often used old and worn-out bags; also, the grain was weighed and packed in the earthen floor. As a result, grains falling on the ground could not be fully recovered, and this resulted in a slightly higher rate of foodgrain loss at farmers level. On the other hand, most of the grain spilled in the unloading process in the wholesale market was found falling in the shop premises (mostly pucca) and therefore, could easily be recovered; hence a lower rate of handling loss was observed in the case of traders.

Handling loss in the primary markets was, on the average, 0.31%. Handling loss was higher [(0.32%) for paddy ] than the same for rice (0.08%). Average handling loss at the secondary market was 0.30%. However, in the secondary market the rate of handling loss was almost similar for both paddy and rice.

Rate of handling loss also differed by type of crop. At the farmers level, the rates of handling loss obtained in Aman, Aus and Boro were 0.49%, 0.22% and 0.34% respectively. The handling loss in wheat was found about 0.22% and 0.45% at the primary and secondary market respectively. The observed differences in handling loss rates by type of crop were partly attributable to differences in weather at the post- harvest time for the three corps. Random errors in measurement might also be partly responsible for the observed differences in handling loss rates by type of crop.

## 5.2 LIMITATION

The study was designed to investigate interalia loss of foodgrain in the post- harvest operations of domestic production; hence public sector foodgrain handling which mostly composed of imported grains were not brought into the scope of the study. However, a small quantity of foodgrains was procured domestically in the public sector for which loss estimate could be derived from the data available in other study or from official records.

Within the scope of the study and resource and time table available to the Consultant, it was not possible to cover wider areas and large number of factors involved and multi-dimensional socio-economic variables linked up with other important national issues. However, within the resources, the consultant tried to make the study meaningful backed by investigated/surveyed primary data. However, consultant thinks that a few micro-level study covering other important variables such as recent loss information in Government storing houses efficiency of heterogeneous milling technologies, modern milling, drying and soaking systems should be undertaken to have a complete picture.

## 5.3 RECOMMENDATIONS

1. The study revealed that about 11.58% of foodgrains (rice and wheat) annually produced in the country are not available for consumption because of use as seed, feed and loss during post-harvest operations. This estimated rate obtained through the survey is higher than the rate used by the Government in food budgeting. The extent of loss of foodgrain in post-harvest operations may be reduced through application of improved post-harvest technology.

2. Proportion of seed used in 1989-90 was 1.73% of the total production. Proportionate seed requirement (5.73% *) was higher in wheat which could be reduced by use of good seed of high yielding varieties and sowing under favorable environment for higher rate of germination and survival of the seedlings. In rice crops proportionate use of seed (1.6% *) can also be reduced by reducing broadcast method of sowing and bringing more areas under transplantation of modern varieties. This calls for a stronger extension programme, timely availability of seeds, and other inputs with good marketing systems.

3. Use of foodgrains as feed is likely to be increased in the coming years with the increase of organized poultry and duck farming in the country. Increased use of grain as feed may be compensated by saving grain in seed use and by reducing the loss in post-harvest operations.

4. The estimate post-harvest processing loss (at 4.14%) can be reduced by adopting modern technology. Present study indicated that loss in threshing was higher among the operations. This loss may be reduced by using paddle and other improved threshing devices. A strong extension programme with availability of threshers in rural areas could popularize the methods and save considerable quantity of foodgrains that are lost during threshing.

5. Milling loss which is estimated 0.70% at farmers level and 0.65% at millers level may probably be reduced by using improved milling technology. Although it is not within the TOR to examine the milling technology and rate of the recovery under variable milling techniques, it was noticed that milling losses were higher in old and out-dated rice mills. This old rice mills should use the modern devices and reduce milling loss.

6. Milling loss can be reduced by using Dheki where rice recovery percentage is relatively higher than husking mills. However, the Dheki process is slower and laborious than the modern rice mills. The Dheki system needs improvement (may be fitted with improved kind of husking devices). Although recovery in Dheki is higher, the use of Dheki is generally reducing in the country.

7. Storage loss can be reduced by improving rural storage conditions through the use of pot type storage structure, earthen jars and metal drums. The small and medium large flat type pucca stores may be used on cooperative and collective basis. The rural farmers, traders and 'arathdars', 'beparis', millers and stockists may be grouped together to use cooperative/ collective storage facilities. Farmers and stockists of foodgrain should be trained on ideal storage and processing operations and maintaining grain hygienic

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* Relates to 1989-90 production.

specifications, such as moisture, admixture, dust and broken, shriveled, infested grains and other standard needed for longer shelf life.

8. Loss during transportation may be reduced considerably with improved handling and transportation facilities. Use of hooks and defective and tornout bags cause considerable loss during transportation. Automatic bagging and stitching may be introduced by large stores and traders.

9. Marketing loss mainly occurs during handling. This loss may be reduced by improving rural grain markets with pucca floor/premise for weighing and packing. Improved type container/carrier for transportation to and from markets may reduce loss.

10. The present study was conducted in one cropping year with selected variables/function at macro-level. These issues may be studied at micro level with stress on seasonal and regional practices covering large areas of sampling and higher sample-population fractions. A similar study covering two to three cropping years may be undertaken to estimate for an average normal year.

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# APPENDIX

Appendix 1.1. Area and Production of Foodgrains (Total Rice and Wheat, from 1947-48 to 1989-90) in Bangladesh.

Area in '000 acres
Production in '000 tons

| Year | Rice | | Wheat | | Total | |
|---|---|---|---|---|---|---|
| | Area | Production | Area | Production | Area | Production |
| 1947-48 | 18606 | 6736 | 85 | 20 | 18691 | 6756 |
| 1948-49 | 19424 | 7673 | 95 | 19 | 19519 | 7692 |
| 1949-50 | 19528 | 7377 | 96 | 23 | 19624 | 7400 |
| 1950-51 | 20007 | 7343 | 94 | 20 | 20101 | 7363 |
| 1951-52 | 20301 | 7033 | 96 | 23 | 20397 | 7056 |
| 1952-53 | 20778 | 7335 | 98 | 24 | 20876 | 7359 |
| 1953-54 | 22010 | 8245 | 98 | 24 | 22108 | 8269 |
| 1954-55 | 21336 | 7588 | 103 | 26 | 21439 | 7614 |
| 1955-56 | 19495 | 6385 | 94 | 22 | 19589 | 6407 |
| 1956-57 | 20055 | 8185 | 133 | 23 | 20188 | 8208 |
| 1957-58 | 20235 | 7598 | 107 | 22 | 20342 | 7620 |
| 1958-59 | 19643 | 6921 | 99 | 25 | 19742 | 6946 |
| 1959-60 | 21151 | 8482 | 138 | 29 | 21289 | 8511 |
| 1960-61 | 21885 | 9519 | 144 | 32 | 22029 | 9551 |
| 1961-62 | 20963 | 9465 | 145 | 39 | 21108 | 9504 |
| 1962-63 | 21484 | 8730 | 182 | 44 | 21666 | 8774 |
| 1963-64 | 22259 | 10456 | 142 | 34 | 22401 | 10490 |
| 1964-65 | 22804 | 10337 | 132 | 31 | 22937 | 10368 |
| 1965-66 | 23130 | 10380 | 136 | 35 | 23266 | 11315 |
| 1966-67 | 22205 | 9397 | 168 | 50 | 22373 | 9447 |
| 1967-68 | 24439 | 10986 | 192 | 58 | 24629 | 11044 |
| 1968-69 | 24073 | 11165 | 290 | 92 | 24363 | 11257 |
| 1969-70 | 25486 | 11816 | 269 | 103 | 25782 | 11919 |
| 1970-71 | 24494 | 10967 | 311 | 110 | 24805 | 11077 |
| 1971-72 | 22975 | 9774 | 314 | 113 | 23289 | 9887 |
| 1972-73 | 23769 | 9931 | 297 | 90 | 24093 | 10021 |
| 1973-74 | 24409 | 11721 | 305 | 109 | 24715 | 11830 |
| 1974-75 | 24197 | 11109 | 311 | 117 | 24508 | 11226 |
| 1975-76 | 25525 | 12561 | 371 | 219 | 25896 | 12780 |
| 1976-77 | 24419 | 11567 | 395 | 260 | 24814 | 11827 |
| 1977-78 | 24778 | 12765 | 467 | 348 | 25245 | 13113 |
| 1978-79 | 24991 | 12646 | 654 | 493 | 25645 | 13139 |
| 1979-80 | 25104 | 12539 | 1071 | 823 | 26175 | 13362 |
| 1980-81 | 25474 | 13662 | 1461 | 1092 | 26935 | 14754 |
| 1981-82 | 25847 | 13415 | 1320 | 967 | 27167 | 14382 |
| 1982-83 | 26159 | 13991 | 1283 | 1095 | 27442 | 15086 |
| 1983-84 | 26064 | 14279 | 1300 | 1211 | 27364 | 15490 |
| 1984-85 | 25263 | 14391 | 1671 | 1464 | 26934 | 15855 |
| 1985-86 | 25696 | 14803 | 1335 | 1042 | 27031 | 15845 |
| 1986-87 | 26216 | 15212 | 1445 | 1091 | 27661 | 16303 |
| 1987-88 | 25507 | 15414 | 1476 | 1048 | 26983 | 16462 |
| 1988-89 | 19239 | 15544 | 1384 | 1022 | 20623 | 16566 |
| 1989-90 | 25893 | 17856 | 1463 | 890 | 27356 | 18746 |

Appendix 1.2 : Annual Food Budget (Availability and Requirement) in Bangladesh, (1980-81 to 1989-90).

('000' m. tons)

| Year | Production(gross) | | | Net Production(after 10% Seed, Feed and wastage) | Mid Year Population (million) | Requirement @ 15.50z/day | Food Gap (7-5) | Internal Procurement | Total Off-Take | Total Availability (5+10-9) | Per Capita Availability(oz/day) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Wheat | Total | | | | | | | | |
| 1980-81 | 18882 | 1092 | 14794 | 13476 | 90.0 | 14435 | 959 | 1032 | 1546 | 13990 | 15.02 |
| 1981-82 | 13630 | 967 | 14597 | 18137 | 92.1 | 14771 | 1634 | 303 | 2069 | 14903 | 15.64 |
| 1982-83 | 14125 | 1095 | 15310 | 13779 | 94.1 | 15092 | 1313 | 194 | 1934 | 15519 | 15.68 |
| 1983-84 | 14506 | 1211 | 15718 | 14146 | 96.1 | 15413 | 1267 | 266 | 2050 | 15930 | 16.01 |
| 1984-85 | 14620 | 1464 | 16034 | 14476 | 98.0 | 16478 | 2002 | 349 | 2562 | 16690 | 16.46 |
| 1985-86 | 15037 | 1042 | 16079 | 14471 | 100.0 | 16865 | 2394 | 349 | 1541 | 15663 | 15.09 |
| 1986-87 | 15496 | 1091 | 16587 | 14928 | 102.5 | 16970* | 2042 | 188 | 2121 | 16361 | 15.90 |
| 1987-88 | 15346 | 1050 | 16396 | 14756 | 104.1 | 17228* | 2472 | 375 | 2503 | 16884 | 15.67 |
| 1988-89 | 15544 | 1022 | 16566 | 14909 | 109.5 | 18130* | 3221 | 416 | 2941 | 17434 | 15.38 |
| 1989-90 | 18187 | 800 | 18987 | 17088 | 111.9 | 18530* | 1442 | 959 | 2163 | 18292 | 15.80 |

Note : Calculated @ 16 oz/day

Source: BBS, Ministry of Food & Planning Commission.

# Appendix 3.1 : Questionnaires

Appendix 3.1a: Questionnaire for Farmers (Household)

Region..... District.....

Upazila..... Village.....

1. General Information of farm households:

1.0 Identification of farmer

1.1 Name of Farmer.....

1.2 Education Level:* .....

1.3 No. of Family member .....

1.4 No. available for farming .....

1.5 Total operated area ..... decimal.
Owned area ..... "
Leased in area ..... "
Shared in area..... "

2.0 Method of sowing and seed rate:

| Crops | Variety | Broadcast method | | | | | Transplanted method | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Area sown (dec.) | Production (kg) | Qty. of seed used (kg) | | | Area sown (dec.) | Production (kg) | Qty. of seed used (kg) | | |
| | | | | Total | Own | Purchased | | | Total | Own | Purchased |
| Aus | LV | | | | | | | | | | |
| | HV | | | | | | | | | | |
| B. Aman | LV | | | | | | | | | | |
| Aus-Aman (mixed) | LV | | | | | | | | | | |
| T. Aman | LV | | | | | | | | | | |
| | HV | | | | | | | | | | |
| Boro | LV | | | | | | | | | | |
| | HV | | | | | | | | | | |
| Wheat | HV | | | | | | | | | | |

* Use code numbers: 1 Below Primary 2 Above Primary

Note: Enumerators will record if there is any double seeding.....

## 3.0 Post Harvest Loss: (Data relating to one lot or one time operation)

| Items of Loss | Aus | | B. Aman | T. Aman | | Boro | | Wheat |
|---|---|---|---|---|---|---|---|---|
| | LV | MV | LV | LV | MV | LV | MV | MV |
| 3.1 Loss (Kg) due to field stacking | | | | | | | | |
| 3.2 Loss (Kg) during carrying from field to threshing yard | | | | | | | | |
| 3.3 Threshing Loss (Kg) by methods (due to non-collection of scattered grains) | | | | | | | | |
| 3.3.1 Beating | | | | | | | | |
| 3.3.2 Threshing with bullock | | | | | | | | |
| 3.3.3 Beating followed by Threshing with bullock | | | | | | | | |
| 3.3.4 Paddle Thresher | | | | | | | | |
| 3.3.5 Others (Specify) | | | | | | | | |
| 4.0 Wastage (kg) at stages of: | | | | | | | | |
| 4.1 Winnowing & Cleaning (Due to non-collection of scattered grains) | | | | | | | | |
| 4.2 Drying (Eaten by poultry, duck & birds, goat - sheep) | | | | | | | | |
| 4.3 Wastage due to bad weather | | | | | | | | |
| 5.0 Total Loss (items 3.1 to 4.3) | | | | | | | | |
| 6.0 Total production (Kg) after drying | | | | | | | | |

## 7.0 Milling Loss and Recovery of Grains: (Data relating one time operation)

### 7.1 Loss During Parboiling & Drying (kg):

| Crops | Variety | Quantity (kg) before parboil and drying | Quantity (kg) after parboil and drying | Total Loss (kg) due to | | | |
|---|---|---|---|---|---|---|---|
| | | | | Soaking | Eaten by | | Others |
| | | | | | Poultry & Birds | Stray Cattle & Goat | |
| Aus | LV | | | | | | |
| | MV | | | | | | |
| B.Aman | LV | | | | | | |
| T.Aman | LV | | | | | | |
| | MV | | | | | | |
| Boro | LV | | | | | | |
| | MV | | | | | | |

## 7.2 Recovery of Grains Husked in Dheki and Small Mills

| Crops | Variety | Dheki Quantity (kg) | | Rice huller Quantity (kg) | | Wheat crusher Quantity (Kg.) | |
|---|---|---|---|---|---|---|---|
| | | Before | *After husking | Before | *After husking | Before | *After husking |
| Aus | LV | | | | | | |
| | MV | | | | | | |
| B.Aman | LV | | | | | | |
| T.Aman | LV | | | | | | |
| | MV | | | | | | |
| Boro | LV | | | | | | |
| | MV | | | | | | |
| Wheat | MV | | | | | | |

* After husking means recovery of rice/atta.

## 8.0 Loss in Marketing Process : (Data relating one time operation)

### 8.1 Handling Loss at Farm (kg) in course of Weighing & putting in Gunny Bag/Basket for Sale:

| Crops | Variety | Quantity Handled (kg) | Quantity Lost (kg)** |
|---|---|---|---|
| Aus | LV | | |
| | MV | | |
| B.Aman | LV | | |
| T.Aman | LV | | |
| | MV | | |
| Boro | LV | | |
| | MV | | |
| Wheat | MV | | |

** Due to non-collection of scattered grains.

## 8.2 Transportation loss:

| Mode of Transport Used | Type of Foodgrain | Qty.Transported (kg) | Distance Travelled (km) | Qty. Sold (kg) | Qty. Lost (kg) |
|---|---|---|---|---|---|
| Headload | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Shoulder sling | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Rickshaw van | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Bullock cart | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Boat | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Truck | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |
| Railways | Rice | | | | |
| | Paddy | | | | |
| | Wheat | | | | |

9.0 Storage loss at farm :

| Type of container used for storing | Kind of foodgrain stored | Quantity stored (kg) | Period of storage (months) | Quantity Released (kg) | Quantity loss (kg) due to | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Evaporation of Moisture | Rodent | Insect | Fungus | Others |
| Gunny Bag | Rice | | | | | | | | |
| | Paddy | | | | | | | | |
| | Wheat | | | | | | | | |
| Motka | Rice | | | | | | | | |
| | Paddy | | | | | | | | |
| | Wheat | | | | | | | | |
| Dool | Rice | | | | | | | | |
| | Paddy | | | | | | | | |
| | Wheat | | | | | | | | |
| Gola | Rice | | | | | | | | |
| | Paddy | | | | | | | | |
| | Wheat | | | | | | | | |
| Others(Specify) | Rice | | | | | | | | |
| | Paddy | | | | | | | | |
| | Wheat | | | | | | | | |

Animal feed:

10.0 Cattle, Goat and Poultry/Duck possessed (Number):

10.1 Total Cattle..... 10.2 Milch Cows .....

10.3 Other Cattle..... 10.4 Goats .....

10.5 Sheep..... 10.6 Poultry.....

10.7 Ducks.....

11.0 Foodgrain used as feed: (kg per month)

| | | Aus | Aman | Boro | Wheat | Processed feed |
|---|---|---|---|---|---|---|
| 11.1 | Cattle | | | | | |
| 11.2 | Goat/Sheep | | | | | |
| 11.3 | Poultry | | | | | |
| 11.4 | Duck | | | | | |
| 11.5 | Others (Specify) | | | | | |

Date:----------

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Signature of Enumerator

Appendix 3.1b: Questionnaire for Rice Miller/Wheat Crusher

Region..... District.....

Upazila..... Location of mill.....

1.0 Name of Miller.....

1.1 Type of Mill[1**] ....

1.2 Crushing capacity (kg) : Paddy .....Wheat .....

1.3 Quantity Milled (kg) 1989/90 in the season of crops:

| | |
|---|---|
| Aus | |
| Aman | |
| Boro | |
| Wheat | |

---

1** Use Code Number:
1 Huller
2 Wheat Crusher
3 Both
4 Boiler
5 Others

## 2.0 Milling Loss at Millers Level:

### 2.1 Soaking, Parboiling and Drying loss (kg)

| Crops | Variety | Quantity (kg) before parboil and drying | Quantity (kg) after parboil and drying | Total Loss (kg) due to | | | |
|---|---|---|---|---|---|---|---|
| | | | | Soaking | Eaten by | | Others |
| | | | | | Poultry & Birds | Stray Cattle & Goat | |
| Aus | LV | | | | | | |
| | MV | | | | | | |
| B.Aman | LV | | | | | | |
| T.Aman | LV | | | | | | |
| | MV | | | | | | |
| Boro | LV | | | | | | |
| | MV | | | | | | |

### 2.2 Recovery during milling (Kg)

| Crops | Variety | Type of mill[2**] | Quantity (kg) milled | Recovery of Rice/Atta (kg) | Remainder (kg) (husk, bran & broken grains) | Loss (kg) in milling |
|---|---|---|---|---|---|---|
| Aus | LV | | | | | |
| | MV | | | | | |
| B.Aman | LV | | | | | |
| T.Aman | LV | | | | | |
| | MV | | | | | |
| Boro | LV | | | | | |
| | MV | | | | | |
| Wheat | MV | | | | | |

2** Use Code Number:
1 Huller
2 Wheat Crusher
3 Both
4 Boiler
5 Others

## 2.3 Storage Loss in case of Boiler Mills only.

| Type of container used | Type of foodgrain Stored | | Qty.stored (kg) | Period of storage (month) | Quantity released (kg) | Quantity Loss (kg) due to | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Evaporation of Moisture | Rodent | Insects | Fungus | Others |
| Gunny Bag | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Gola | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Motka | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Others (Specify) | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |

Appendix 3.1c: Questionnaire for Traders

Region..... District.....

Upazila..... Market.....

1.1 Name of Trader.....

1.2 Type of foodgrain handled & quantity (Kg) during 1989/90 in the seasons of crops.

Paddy: Aus..... Aman..... Boro.....

Rice: Aus..... Aman..... Boro.....

Wheat:.....

2.0 Loss in Marketing process:

2.1 Handling loss at shop during weighing and bagging: (due to non-collection of scattered grains)

| Crops | Original quantity (kg) | After transaction (kg) | Loss (kg) |
|---|---|---|---|
| Aus | | | |
| Aman | | | |
| Boro | | | |
| Wheat | | | |

## 2.2 Transportation loss:

| Mode of Transport Used | Type of Foodgrain | Quantity Transported (kg) | Distance Travelled (km) | Quantity Received (kg) | Qty. Lost (kg) due to | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Use of nook | Pilferage | Trans shipment | Others |
| Headload | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Shoulder sling | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Rickshaw van | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Bullock cart | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Boat | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Truck | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |
| Railways | Rice | | | | | | | |
| | Paddy | | | | | | | |
| | Wheat | | | | | | | |

## 3.0 Storage loss:

| Type of container used | Type of foodgrain Stored | | Qty.stored (kg) | Period of storage (month) | Quantity released (kg) | Quantity Lost (kg) due to | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Evaporation of Moisture | Rodent | Insects | Fungus | Others |
| Gunny Bag | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Gola | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Motka | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |
| Others (Specify) | Aus | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Aman | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Boro | Rice | | | | | | | | |
| | | Paddy | | | | | | | | |
| | Wheat | | | | | | | | | |

Appendix 3.1d: Questionnaire for Feed Mills

Region..... District .....

Upazila ..... Location .....

1.0 Type of feed mill[3**].....

2.0 Name of proprietor.....

3.0 Quantity of feed prepared during 1989/90 (kg)

Cattle feed.....

Poultry feed.....

4.0 Major ingredients (kg)

| Ingredients | Cattle feed(kg) | Poultry feed(kg) |
|---|---|---|
| Rice | | |
| Wheat | | |
| Maize | | |
| Oilcake | | |
| Others | | |

5.0 Source of feed ingredients:

Rice: Local .....kg Imported/Food Deptt. .....kg

Wheat : Local.....kg Imported/Food Deptt. .....kg

---

** Use Code Number:
1 Cattle Feed
2 Poultry Feed
3 Both

6.0 Storage Loss of feed ingredients (local grains only) during 1989/90.

| Type of foodgrain Stored | Qty.stored (kg) | Period of storage (month) | Quantity released (kg) | Quantity Loss (kg) due to | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Evapora-tion of Moisture | Rodent | Insects | Fungus | Others |
| Rice | | | | | | | | |
| Wheat | | | | | | | | |

Date:----------

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Signature of Enumerator

Appendix 3.1e: Questionnaire for Cattle & Poultry Farms

Region ..... District .....

Upazila ..... Location .....

1.0 Type of Farm :[4**]

1.1 Proprietor of Farm .....

2.0 Number of cattle ..... No. of Goat.....

No. of Poultry..... No. of Duck.....

3.0 Feed used per day (kg)

| Type of Animal/ Poultry | Direct grains (Paddy/rice) | | | | | | | Prepared feed |
|---|---|---|---|---|---|---|---|---|
| | Aus | | Aman | | Boro | | Wheat | |
| | Paddy | Rice | Paddy | Rice | Paddy | Rice | | |
| Cattle | | | | | | | | |
| Goat | | | | | | | | |
| Poultry | | | | | | | | |
| Duck | | | | | | | | |

4.0 Source of prepared feed, 1989/90

Purchased .....kg. Own..... kg.

** Use Code Number:
1 Cattle Firm
2 Poultry Firm
3 Both

5.0 If own, quantities of ingredints used by type (kg)

| | |
|---|---|
| Rice | |
| Wheat | |
| Maize | |
| Oilcake | |
| Others | |

6.0 Source of feed ingredients:

Rice: Local .....kg Imported/Food Deptt. .....kg

Wheat : Local.....kg Imported/Food Deptt. .....kg

7.0 Storage Loss of feed ingredients (local grains only) during 1989/90.

| Type of foodgrain Stored | Qty.stored (kg) | Period of storage (month) | Quantity released (kg) | Quantity Loss (kg) due to | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Evaporation of Moisture | Rodent | Insects | Fungus | Others |
| Rice | | | | | | | | |
| Wheat | | | | | | | | |

Date:----------

----------
Signature of Enumerator

Appendix 3.2: Selected Villages in different Agro-Ecological Zones (AEZ).

| Agro-Ecological Zones (AEZ) | No. and Name of selected Upazilas | No. of Villages in the Upazilas | No. of Selected Villages | Name of Selected Villages |
|---|---|---|---|---|
| 1. Chittagong-Noakhali | 1. Rangunia | 113 | 2 | Jungleghat Chek Muradnagar |
| | 2. Satkania | 125 | 3 | Nayapara Afjalnagar Gariberjhil |
| | 3. Feni | 135 | 3 | Uttar Kashimpur Ratanpur Aswadia |
| 2. Mymensingh-Kishoregonj-Jamalpur | 1. Trishal | 162 | 3 | Sammuk Bailor Singrail Darirampur |
| | 2. Kishorganj | 205 | 4 | Kutakeli Babundia Char Maria Purba Latibabad |
| | 3. Sarishabari | 202 | 4 | Char Sarishabari Pingna Bonogram Kamrabad |
| 3. Dhaka-Tangail | 1. Kaliakair | 282 | 6 | Dakurai Doanipara Sahebabad Nayanagar Ultapara Basura |
| | 2. Kalihati | 289 | 6 | Dattagram Utraiol Alam Naga Fultala Kursabenu Machhuahata |
| 4. Comilla-Sylhet | 1. Chandina | 233 | 5 | Gazaria Bamanda Parchanga Pihar Govindapur Teerchor |
| | 2. Chandpur | 139 | 3 | Makimpur Kamrua Char Measa |

Appendix 3.2: Selected Villages in different Agro-Ecological Zones (AEZ) (Contd.).

| Agro-Ecological Zones (AEZ) | No. and Name of selected Upazilas | No. of Villages in the Upazilas | No. of Selected Villages | Name of Selected Villages |
|---|---|---|---|---|
| 4. Comilla-Sylhet | 3. Habiganj | 325 | 6 | Hasanabad<br>Shailjura<br>Shujatpur<br>Uttar Paikpara<br>Sudiakhola<br>Uluhra |
| 5. Rajshahi-Bogra- | 1. Gabtali | 218 | 4 | Beltala<br>Sonarpukur<br>Bamania<br>Karnipara |
| | 2. Shahzadpur | 317 | 6 | Bherakhola<br>Chithulia<br>Haldighar<br>Sherkhali<br>Choira<br>Garadaha |
| 6. Rangpur-Dinajpur | 1. Mithapukur | 310 | 7 | Malipara<br>Ramnathpur<br>Jadabpur<br>Khorda Kashinathpur<br>Shyampur<br>Taiyabpur<br>Sitalgari |
| | 2. Chirirbandar | 145 | 3 | Uttar Bholanathpur<br>Rasulpur<br>Gonoalgram |
| 7. Jessore-Kushtia-Khulna | 1. Monirampur | 257 | 5 | Taruapara<br>Asannagar<br>Goalbari<br>Noapara<br>Panchakari |
| | 2. Meherpur | 118 | 2 | Basantapur<br>Raja Nagar |
| 8. Barisal-Faridpur-Patuakhali | 1. Gournadi | 208 | 4 | Basudabpara<br>Asukhati<br>Uttar Bijoypur<br>Khanjapur |
| Total | 18 | 3775 | 76 | |

Appendix 3.3 : List of the Primary Markets Selected for Study.

| Sl. No. | Name of the Market | Location |
|---|---|---|
| 1. | Charanihat | Upazila-Satkania, Dist.-Chittagong. |
| 2. | Chowmuhoni Bazar | Upazila-Ranguia, Dist.-Chittagong. |
| 3. | Beroli Bazar | Upazila-Feni, Dist.-Feni. |
| 4. | New Ranirhat | - do - |
| 5. | Majid Miar Bazar | - do - |
| 6. | Kalir Bazar | Upazila-Trishal, Dist.-Mymensingh. |
| 7. | Jashadal | Upazila-Kishoreganj, Dist.-Kishoreganj. |
| 8. | Gopalganj | Upazila-Sharishabari, Disi.-Jamalpur. |
| 9. | Banagram | - do - |
| 10. | Baushi Bazar | - do - |
| 11. | Ballaha | Upazila-Kalihati, Dist.-Tangail. |
| 12. | Patalhat, Durgapur | - do - |
| 13. | Shahahat | - do - |
| 14. | Kakdahara | - do - |
| 15. | Latifpur | Upazila-Kailakair, Dist.-Gazipur. |
| 16. | Shafipur | - do - |
| 17. | Baraibarhat | - do - |
| 18. | Banipur | - do - |
| 19. | Nimshar | Upazila-Chandina, Dist.-Comilla. |
| 20. | Mahichail | - do - |
| 21. | Kaduty Bazar | - do - |
| 22. | Chandina Bazar | - do - |
| 23. | Chadra Bazar | Upazila-Chandpur, Dist.-Chandpur. |
| 24. | Bagra Bazar | - do - |

Appendix 3.3: List of the Primary Markets Selected for Study (contd.)

| Sl. No. | Name of the Market | Location |
|---|---|---|
| 25. | Daud Nagar Bazar | - do - |
| 26. | Bramon Dora Bazar | - do - |
| 27. | Pirgachha | Upazila-Gabtoli, Dist.-Bogra. |
| 28. | Peri | - do - |
| 29. | Kagail | - do - |
| 30. | Harirampur | Upazila-Shahjadpur, Dist.-Shahjadpur. |
| 31. | Kashinalpur | - do - |
| 32. | Narina Bazar | - do - |
| 33. | Talgachhi | - do - |
| 34. | Bherakhola | - do - |
| 35. | Sonatani Bazar | - do - |
| 36. | Faridpur | Upazila-Mithapukur, Dist.-Rangpur. |
| 37. | Fakirhat (Malipara) | - do - |
| 38. | Kumargonj | - do - |
| 39. | Miaharhat | - do - |
| 40. | Jagir hat | - do - |
| 41. | Ranirbandar | Upazila-Chirirbandar, Dist.-Dinajpur. |
| 42. | Bhushirbandar | - do - |
| 43. | Currenterhat | - do - |
| 44. | Shukhipirhat | - do - |
| 45. | Bakra | Upazila-Monirampur, Dist.-Jessore. |
| 46. | Khadapara | - do - |
| 47. | Pachakari | - do - |
| 48. | Dakuria | - do - |
| 49. | Amjhupi | Upazila-Meherpur, Dist.-Meherpur. |

Appendix 3.3: List of the Primary Markets Selected for Study (Contd.)

| Sl. No. | Name of the Market | Location |
|---|---|---|
| 50. | Baradi Bazar | - do - |
| 51. | Chandshi | Upazila-Gournadi, Dist.-Barishal. |
| 52. | Gopalpur | - do - |
| 53. | Gournadi Bandar | - do - |
| 54. | Mahilara | - do - |

Appendix 3.4 : List of the Secondary Markets Selected for the Study.

| Sl. No. | Name of the Market | Location |
|---|---|---|
| 1. | Dewanhat | Upazila-Satkania, Dist.-Chittagong. |
| 2. | Rowzahat | Upazila-Rangunia, Dist.-Chittagong. |
| 3. | Panchgachhia Bazar | Upazila-Feni, Dist.-Feni. |
| 4. | Trishal Bazar | Upazila-Trishal, Dist.-Mymensingh. |
| 5. | Bara Bazar | Upazila-Kishoregonj, Dist.-Kishoregonj. |
| 6. | Aram Nagar | Upazila-Sharishabari, Dist.-Jamalpur. |
| 7. | Elenga | Upazila-Kalihati, Dist.-Tangail. |
| 8. | Kaliakair Bazar | Upazila-Kaliakair, Dist.-Gazipur. |
| 9. | Eliatganj | Upazila-Chandina, Dist.-Comilla. |
| 10. | Puran Bazar | Upazila-Chandpur, Dist.-Chandpur. |
| 11. | Shaestaganj Puran Bazer | Upazila-Habiganj, Dist.-Habiganj. |
| 12. | Naruamela | Upazila-Gabtali, Dist.-Bogra. |
| 13. | Dariapur | Upazila-Shahjadpur, Dist.-Pabna. |
| 14. | Shotibari | Upazila-Mithapukur, Dist.-Rangpur. |
| 15. | Okrabari | Upazila-Chirirbandar, Dist.-Dinajpur. |
| 16. | Monirampur Bazar | Upazila-Moirampur, Dist.-Jessore. |
| 17. | Meherpur | Upazila-Meherpur, Dist.-Meherpur. |
| 18. | Torki | Upazila-Gournadi, Dist.-Barishal. |

Appendix 3.5 : List of the Selected Big Markets for Study.

| Sl. No. | Name of the Market | Location |
|---|---|---|
| 1. | Badam Tali | Sadar Ghat, Dhaka. |
| 2. | Mohammadpur Krishi Super Market | Mohammadpur, Dhaka. |
| 3. | Puran Bazar | Chandpur Sadar, Chandpur. |
| 4. | Shotibari | Mithapukur, Rangpur. |

Appendix 3.6 : List of the Selected Godowns for Study.

| Sl. No. | Name of the Godown | Location |
|---|---|---|
| 1. | Mubarak Traders | Panchgachhia Road, Uapazila-Feni, Dist.-Feni. |
| 2. | Mosharaf Traders | - do - |
| 3. | Razzak Traders | Elenga hat, Upazila-Kalihati, Dist.-Tangail. |
| 4. | Nasir Traders | Kaliakair, Upazila-Kaliakair, Dist.-Gazipur. |
| 5. | Jalil Traders | Latifpur, Upazila-Kaliakair, Dist.-Gazipur. |
| 6. | Taj Traders | Puran Bazar, Upazila-Chandpur Sadar, Dist.- Chandpur. |
| 7. | Dhali & Sons | - do - |
| 8. | Mubarak Traders | Shaestagonj, Upazila - Habigonj Dist.- Habigonj. |
| 9. | Shamiran Traders | - do - |
| 10. | Younus Traders | Dariapur, Upazila- Shahjadpur, Dist.- Sirajgonj. |
| 11. | Bishnu Traders | Monirampur Bazar, Upazila-Monirampur, Dist.- Jesssore. |
| 12. | Sreebas Traders | - do - |
| 13. | Shamsuddin Traders | Meherpur, Upazila- Meherpur Sadar, Dist.- Meherpur. |
| 14. | Shahidul Traders | - do - |

Appendix 3.7 : List of the Selected Rice Mills/Wheat Crushers for Study.

| Sl. No. | Name of Miller | Type of Mill | Location | Upazila | District |
|---|---|---|---|---|---|
| 1. | Md. Saifuddin | Huller | Jungleghat Chek | Rangunia | Chittagong |
| 2. | Md. Shirajul Islam | Huller | - do - | - do - | - do - |
| 3. | Mr. Moinuddin | Auto Rice Mill | Chowmohoni | - do - | - do - |
| 4. | Mr. Rahmatullah | - do - | - do - | - do - | - do - |
| 5. | Md. Mozaher Miah | Huller/W.Crusher | Charpara, Damsha | Satkania | - do - |
| 6. | Md. Shafi | Huller | Shamadia Bazar | - do - | - do - |
| 7. | Md. Salimullah | Huller | Dolubridge | - do - | - do - |
| 8. | Md. Enait Ali | Huller | Karanihat | - do - | - do - |
| 9. | Md. Mamunur Rashid | Auto Rice Mill | Dewanhat | - do - | - do - |
| 10. | Md. Sadek Bhuiyan | Huller | Aswadia | Feni | Noakhali |
| 11. | Md. Wahidur Rahman | Boiler | Kazirbag Road | - do - | - do - |
| 12. | Md. Abul Mansur | Huller/W.Crusher | Trishal Bazar | Trishal | Mymensingh |
| 13. | Md. Abdur Rahman | Wheat Crusher | - do - | - do - | - do - |
| 14. | Md. Abdur Rashid | - do - | - do - | - do - | - do - |
| 15. | Md. Mofazzal Hossain | Huller/W.Crusher | Shamuk Boilar | - do - | - do - |
| 16. | Dewan Md. Khaleque | Boiler | Haibal Nagar | Kishoregonj | Kishoregonj |
| 17. | Mrs. Sabiha Akter | Huller/W.Crusher | Monipuri Ghat | - do - | - do - |
| 18. | Md. Shahab Uddin | Huller/W.Crusher | Char Maria | - do - | - do - |
| 19. | Md. Dulal | - do - | Babundia | - do - | - do - |
| 20. | Md. Mamtaj Ali | Boiler | Danata | Sarishabari | Jamalpur |
| 21. | Mrs. Samsun Nahar | Huller/W.Crusher | Aram Nagar | - do - | - do - |
| 22. | Md. Shorab Ali | - do - | Banshi | - do - | - do - |
| 23. | Md. Siraj Sikdar | Huller | Boraibari | Kaliakair | Gazipur |
| 24. | Mr. Mofizur Rahman | Boiler | Hezaltoli | - do - | - do - |
| 25. | Mr. Shamsul Haque | Huller | Kaliakair Bazar | - do - | - do - |

Appendix 3.7 : List of the Selected Rice Mills/Wheat Crusher for Study (Contd.).

| Sl. No. | Name of Miller | Type of Mill | Location | Upazila | District |
|---|---|---|---|---|---|
| 26. | Md. A. Rashid | Boiler | Shatutia | Kalihati | Tangail |
| 27. | Mr. Lablu Miah | Huller/W.Crusher | Durgapur | - do - | - do - |
| 28. | Mr. Naba Talukder | - do - | - do - | - do - | - do - |
| 29. | Mr. Abdul Gani | Huller | Narinda | - do - | - do - |
| 30. | Mr. Muslauddin | Huller/W.Crusher | Chandina Bazar | Chandina | Comilla |
| 31. | Mr. Moniruddin | - do - | - do - | - do - | - do - |
| 32. | Mr. Shama Chandra | - do - | Kaduti Bazar | - do - | - do - |
| 33. | Mr. Abdul Mobin | - do - | Parchanga | - do - | - do - |
| 34. | Mr. Abdur Rashid | Boiler | Puran Bazar | Chandpur | Chandpur |
| 35. | Alhaj Md. Mostafa Miah | - do - | Roiez Road | - do - | - do - |
| 36. | Mr. Tofazzal Hossain | - do - | Bagadi Road | - do - | - do - |
| 37. | Mr. Fazal Tafadar | Huller | Chandpur Bazar | Chandpur | - do - |
| 38. | Mr. Mofazzal Hossain | Huller/W.Crusher | Uttar Balia | - do - | - do - |
| 39. | Mr. Seer Ali | Boiler | Langapara, Shaeztagonj | Hobigonj | Habigonj |
| 40. | Mr. Shiraj Miah | Huller/W.Crusher | Shahji Bazar | - do - | - do - |
| 41. | Mr. Abdul Haque | Huller | Station Road | Hobigonj | - do - |
| 42. | Mr. Nirmal Chandra | - do - | Bamunia | Gabtoli | Bogra |
| 43. | Mr. Azizar Rahman | Huller/W.Crusher | Peri | - do - | - do - |
| 44. | Mr. Yousuf Ali | - do - | Narua Mela | - do - | - do - |
| 45. | Mr. Mazibor Rahman | Boiler | Kagoil | - do - | - do - |
| 46. | Mr. Shirajul Islam | Huller/W.Crusher | Dariapur | Shahjadpur | Serajgonj |
| 47. | Mrs. Fatama Karim | Huller | Thanaghatpara | - do - | - do - |
| 48. | Mr. Sharab Ali | Huller/W.Crusher | Ramkharua | - do - | - do - |
| 49. | Mr. Musha Molla | Huller | Chaira | - do - | - do - |
| 50. | Alhaj Amir Hossain | Huller/W.Crusher | Garadah Bazar | - do - | - do - |

Appendix 3.7 : List of the Selected Rice Mills/Wheat Crushe for Study (Contd.).

| Sl. No. | Name of Mille | Type of Mill | Location | Upazila | District |
|---|---|---|---|---|---|
| 51. | Mr. Hossain Ali | - do - | Baghabari Bazar | - do - | - do - |
| 52. | Mr. Halim Master | Huller | Talgachhi Bazar | Shahzadpur | Serajgonj |
| 53. | Mr. Safiur Sardar | Boiler | Shotibari | Mithapukur | Rangpur |
| 54. | Rafiqul Islam | Huller | - do - | - do - | - do - |
| 55. | Abdur Rahim | Huller | Miar Hat | - do - | - do - |
| 56. | Shah Md. Sarwarul Islam | Boiler | Zakirhat | - do - | - do - |
| 57. | Abdur Rouf | Huller/W.Crusher | - do - | - do - | - do - |
| 58. | Mr. Nurul Haque | Huller | Ramnathpur | - do - | - do - |
| 59. | Mr. Mostafa | Huller/W.Crusher | Omarpur | Chirirbandar | Dinajpur |
| 60. | Mr. Mostaque | - do - | - do - | - do - | - do - |
| 61. | Mr. Mozammel Hossain | Boiler | Chirirbandar | - do - | - do - |
| 62. | Mr. Sarkar | Huller/W.Crusher | Bhosirbandar | - do - | - do - |
| 63. | Mr. Safiur Rahman | Huller/W.Crusher | Monirampur Bazar | Monirampur | Jessore |
| 64. | Manoranjan Ghos | - do - | - do - | - do - | - do - |
| 65. | Mr. Motiar Rahman | - do - | Meherpur | Meherpur | Meherpur |
| 66. | Mr. Amzad Hossain | - do - | Meherpur | Meherpur | - do - |
| 67. | Mr. Ismail Hossain | - do - | - do - | - do - | - do - |
| 68. | Mr. Robiul Islam | - do - | Basantapur | - do - | - do - |
| 69. | Mr. Araj Ali Sardar | - do - | Gournadi | Gournadi | Barisal |
| 70. | Mr. A. Rashid | - do - | Ashukati | - do - | - do - |
| 71. | Md. Abul Hossain | - do - | Tarki Bandar | - do - | - do - |

Appendix 3.8 : List of the Major Poultry and Cattle Farms in Bangladesh with Selected Farms for Study.

| Sl. No. | Name of the Farms | Location |
|---|---|---|
| 1. | Central Poultry Farm, Mirpur* | Mirpur, Dhaka |
| 2. | Zonal Poultry Farm, Rajshahi | Rajabarihat, Rajahahi |
| 3. | Zonal Poultry Farm, Pahartali | Pahartali, Chittagong |
| 4. | Govt. Poultry Farm, Tajgaon | Mirpur, Dhaka |
| 5. | Govt. Poultry Farm, Comilla | Chartha, Comilla |
| 6. | Govt. Poultry Farm, Sitakunda | Sitakunda, Chittagong |
| 7. | Govt. Poultry Farm, Sylhet | Tilaghar, Sylhet |
| 8. | Govt. Poultry Farm, Jamalganj | Jamalganj, Jypurhat |
| 9. | Govt. Poultry Farm, Rangpur | Alamnagar, Rangpur |
| 10. | Govt. Poultry Farm, Jessore* | Sankarpur, Jossere |
| 11. | Govt. Poultry Farm, Barisal | Amanatganj, Barisal |
| 12. | Govt. Poultry Farm, Tangail | Tangail |
| 13. | Govt. Poultry Farm, Kishoreganj* | Bagadia, Kishoreganj |
| 14. | Govt. Poultry Farm, Faridpur | Badarpur, Faridpur |
| 15. | Govt. Poultry Farm, Rajbari | Rajbari |
| 16. | Govt. Poultry Farm, Madaripur | Madaripur |
| 17. | Govt. Poultry Farm, Rangamati | Assibasti, Rangamati |
| 18. | Govt. Poultry Farm, Pabna | Industrial Area, Pabna |
| 19. | Govt. Poultry Farm, Serajganj* | Sialcol, Sirajganj |
| 20. | Govt. Poultry Farm, Bogra* | Bogra |
| 21. | Govt. Poultry Farm, Dinajpur* | Baskerhat, Dinajpur |
| 22. | Govt. Poultry Farm, Thakurgaon | Thakurgaon |
| 23. | Govt. Poultry Farm, Kushtia | Kushtia |
| 24. | Govt. Poultry Farm, Chuadanga | Chuadanga |
| 25. | Govt. Poultry Farm, Noakhali | Sonapur, Noakhali |
| 26. | Govt. Poultry Farm, Patuakhli | Patuakhli |
| 27. | Poultry Rearing Unit, Manikganj | Manikganj |
| 28. | Poultry Rearing Unit, Nababganj | Nababganj |
| 29. | Poultry Rearing Unit, Satkhari | Satkhari |
| 30. | Poultry Rearing Unit, Gopalganj | Gopalganj |
| 31. | Poultry Rearing Unit, Bagerhat | Bagerhat |
| 32. | Poultry Rearing Unit, Kurigram | Kurigram |
| 33. | Poultry Rearing Unit, Jamalpur | Jamalpur |
| 34. | Central Duck Breeding Farm* | Haziganj, Narayangonj |
| 35. | Regional Duck Farm, Khulna | Daulatpur, Khulna |
| 36. | Poultry Farm, Satkania* | Rampur, Satkania Chittagong |
| 37. | Barabagh Poultry Farm* | Barabagh, Kishoregonj |
| 38. | Phenix Poultry Farm* | Demra, Dhaka |
| 39. | Echilee Poultry & Cattle Farm* | Bagadi Road, Chandpur |
| 40. | Tulip Dairy Farm* | Chandra, Kaliakair Gazipur |
| 41. | Savar Dairy Farm* | Savar, Dhaka |
| 42. | National Development Poultry Farm* | Karatia Road, Chandpur |
| 43. | Damty Poultry Farm* | Balashar, Debidder, Comilla |
| 44. | Potazia Cattle Farm* | Roypara, Shajadpur, Sherajgonj |

Appendix 3.8 : List of the Major Poultry and Cattle Farms in Bangladesh with Selected Farms for Study (Contd.).

| Sl. No. | Name of the Farms | Location |
|---|---|---|
| 45. | Satkania Poultry Farm* | Satkania, Chittagong |
| 46. | Manaranjan Poultry Farm* | Dinajpur Sadar |
| 47. | Basudevpara Poultry Farm* | Gournadi, Barisal |

* Surveyed Poultry and Cattle Farm.

Appendix 3.9 : List of the Feed Mills in Bangladesh with Selected Mills for Study.

| Sl. No. | Name of the Mill | Location and Address |
|---|---|---|
| 1. | Bangladesh Solvent Oil Ltd. | Bagabari, Pabna. |
| 2. | Dossa Extraction Ltd. | Shagorika Road, Chittagong. |
| 3. | Nurpur Feed Meal Plant | Tarabo, Narshingdi. |
| 4. | Rupan Oil and Feed Ltd. | Pulhat, Dinajpur. |
| 5. | Monno Grimexpel Ltd. | Narayangonj. |
| 6. | Government Feed Meal Plant* | Mirpur, Dhaka. |
| 7. | Government Flower Mill | Postogolla, Dhaka. |
| 8. | Government Feed Meal Plant* | Savar, Dhaka. |

* Surveyed Feed Mill

Appendix 3.10: A Case Study on the Estimation of Grain Losses due to Field Stacking, Carrying and threshing of Foodgrains Crop.

A crop cutting experiment was conducted in each selected Upazila (18) for estimating grain losses due to field stacking, carrying and threshing in Boro and Aus crops. From each selected Upazila one village was selected at random. From each selected village one household was selected at random, as the ultimate sampling unit. Crop cutting experiments were conducted in the plot of the sampled household. In selection of household, emphasis was given to the household who had harvestable Boro or Aus crops at the time of survey.

An area of 9 sq. m (3 m x 3 m) was taken from a plot (ready for harvest) of the selected household. After harvesting, the harvest were kept in small bundles on the gunny bags. The scattered grains which dropped on the gunny bags were collected and weighed to estimate the loss due to field stacking. The bundles were then weighed on a balance. The harvest was tied by a rope and taken to the threshing floor by headload.

At threshing floor, the harvest was weighed again to estimate the loss during carrying using following formula:

$$FCL = (WCF - WCT)/9 \quad \ldots\ldots\ldots\ldots gm^{-2}$$

Where,

FCL stands for Field Carrying Loss,
WCF stands for Weight of crop in the field,
WCT stands for Weight of crop after carrying to the threshing floor.

After threshing the crop, the paddy (including some sterile grains and debris) and the straw were weighed separately. Again, paddy was weighed after winnowing. Losses due to threshing were calculated using following formula :

$$TL = (WCBT - WCAT)/9 \quad \ldots\ldots\ldots\ldots gm^{-2}$$
$$WCAT = (WP + WSGD + WS) \quad \ldots\ldots\ldots g$$

Where,

TL stands for threshing Losses,
WCBT stands for weight of crop before threshing,
WCAT stands for weight of crop after threshing,
WP stands for weight of paddy,
WSGD stands for weight of sterile grains and debris, and
WS stands for weight of straw.

The harvest was carried from the field to the threshing floor under umbrella shading and threshing was done under shade as quickly as possible to minimize loss of moisture of the harvest.

Appendix 3.11 : Procedure for Laboratory Analysis of Stored Foodgrains and Seed Samples.

| | |
|---|---|
| Moisture content | : Moisture content was determined by 'Dicky John' moisture meter. |
| Chaff | : Chaff was separated from 500g sample and per cent chaff was calculated by weight basis. |
| Foreign materials | : Foreign matter (other than rice materials) was separated form 500g sample and per cent foreign materials was calculated on weight basis. |
| Admixture | : Contrasting grain was separated from 500g sample and per cent admixture was calculated on weight basis. |
| Damaged/discolored grain | : Physically damaged and discolored grains were separated from 500g sample and percent was calculated on weight basis. |
| Insect infection | : Insect bored grains were separated from the 500g sample and percent insect infection was calculated by weight. |
| Aspergellus flavus | : One hundred randomly selected wet grains were placed on PDA media and incubated. The number of grains around which mould grew was termed as per cent of infested grain. |
| Aflatoxin | : The A. flavus contaminated grain was extracted with chloroform. The extract was concentrated and sported on TLC plate, run in chloroform, thethanol light to detect Aflatoxin. |
| Germination(%) | : One hundred grain (seed) were placed in a germination plate containing moist blotting paper. After 7th day first count was made then every day till 10th day. The average grain germinated was the percent germination. |

Appendix 4.1: Seed, Feed and Post-harvest Loss as % of Total Production of Foodgrain Crops by AEZ during 1989-90.

| CROPS | TOTAL (SURVEY AREA) | | | | | CHITTAGONG AND NOAKHALI | | | | | MYMENSINGH, KISHOREGONJ & JAMALPUR | | | | | DHAKA AND TANGAIL | | | | | COMILLA AND SYLHET | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL |
| AREA IN DECIMAL | 84224 | 236163 | 123492 | 23719 | 472598 | 9050 | 38500 | 11219 | 0 | 58769 | 23055 | 50952 | 20343 | 3177 | 97527 | 6220 | 13857 | 16901 | 3512 | 40450 | 12128 | 19798 | 5902 | 5056 | 42884 |
| Production in Kg. | 707405 | 2697527 | 2051315 | 174637 | 5630884 | 98520 | 481578 | 175575 | 0 | 755673 | 226949 | 531714 | 316372 | 16381 | 1091416 | 30866 | 148256 | 287335 | 14061 | 480518 | 105975 | 221723 | 82658 | 25105 | 435464 |
| Rice equivalent in Kg | 475660 | 1835991 | 1386325 | | 3697976 | 67693 | 333830 | 121533 | 0 | 523056 | 152986 | 372732 | 217442 | | 743160 | 19239 | 101629 | 187572 | | 308440 | 70092 | 147446 | 56042 | | 273580 |
| Seed used % of Production | 2.89 | 1.80 | 0.69 | 5.73 | 1.73 | 1.77 | 1.60 | 0.78 | 0.00 | 1.28 | 2.21 | 2.04 | 0.92 | 6.33 | 1.79 | 4.43 | 1.70 | 0.90 | 3.00 | 1.96 | 2.62 | 2.57 | 1.09 | 7.12 | 2.18 |
| Feed as % of Production | 0.68 | 0.50 | 0.46 | 0.46 | 0.51 | 1.34 | 0.54 | 0.96 | 0.00 | 0.78 | 0.48 | 0.32 | 0.32 | 1.26 | 0.37 | 1.76 | 0.66 | 0.36 | 0.19 | 0.68 | 0.32 | 0.70 | 0.54 | 0.84 | 0.60 |
| Field Stackig Loss | 0.41 | 1.09 | 0.87 | 0.54 | 0.91 | 0.72 | 0.91 | 0.72 | 0.00 | 0.79 | 0.57 | 0.89 | 0.76 | 0.00 | 0.77 | 0.72 | 1.20 | 1.53 | 0.60 | 1.24 | 0.16 | 1.12 | 0.51 | 0.19 | 0.75 |
| Carrying Loss | 1.00 | 0.62 | 0.32 | 0.57 | 0.74 | 0.26 | 0.35 | 0.26 | 0.00 | 0.30 | 1.09 | 0.40 | 0.80 | 0.24 | 0.63 | 0.27 | 0.68 | 0.48 | 0.23 | 0.54 | 0.78 | 0.60 | 0.55 | 0.58 | 0.60 |
| Beating Loss | 0.63 | 0.68 | 0.61 | 0.66 | 0.65 | 0.22 | 0.83 | 0.07 | 0.00 | 0.45 | 0.76 | 0.66 | 0.43 | 0.76 | 0.59 | 0.00 | 0.18 | 0.43 | 0.46 | 0.26 | 0.61 | 0.54 | 0.09 | 0.53 | 0.39 |
| Bull Threshing | 0.27 | 0.25 | 0.02 | 0.05 | 0.16 | 0.68 | 0.02 | 0.01 | 0.00 | 0.10 | 0.13 | 0.27 | 0.02 | 0.40 | 0.21 | 0.60 | 0.52 | 0.00 | 0.01 | 0.33 | 0.20 | 0.26 | 0.09 | 0.08 | 0.19 |
| Beating after threshing | 0.23 | 0.31 | 0.13 | 0.02 | 0.23 | 0.01 | 0.45 | 0.00 | 0.00 | 0.22 | 0.54 | 0.30 | 0.38 | 0.13 | 0.35 | 0.00 | 0.15 | 0.11 | 0.00 | 0.11 | 0.26 | 0.35 | 0.00 | 0.00 | 0.20 |
| Paddle Threshing | 0.13 | 0.16 | 0.16 | 0.00 | 0.15 | 0.53 | 0.68 | 1.27 | 0.00 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.02 | 0.30 | 0.25 | 0.62 | 0.01 | 0.38 |
| Other Threshing | 0.00 | 0.03 | 0.00 | 0.05 | 0.02 | 0.00 | 0.05 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.34 | 0.01 |
| Winnowing | 0.69 | 0.88 | 0.50 | 0.63 | 0.68 | 0.68 | 1.35 | 0.68 | 0.00 | 0.98 | 0.64 | 0.75 | 0.45 | 1.22 | 0.64 | 0.31 | 0.43 | 0.37 | 0.24 | 0.39 | 0.64 | 0.91 | 0.71 | 0.84 | 0.80 |
| Drying (Birds, Goats etc. | 0.68 | 0.43 | 0.65 | 0.48 | 0.54 | 0.75 | 0.49 | 0.80 | 0.00 | 0.62 | 0.62 | 0.77 | 0.65 | 0.95 | 0.71 | 0.74 | 0.56 | 0.89 | 0.86 | 0.72 | 0.84 | 0.72 | 1.06 | 0.90 | 0.83 |
| Bad weather | 0.13 | 0.00 | 0.11 | 0.03 | 0.06 | 0.15 | 0.00 | 0.02 | 0.00 | 0.03 | 0.06 | 0.00 | 0.03 | 0.00 | 0.02 | 0.28 | 0.00 | 0.44 | 0.16 | 0.20 | 0.27 | 0.00 | 0.17 | 0.01 | 0.09 |
| Tot. Post harvest loss | 4.18 | 4.39 | 3.88 | 3.04 | 4.14 | 4.00 | 5.12 | 3.83 | 0.00 | 4.36 | 4.42 | 4.14 | 3.55 | 3.76 | 3.94 | 2.93 | 3.77 | 4.24 | 2.57 | 3.80 | 3.85 | 4.76 | 3.76 | 3.51 | 4.23 |
| Parboiling Loss | 0.95 | 2.14 | 1.96 | 0.00 | 1.82 | 1.37 | 1.76 | 1.22 | 0.00 | 1.46 | 0.93 | 2.08 | 1.89 | 0.00 | 1.80 | 0.77 | 3.20 | 3.48 | 0.00 | 2.89 | 1.12 | 2.53 | 2.11 | 0.00 | 2.12 |
| Milling Loss | 1.05 | 1.22 | 1.32 | 1.48 | 1.24 | 1.02 | 0.53 | 0.85 | 0.00 | 0.69 | 0.47 | 0.77 | 1.12 | 1.04 | 0.87 | 2.56 | 2.77 | 3.32 | 2.30 | 2.93 | 1.56 | 1.57 | 1.41 | 1.37 | 1.51 |
| Handling Loss | 0.45 | 0.49 | 0.32 | 0.46 | 0.42 | 0.43 | 0.43 | 0.19 | 0.00 | 0.33 | 0.23 | 0.34 | 0.21 | 0.37 | 0.28 | 0.67 | 0.19 | 0.19 | 0.37 | 0.26 | 0.49 | 0.47 | 0.51 | 0.55 | 0.49 |
| Transportation Loss | 0.25 | 0.38 | 0.26 | 0.34 | 0.32 | 0.21 | 0.29 | 0.21 | 0.00 | 0.24 | 0.27 | 0.19 | 0.28 | 0.25 | 0.23 | 0.67 | 0.15 | 0.17 | 0.34 | 0.23 | 0.28 | 0.32 | 0.38 | 0.49 | 0.34 |
| Storage Loss | 2.44 | 1.16 | 0.90 | 0.00 | 1.03 | 2.63 | 1.49 | 0.90 | 0.00 | 1.39 | 3.39 | 0.83 | 0.60 | 0.00 | 1.06 | 0.00 | 0.67 | 1.05 | 0.00 | 0.70 | 2.14 | 1.16 | 1.00 | 0.00 | 1.19 |
| Total Loss at Farm Level | 12.87 | 12.08 | 9.89 | 11.51 | 11.21 | 12.77 | 11.76 | 8.94 | 0.00 | 10.53 | 12.40 | 10.76 | 8.58 | 13.01 | 10.35 | 13.79 | 13.11 | 15.31 | 13.76 | 13.44 | 12.36 | 14.08 | 10.71 | 13.88 | 12.65 |
| Weighted Traders Loss | 0.33 | 0.30 | 0.49 | 0.33 | 0.37 | 0.34 | 0.31 | 0.51 | 0.00 | 0.38 | 0.26 | 0.24 | 0.39 | 0.20 | 0.30 | 0.11 | 0.11 | 0.17 | 0.03 | 0.13 | 0.33 | 0.31 | 0.50 | 0.12 | 0.37 |
| GRAND TOTAL | 13.20 | 12.38 | 10.38 | 11.84 | 11.58 | 13.11 | 12.07 | 9.45 | 0.00 | 10.91 | 12.66 | 11.00 | 9.27 | 13.21 | 10.65 | 13.90 | 13.22 | 13.48 | 13.79 | 13.57 | 12.69 | 14.39 | 11.21 | 14.00 | 13.02 |

Appendix 4.1: Seed, Feed and Post-harvest Loss as % of Total Production of Foodgrain Crops by AEZ during 1989-90 (Continued).

| CROPS | RAJSHAHI, BOGRA AND PABNA | | | | | RANGPUR AND DINAJPUR | | | | | JESSORE, KUSHTIA AND KHULNA | | | | | BARISAL, FARIDPUR AND PATUAKHALI | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL |
| AREA IN DECIMAL | 7722 | 15818 | 20352 | 1016 | 44908 | 4412 | 62410 | 21736 | 5652 | 94260 | 15947 | 25342 | 18729 | 10191 | 70708 | 5639 | 9986 | 8761 | 115 | 25092 |
| Production in Kg. | 51501 | 150512 | 394871 | 14124 | 611008 | 26331 | 775304 | 362529 | 36104 | 1200268 | 130757 | 333212 | 305671 | 67971 | 837611 | 36506 | 55228 | 126304 | 833 | 218926 |
| Rice equivalent in Kg | 34454 | 101325 | 256864 | | 392643 | 17475 | 520539 | 244745 | | 782755 | 88255 | 220653 | 214398 | | 523286 | 25482 | 37837 | 87731 | | 151056 |
| Seed used % of Production | 3.70 | 2.54 | 0.35 | 2.61 | 2.08 | 3.71 | 1.21 | 1.02 | 5.52 | 1.60 | 3.99 | 1.73 | 0.73 | 5.34 | 1.77 | 3.39 | 4.84 | 0.90 | 4.39 | 3.30 |
| Feed as % of Production | 1.00 | 1.18 | 0.34 | 0.10 | 0.69 | 1.26 | 0.42 | 0.76 | 0.34 | 0.65 | 0.20 | 0.26 | 0.26 | 0.32 | 0.23 | 0.99 | 0.66 | 0.38 | 1.12 | 0.60 |
| Field Stackig Loss | 0.58 | 0.98 | 0.35 | 0.41 | 0.68 | 0.39 | 1.04 | 1.00 | 0.19 | 1.21 | 0.00 | 0.35 | 1.12 | 0.89 | 0.60 | 0.30 | 1.07 | 0.77 | 0.34 | 0.84 |
| Carrying Loss | 0.62 | 0.92 | 0.60 | 0.48 | 0.75 | 0.97 | 0.74 | 1.37 | 0.34 | 0.98 | 1.94 | 0.95 | 1.32 | 0.85 | 1.21 | 0.98 | 0.62 | 0.59 | 0.35 | 0.66 |
| Beating Loss | 0.04 | 0.34 | 0.50 | 0.41 | 0.36 | 1.08 | 0.93 | 1.50 | 1.10 | 1.18 | 1.03 | 0.41 | 0.74 | 0.54 | 0.61 | 0.56 | 0.05 | 0.03 | 0.11 | 0.11 |
| Bull Threshing | 0.62 | 0.27 | 0.00 | 0.01 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.00 | 0.00 | 0.40 | 0.64 | 0.13 | 0.14 | 0.23 | 0.20 |
| Beating after threshing | 0.01 | 0.32 | 0.13 | 0.13 | 0.21 | 0.26 | 0.32 | 0.18 | 0.00 | 0.25 | 0.00 | 0.17 | 0.00 | 0.00 | 0.08 | 0.21 | 0.02 | 0.00 | 0.00 | 0.04 |
| Paddle Threshing | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.74 | 0.47 | 0.56 | 0.56 |
| Other Threshing | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 | 0.01 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Winnowing | 0.78 | 0.57 | 0.42 | 0.40 | 0.54 | 0.46 | 0.71 | 0.56 | 0.73 | 0.62 | 0.96 | 0.71 | 0.55 | 0.48 | 0.68 | 0.61 | 0.63 | 0.51 | 0.96 | 0.59 |
| Drying (Birds, Goats etc. | 0.87 | 0.55 | 0.58 | 0.52 | 0.60 | 0.54 | 0.01 | 0.41 | 0.09 | 0.23 | 0.71 | 0.47 | 0.50 | 0.31 | 0.51 | 0.23 | 0.43 | 0.35 | 0.56 | 0.64 |
| Bad weather | 0.36 | 0.00 | 0.17 | 0.20 | 0.11 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.18 | 0.00 | 0.02 | 0.00 | 0.03 |
| Tot. Post harvest loss | 3.92 | 3.95 | 2.75 | 2.55 | 3.47 | 3.71 | 4.39 | 5.03 | 2.67 | 4.49 | 4.66 | 4.13 | 4.25 | 3.09 | 4.19 | 4.42 | 3.69 | 3.39 | 3.49 | 3.67 |
| Parboiling Loss | 0.91 | 2.35 | 1.61 | 0.00 | 1.83 | 0.96 | 1.96 | 1.46 | 0.00 | 1.59 | 0.65 | 1.68 | 0.89 | 0.00 | 1.21 | 1.28 | 2.95 | 2.73 | 0.00 | 2.57 |
| Milling Loss | 0.49 | 1.41 | 1.68 | 1.25 | 1.45 | 0.63 | 1.56 | 0.86 | 1.54 | 1.19 | 1.05 | 1.21 | 2.28 | 1.53 | 1.58 | 0.28 | 0.53 | 1.72 | 1.87 | 0.97 |
| Handling Loss | 1.09 | 0.48 | 0.46 | 0.69 | 0.56 | 0.60 | 0.55 | 0.46 | 0.42 | 0.52 | 0.17 | 0.54 | 0.21 | 0.46 | 0.37 | 1.09 | 0.30 | 0.21 | 0.54 | 0.33 |
| Transportation Loss | 0.46 | 0.38 | 0.38 | 0.45 | 0.39 | 0.20 | 0.48 | 0.24 | 0.32 | 0.35 | 0.20 | 0.21 | 0.18 | 0.32 | 0.20 | 0.18 | 0.46 | 0.33 | 0.54 | 0.37 |
| Storage Loss | 2.09 | 3.17 | 0.86 | 0.00 | 2.10 | 3.29 | 1.10 | 0.98 | 0.00 | 1.30 | 0.82 | 1.13 | 0.95 | 0.00 | 0.99 | 1.69 | 0.73 | 0.91 | 0.00 | 0.90 |
| Total Loss at Farm Level | 13.16 | 15.46 | 8.99 | 7.65 | 12.58 | 14.36 | 11.67 | 10.31 | 10.37 | 11.69 | 11.54 | 10.86 | 9.75 | 11.06 | 10.55 | 13.83 | 14.16 | 10.55 | 11.95 | 12.75 |
| Weighted Traders Loss | 0.38 | 0.35 | 0.56 | 0.58 | 0.43 | 0.24 | 0.22 | 0.36 | 0.46 | 0.23 | 0.31 | 0.29 | 0.46 | 0.45 | 0.36 | 0.16 | 0.15 | 0.24 | 0.14 | 0.18 |
| GRAND TOTAL | 13.54 | 15.81 | 9.54 | 8.23 | 13.01 | 14.60 | 11.89 | 11.17 | 11.35 | 11.97 | 11.95 | 11.15 | 10.21 | 11.51 | 10.91 | 13.99 | 14.31 | 10.79 | 12.09 | 12.93 |

Appendix 4.2: Estimated Seed, Feed and Post-harvest Loss (in metric tons) of Foodgrain Crops During 1989-90 in Bangladesh.

| CROPS | BANGLADESH | | | | | CHITTAGONG AND NOAKHALI | | | | | MYMENSINGH, KISHOREGONJ & JAMALPUR | | | | | DHAKA AND TANGAIL | | | | | COMILLA AND SYLHET | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL |
| Production in m. tons | 2487530 | 9202040 | 6166750 | 890000 | 18746320 | 245920 | 905740 | 605200 | 1920 | 1758780 | 314790 | 315630 | 1961490 | 69410 | 2362380 | 159025 | 411970 | 767240 | 80050 | 1418285 | 425195 | 1243850 | 987400 | 95330 | 2751775 |
| Seed used | 71890 | 165637 | 54884 | 50997 | 324311 | 4353 | 14492 | 4721 | 0.00 | 23512 | 6357 | 18700 | 9756 | 4394 | 42237 | 7045 | 7003 | 6905 | 6404 | 27798 | 11140 | 31967 | 10763 | 6787 | 59939 |
| Foodgrain used as feed | 16915 | 46010 | 28357 | 4094 | 95606 | 3295 | 4891 | 5810 | 0.00 | 13718 | 1511 | 2933 | 3397 | 875 | 8741 | 2799 | 2719 | 2762 | 144 | 9644 | 1361 | 8707 | 5332 | 801 | 16511 |
| | | | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Field Stackig Loss | 10199 | 100302 | 53651 | 4806 | 170592 | 1771 | 8242 | 4357 | 0.00 | 13834 | 1794 | 8159 | 8067 | 0 | 18190 | 1145 | 4944 | 11739 | 480 | 17587 | 580 | 13931 | 5036 | 181 | 20638 |
| Carrying Loss | 24875 | 57053 | 50567 | 5073 | 138723 | 639 | 3170 | 1574 | 0.00 | 5276 | 3431 | 3657 | 8432 | 167 | 14683 | 429 | 2801 | 3683 | 184 | 7659 | 3317 | 7463 | 5233 | 553 | 16511 |
| Beating Loss | 15671 | 62574 | 37617 | 5874 | 121851 | 341 | 7518 | 424 | 0.00 | 7915 | 2392 | 6059 | 4564 | 528 | 13938 | 0 | 742 | 3299 | 368 | 3688 | 2594 | 6717 | 889 | 505 | 10732 |
| Bull Threshing | 6716 | 23025 | 1233 | 445 | 29994 | 1672 | 181 | 61 | 0.00 | 1753 | 409 | 3392 | 212 | 278 | 4961 | 954 | 2142 | 0 | 8 | 4680 | 850 | 3234 | 889 | 76 | 5228 |
| Beating after threshing | 5721 | 28526 | 8017 | 178 | 43117 | 25 | 4076 | 0 | 0.00 | 3869 | 1700 | 2750 | 4034 | 90 | 8258 | 0 | 618 | 844 | 0 | 1560 | 1105 | 4353 | 0 | 0 | 5504 |
| Paddle Threshing | 3234 | 14723 | 9867 | 0 | 29119 | 1303 | 6159 | 7686 | 0.00 | 14950 | 0 | 0 | 0 | 0 | 0 | 0 | 165 | 0 | 0 | 284 | 1276 | 3110 | 6122 | 10 | 10457 |
| Other Threshing | 0 | 2761 | 0 | 446 | 3749 | 0 | 453 | 0 | 0.00 | 352 | 0 | 0 | 106 | 14 | 99 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 99 | 324 | 275 |
| Winnowing | 17164 | 75457 | 30834 | 5607 | 127475 | 1672 | 12227 | 4115 | 0.00 | 17236 | 2015 | 6875 | 4777 | 847 | 15119 | 493 | 1771 | 2839 | 192 | 5531 | 2721 | 11319 | 7011 | 801 | 22014 |
| Drying (Birds, Goats etc.) | 16915 | 39569 | 40084 | 4272 | 101230 | 1844 | 4438 | 4842 | 0.00 | 10904 | 1952 | 7059 | 6900 | 680 | 16773 | 1177 | 2389 | 6828 | 688 | 10212 | 2594 | 8956 | 10466 | 858 | 22540 |
| Bad weather | 3234 | 0 | 6783 | 257 | 11248 | 369 | 0 | 121 | 0.00 | 528 | 189 | 0 | 318 | 0 | 472 | 445 | 0 | 3376 | 128 | 2837 | 1148 | 0 | 1284 | 10 | 2291 |
| Tot. Post harvest loss | 103979 | 403970 | 239270 | 27056 | 776098 | 9837 | 46374 | 23179 | 0.00 | 76683 | 13914 | 37351 | 37623 | 2610 | 93076 | 4659 | 15531 | 32531 | 2057 | 53895 | 16285 | 59207 | 37126 | 3346 | 115400 |
| Parboiling Loss | 23632 | 196924 | 114702 | 0 | 341183 | 3369 | 15341 | 7383 | 0.00 | 25673 | 2928 | 19067 | 19956 | 0 | 42523 | 1224 | 13183 | 26700 | 0 | 40988 | 4762 | 31469 | 20834 | 0 | 58338 |
| Milling Loss | 26119 | 112265 | 81401 | 13172 | 232454 | 2508 | 4300 | 5144 | 0.00 | 12136 | 1480 | 7059 | 11889 | 722 | 20553 | 4071 | 11412 | 25472 | 1841 | 41556 | 6633 | 19528 | 13922 | 1306 | 41552 |
| Handling Loss | 11194 | 45030 | 19734 | 4094 | 78735 | 1057 | 3395 | 1150 | 0.00 | 5604 | 724 | 3117 | 2223 | 257 | 6615 | 1065 | 783 | 1458 | 296 | 3638 | 2083 | 5846 | 5036 | 524 | 13484 |
| Transportation Loss | 5721 | 34968 | 16034 | 3025 | 59938 | 516 | 2527 | 1271 | 0.00 | 4221 | 850 | 1742 | 2972 | 174 | 5433 | 1065 | 618 | 1304 | 272 | 3252 | 1191 | 3980 | 3752 | 467 | 9356 |
| Storage Loss | 60696 | 106744 | 55501 | 0 | 193057 | 6468 | 13496 | 5447 | 0.00 | 24447 | 10671 | 8067 | 6369 | 0 | 25514 | 0 | 2760 | 8056 | 0 | 9923 | 9099 | 14429 | 9874 | 0 | 32746 |
| Total Loss at Farm Level | 320145 | 1111606 | 609892 | 102439 | 2101462 | 31404 | 106515 | 54105 | 0.00 | 185200 | 39034 | 98635 | 94259 | 9030 | 244506 | 21930 | 54009 | 102120 | 11015 | 190618 | 52554 | 175134 | 105751 | 13232 | 348100 |
| Weighted Traders Loss | 8191 | 27845 | 30186 | 2937 | 69361 | 836 | 2309 | 3087 | 0.00 | 6633 | 812 | 2290 | 4140 | 139 | 7087 | 175 | 453 | 1304 | 24 | 1844 | 1403 | 3856 | 4937 | 114 | 10182 |
| GRAND TOTAL | 328354 | 1139213 | 640109 | 105376 | 2170824 | 32240 | 108823 | 57191 | 0.00 | 191383 | 39252 | 100836 | 98400 | 9169 | 251593 | 22104 | 54462 | 103424 | 11039 | 192461 | 53957 | 178990 | 110688 | 13345 | 358231 |

Appendix 4.2: Estimated Seed, Feed and Post-harvest Loss (in metric tons) of Foodgrain Crops During 1989-90 in Bangladesh (Continued).

| CROPS | RAJSHAHI, BOGRA AND PABNA | | | | | RANGPUR AND DINAJPUR | | | | | JESSORE, KUSHTIA AND KHULNA | | | | | BARISAL, FARIDPUR AND PATUAKHALI | | | | | CHITTAGONG HILL TRACTS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL | AUS | AMAN | BORO | WHEAT | TOTAL |
| Production in m. tons | 232275 | 1308130 | 1129990 | 185880 | 2856275 | 238805 | 1833880 | 627940 | 251380 | 2952005 | 368125 | 1369860 | 460680 | 140240 | 2338905 | 477855 | 1163370 | 505640 | 65790 | 2212655 | 25540 | 48550 | 21170 | 0 | 95260 |
| Seed used | 8594 | 33227 | 9605 | 4851 | 59411 | 8850 | 22190 | 6405 | 14027 | 47232 | 14688 | 23699 | 3363 | 7489 | 41399 | 19066 | 56307 | 4551 | 2888 | 73018 | 732 | 874 | 188 | 0 | 1696 |
| Foodgrain used as feed | 8283 | 18436 | 3848 | 186 | 19708 | 3009 | 7708 | 4772 | 855 | 19188 | 736 | 3562 | 1198 | 449 | 5379 | 4301 | 7678 | 1921 | 737 | 13276 | 174 | 243 | 97 | 0 | 505 |
| | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 |
| Field Stackig Loss | 1347 | 12820 | 3955 | 762 | 19423 | 931 | 30076 | 6279 | 980 | 35719 | 0 | 4795 | 5160 | 1248 | 14033 | 1434 | 12448 | 3893 | 224 | 18586 | 105 | 529 | 184 | 0 | 857 |
| Carrying Loss | 1440 | 12035 | 6780 | 892 | 21422 | 2316 | 13571 | 8603 | 855 | 28930 | 7142 | 13014 | 6081 | 1192 | 28301 | 4683 | 7213 | 2983 | 480 | 14604 | 255 | 301 | 174 | 0 | 714 |
| Beating Loss | 93 | 4448 | 5650 | 762 | 10283 | 2579 | 17972 | 9419 | 2765 | 34834 | 3792 | 5616 | 3409 | 757 | 14267 | 2676 | 582 | 152 | 72 | 2434 | 161 | 330 | 129 | 0 | 619 |
| Bull Threshing | 1440 | 3532 | 0 | 19 | 5996 | 0 | 0 | 0 | 0 | 0 | 0 | 11370 | 0 | 0 | 9318 | 3058 | 1512 | 708 | 151 | 4425 | 69 | 121 | 4 | 0 | 181 |
| Beating after threshing | 23 | 4186 | 1469 | 242 | 5998 | 621 | 5868 | 1130 | 0 | 7390 | 0 | 2329 | 0 | 0 | 1871 | 1003 | 233 | 0 | 0 | 885 | 59 | 151 | 23 | 0 | 219 |
| Paddle Threshing | 116 | 0 | 0 | 0 | 286 | 0 | 0 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 526 | 8609 | 2377 | 368 | 12391 | 33 | 78 | 34 | 0 | 143 |
| Other Threshing | 0 | 0 | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 0 | 2603 | 0 | 14 | 2105 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 0 | 0 | 19 |
| Winnowing | 1812 | 7456 | 4746 | 744 | 15424 | 1099 | 13021 | 3516 | 1835 | 18302 | 3534 | 9726 | 2534 | 673 | 15905 | 2915 | 7329 | 2579 | 632 | 13055 | 176 | 398 | 106 | 0 | 676 |
| Drying (Birds, Goats etc.) | 2021 | 7195 | 6554 | 967 | 17138 | 1290 | 183 | 2575 | 226 | 6790 | 2614 | 6438 | 2303 | 435 | 11928 | 3965 | 5002 | 4298 | 368 | 14161 | 174 | 209 | 132 | 0 | 514 |
| Bad weather | 836 | 0 | 1921 | 372 | 3142 | 24 | 0 | 0 | 0 | 0 | 0 | 137 | 46 | 0 | 234 | 860 | 0 | 101 | 0 | 664 | 33 | 0 | 23 | 0 | 48 |
| Tot. Post harvest loss | 9105 | 51671 | 31075 | 4740 | 99113 | 8860 | 80507 | 31585 | 6712 | 132545 | 17155 | 56164 | 19579 | 4333 | 98000 | 21121 | 42928 | 17141 | 2296 | 81204 | 1068 | 2131 | 821 | 0 | 4010 |
| Parboiling Loss | 2114 | 30741 | 18193 | 0 | 51984 | 2293 | 35944 | 9168 | 0 | 46937 | 2393 | 23014 | 4100 | 0 | 28301 | 6117 | 34319 | 13804 | 0 | 56865 | 243 | 1039 | 394 | 0 | 1743 |
| Milling Loss | 1138 | 18445 | 21244 | 2324 | 41416 | 1504 | 28609 | 5400 | 3871 | 35125 | 3865 | 16575 | 10504 | 2146 | 36955 | 1338 | 6166 | 8748 | 1230 | 21463 | 263 | 592 | 279 | 0 | 1153 |
| Handling Loss | 2532 | 6279 | 5193 | 1283 | 16281 | 1433 | 10086 | 2839 | 1056 | 15350 | 626 | 7337 | 967 | 645 | 8654 | 5209 | 3490 | 1062 | 355 | 8408 | 115 | 238 | 68 | 0 | 419 |
| Transportation Loss | 1068 | 4971 | 4294 | 806 | 11139 | 478 | 8803 | 1507 | 304 | 10337 | 736 | 2877 | 829 | 449 | 4678 | 360 | 5352 | 1517 | 355 | 8187 | 59 | 184 | 55 | 0 | 305 |
| Storage Loss | 4355 | 41468 | 9718 | 0 | 59982 | 7857 | 20173 | 6154 | 0 | 38376 | 3019 | 15479 | 4376 | 0 | 23155 | 8076 | 8493 | 4671 | 0 | 19914 | 623 | 563 | 191 | 0 | 1286 |
| Total Loss at Farm Level | 30567 | 202237 | 101473 | 14220 | 359319 | 34292 | 214014 | 67889 | 27325 | 345039 | 42850 | 148767 | 44916 | 15511 | 246754 | 66087 | 164733 | 53345 | 7862 | 282114 | 3287 | 5865 | 2094 | 0 | 11117 |
| Weighted Traders Loss | 877 | 4578 | 6328 | 1078 | 12282 | 574 | 4053 | 2261 | 1156 | 8256 | 1141 | 3373 | 2128 | 631 | 8654 | 765 | 1745 | 1214 | 92 | 3983 | 84 | 146 | 104 | 0 | 343 |
| GRAND TOTAL | 31450 | 206815 | 107801 | 15298 | 371601 | 34866 | 218048 | 70141 | 28481 | 353355 | 43991 | 152739 | 47035 | 16142 | 255175 | 66852 | 166478 | 54559 | 7954 | 286096 | 3371 | 6010 | 2197 | 0 | 11460 |

Appendix 4.3 : Weighted use of seed, and feed, Post harvest, milling, transportation, storage and marketting losses of rice crops as % of production.

| REGION --> | TOTAL | | | | CHITTAGONG AND NOAKHALI | | | | MYMENSINGH, KISHOREGONJ & JAMALPUR | | | | DHAKA AND TANGAIL | | | | COMILLA AND SYLHET | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEM DESCRIPTIONS: \| CROPS--> | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL |
| Seed Used | 2.89 | 1.80 | 0.89 | 1.78 | 1.77 | 1.60 | 0.78 | 1.42 | 2.21 | 2.04 | 0.92 | 1.78 | 4.43 | 1.70 | 0.90 | 2.04 | 2.62 | 2.57 | 1.09 | 2.20 |
| Feed loss (used as feed) | 0.68 | 0.50 | 0.46 | 0.53 | 1.34 | 0.54 | 0.96 | 0.81 | 0.48 | 0.32 | 0.32 | 0.35 | 1.76 | 0.66 | 0.36 | 0.80 | 0.32 | 0.70 | 0.54 | 0.58 |
| Post-harvest loss | | | | | | | | | | | | | | | | | | | | |
| Stacking loss | 0.41 | 1.09 | 0.87 | 0.90 | 0.72 | 0.91 | 0.72 | 0.82 | 0.57 | 0.89 | 0.76 | 0.79 | 0.72 | 1.20 | 1.53 | 1.19 | 0.16 | 1.12 | 0.51 | 0.77 |
| Carrying loss | 1.00 | 0.62 | 0.82 | 0.75 | 0.26 | 0.35 | 0.26 | 0.31 | 1.09 | 0.40 | 0.80 | 0.64 | 0.27 | 0.68 | 0.48 | 0.55 | 0.78 | 0.60 | 0.53 | 0.62 |
| Threshing by beating | 0.63 | 0.68 | 0.61 | 0.65 | 0.22 | 0.83 | 0.07 | 0.51 | 0.76 | 0.66 | 0.43 | 0.62 | 0.00 | 0.18 | 0.43 | 0.21 | 0.61 | 0.54 | 0.09 | 0.44 |
| Bull threshing | 0.27 | 0.25 | 0.02 | 0.19 | 0.68 | 0.02 | 0.01 | 0.15 | 0.13 | 0.37 | 0.02 | 0.23 | 0.60 | 0.52 | 0.00 | 0.40 | 0.20 | 0.26 | 0.09 | 0.20 |
| Beating after threshing | 0.23 | 0.31 | 0.13 | 0.25 | 0.01 | 0.45 | 0.00 | 0.25 | 0.54 | 0.30 | 0.38 | 0.37 | 0.00 | 0.15 | 0.11 | 0.11 | 0.26 | 0.35 | 0.00 | 0.24 |
| Paddle threshing loss | 0.13 | 0.16 | 0.16 | 0.15 | 0.53 | 0.68 | 1.27 | 0.80 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.04 | 0.00 | 0.02 | 0.30 | 0.25 | 0.62 | 0.36 |
| Other threshing loss | 0.00 | 0.03 | 0.00 | 0.02 | 0.00 | 0.05 | 0.00 | [illegible]03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Winnowing loss | 0.69 | 0.82 | 0.50 | 0.71 | 0.68 | 1.35 | 0.68 | [illegible].04 | 0.64 | 0.75 | 0.45 | 0.65 | 0.31 | 0.43 | 0.37 | 0.39 | 0.64 | 0.91 | 0.71 | 0.80 |
| Drying loss:birds, goat etc. | 0.68 | 0.43 | 0.65 | 0.54 | 0.75 | 0.49 | 0.80 | 0.32 | 0.62 | 0.77 | 0.65 | 0.71 | 0.74 | 0.58 | 0.89 | 0.69 | 0.61 | 0.72 | 1.06 | 0.79 |
| Bad weather | 0.13 | 0.00 | 0.11 | 0.05 | 0.15 | 0.00 | 0.02 | 0.04 | 0.06 | 0.00 | 0.03 | 0.02 | 0.28 | 0.00 | 0.44 | 0.17 | 0.27 | 0.00 | 0.13 | 0.09 |
| Total post-harvest loss | 4.18 | 4.39 | 3.88 | 4.21 | 4.00 | 5.12 | 3.83 | 4.57 | 4.42 | 4.14 | 3.55 | 4.04 | 2.93 | 3.77 | 4.24 | 3.73 | 3.83 | 4.76 | 3.76 | 4.31 |
| Parboiling loss | 0.95 | 2.14 | 1.86 | 1.83 | 1.37 | 1.76 | 1.22 | 1.54 | 0.93 | 2.08 | 1.88 | 1.80 | 0.77 | 3.20 | 3.48 | 2.79 | 1.12 | 2.53 | 2.11 | 2.14 |
| Milling Loss | 1.05 | 1.22 | 1.32 | 1.21 | 1.02 | 0.53 | 0.85 | 0.71 | 0.47 | 0.77 | 1.12 | 0.80 | 2.56 | 2.77 | 3.32 | 2.87 | 1.56 | 1.57 | 1.41 | 1.53 |
| Total milling loss | 2.00 | 3.36 | 3.18 | 3.04 | 2.39 | 2.29 | 2.07 | 2.25 | 1.40 | 2.85 | 3.00 | 2.60 | 3.33 | 5.97 | 6.80 | 5.66 | 2.68 | 4.10 | 3.52 | 3.67 |
| Handling loss | 0.45 | 0.49 | 0.32 | 0.44 | 0.43 | 0.43 | 0.19 | 0.37 | 0.23 | 0.34 | 0.21 | 0.26 | 0.67 | 0.19 | 0.19 | 0.29 | 0.49 | 0.47 | 0.51 | 0.48 |
| Transportation loss | 0.23 | 0.38 | 0.26 | 0.32 | 0.21 | 0.23 | 0.21 | 0.25 | 0.27 | 0.19 | 0.28 | 0.23 | 0.67 | 0.15 | 0.17 | 0.26 | 0.28 | 0.32 | 0.38 | 0.33 |
| Storage loss | 2.44 | 1.16 | 0.90 | 1.35 | 2.63 | 1.49 | 0.90 | 1.56 | 3.39 | 0.88 | 0.69 | 1.31 | 0.00 | 0.67 | 1.05 | 0.63 | 2.14 | 1.16 | 1.00 | 1.31 |
| Total loss at farmers level | 12.87 | 12.08 | 9.89 | 11.67 | 12.77 | 11.76 | 8.94 | 11.24 | 12.40 | 10.76 | 8.88 | 10.60 | 13.79 | 13.11 | 13.71 | 13.41 | 12.36 | 14.08 | 10.90 | 12.87 |
| Weighted loss at traders level | 0.33 | 0.30 | 0.49 | 0.36 | 0.34 | 0.31 | 0.51 | 0.37 | 0.26 | 0.24 | 0.39 | 0.28 | 0.11 | 0.11 | 0.17 | 0.12 | 0.33 | 0.31 | 0.50 | 0.36 |
| GRAND TOTAL LOSS | 13.20 | 12.38 | 10.38 | 12.03 | 13.11 | 12.07 | 9.45 | 11.60 | 12.66 | 11.00 | 9.27 | 10.88 | 13.90 | 13.22 | 13.88 | 13.53 | 12.69 | 14.39 | 11.30 | 13.24 |

Appendix 4.3 : Weighted use of seed, and feed, Post harvest, milling, transportation, storage and marketting losses of rice crops as % of production (Continued).

| REGION --> | RAJSHAHI, BOGRA AND PABNA | | | | RANGPUR AND DINAJPUR | | | | JESSORE, KUSHTIA & KHULNA | | | | BARISAL, FARIDPUR & PATUAKHALI | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ITEM DESCRIPTIONS: ¦ CROPS--> | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL | AUS | AMAN | BORO | TOTAL |
| Seed Used | 3.70 | 2.54 | 0.85 | 2.33 | 3.71 | 1.21 | 1.02 | 1.66 | 3.99 | 1.73 | 0.73 | 1.92 | 3.99 | 4.84 | 0.90 | 3.65 |
| Feed loss (used as feed) | 1.00 | 1.18 | 0.34 | 0.73 | 1.26 | 0.42 | 0.76 | 0.68 | 0.20 | 0.26 | 0.26 | 0.21 | 0.90 | 0.66 | 0.38 | 0.64 |
| Post-harvest loss | | | | | | | | | | | | | | | | |
| Stacking loss | 0.58 | 0.98 | 0.35 | 0.74 | 0.39 | 1.64 | 1.00 | 1.22 | 0.00 | 0.35 | 1.12 | 0.48 | 0.30 | 1.07 | 0.77 | 0.84 |
| Carrying loss | 0.62 | 0.92 | 0.60 | 0.78 | 0.97 | 0.74 | 1.37 | 0.95 | 1.94 | 0.95 | 1.32 | 1.24 | 0.98 | 0.62 | 0.59 | 0.68 |
| Threshing by beating | 0.04 | 0.34 | 0.50 | 0.32 | 1.08 | 0.98 | 1.50 | 1.14 | 1.03 | 0.41 | 0.74 | 0.62 | 0.56 | 0.05 | 0.03 | 0.15 |
| Bull threshing | 0.62 | 0.27 | 0.00 | 0.27 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.83 | 0.00 | 0.45 | 0.64 | 0.13 | 0.14 | 0.23 |
| Beating after threshing | 0.01 | 0.32 | 0.13 | 0.21 | 0.26 | 0.32 | 0.18 | 0.27 | 0.00 | 0.17 | 0.00 | 0.09 | 0.21 | 0.02 | 0.00 | 0.05 |
| Paddle threshing loss | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.74 | 0.47 | 0.54 |
| Other threshing loss | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Winnowing loss | 0.78 | 0.57 | 0.42 | 0.57 | 0.46 | 0.71 | 0.56 | 0.62 | 0.96 | 0.71 | 0.55 | 0.72 | 0.61 | 0.63 | 0.51 | 0.59 |
| Drying loss:birds, goat etc. | 0.87 | 0.55 | 0.58 | 0.62 | 0.54 | 0.01 | 0.41 | 0.22 | 0.71 | 0.47 | 0.50 | 0.53 | 0.83 | 0.43 | 0.85 | 0.62 |
| Bad weather | 0.36 | 0.00 | 0.17 | 0.12 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.18 | 0.00 | 0.02 | 0.04 |
| Total post-harvest loss | 3.92 | 3.95 | 2.75 | 3.63 | 3.71 | 4.39 | 5.03 | 4.43 | 4.66 | 4.10 | 4.25 | 4.24 | 4.42 | 3.69 | 3.39 | 3.76 |
| Parboiling loss | 0.91 | 2.35 | 1.61 | 1.87 | 0.96 | 1.96 | 1.46 | 1.63 | 0.65 | 1.68 | 0.89 | 1.27 | 1.28 | 2.95 | 2.73 | 2.56 |
| Milling Loss | 0.49 | 1.41 | 1.88 | 1.35 | 0.63 | 1.56 | 0.86 | 1.19 | 1.05 | 1.21 | 2.28 | 1.46 | 0.28 | 0.53 | 1.73 | 0.79 |
| Total milling loss | 1.40 | 3.76 | 3.49 | 3.22 | 1.59 | 3.52 | 2.32 | 2.82 | 1.70 | 2.89 | 3.17 | 2.72 | 1.56 | 3.48 | 4.46 | 3.35 |
| Handling loss | 1.09 | 0.48 | 0.46 | 0.60 | 0.60 | 0.55 | 0.46 | 0.54 | 0.17 | 0.54 | 0.21 | 0.38 | 1.09 | 0.30 | 0.21 | 0.43 |
| Transportation loss | 0.46 | 0.38 | 0.38 | 0.40 | 0.20 | 0.48 | 0.24 | 0.36 | 0.20 | 0.21 | 0.18 | 0.20 | 0.18 | 0.46 | 0.30 | 0.36 |
| Storage loss | 2.09 | 3.17 | 0.86 | 2.35 | 3.29 | 1.10 | 0.98 | 1.51 | 0.82 | 1.13 | 0.95 | 1.02 | 1.69 | 0.73 | 0.91 | 0.97 |
| Total loss at farmers level | 13.66 | 15.46 | 9.13 | 13.25 | 14.36 | 11.67 | 10.81 | 12.00 | 11.74 | 10.86 | 9.75 | 10.70 | 13.83 | 14.16 | 10.55 | 13.16 |
| Weighted loss at traders level | 0.38 | 0.35 | 0.56 | 0.41 | 0.24 | 0.22 | 0.36 | 0.26 | 0.31 | 0.29 | 0.46 | 0.34 | 0.16 | 0.15 | 0.24 | 0.17 |
| GRAND TOTAL LOSS | 14.04 | 15.81 | 9.69 | 13.66 | 14.60 | 11.89 | 11.17 | 12.26 | 12.05 | 11.15 | 10.21 | 11.03 | 13.99 | 14.31 | 10.79 | 13.33 |

Appendix 4.1.1 : Region-wise Distribution of % Seed used by the Sample Households.

| Region | Aus | Aman | Boro | Wheat | Total |
|---|---|---|---|---|---|
| Chittagong-Noakhali | 1.77 | 1.60 | 0.78 | 0.00 | 1.28 |
| Mymensingh-Kishore-Jamalpur | 2.21 | 2.04 | 0.92 | 6.33 | 1.79 |
| Dhaka-Tangail | 4.43 | 1.70 | 0.90 | 8.00 | 1.96 |
| Comilla-Sylhet | 2.62 | 2.57 | 1.09 | 7.12 | 2.18 |
| Rajshahi-Bogra-Pabna | 3.70 | 2.54 | 0.85 | 2.61 | 2.08 |
| Rangpur-Dinajpur | 3.71 | 1.21 | 1.02 | 5.58 | 1.60 |
| Jessore-Kushtia-Khulna | 3.99 | 1.73 | 0.73 | 5.34 | 1.77 |
| Barisal-Faridpur-Patuakhali | 3.99 | 4.84 | 0.90 | 4.39 | 3.30 |
| Total (weighted) | 2.89 | 1.80 | 0.89 | 5.73 | 1.73 |

Appendix 4.1.2 : Germination Percentage of Stored Seed Sample

| Type of Container | Germination Percentage | | | | |
|---|---|---|---|---|---|
| | Aus | Aman | Boro | Wheat | Mean |
| Gunny Bag | 75.60 | 79.33 | 83.75 | 85.50 | 80.85 |
| Motka | 81.50 | 85.44 | 81.63 | 84.50 | 83.25 |
| Dool | 82.20 | 84.04 | 81.95 | 85.00 | 83.00 |
| Gola | 80.00 | 82.07 | 82.68 | - | 81.60 |
| Others (Tin Container) | - | - | 83.00 | - | 83.00 |
| Average (%) | 79.82 | 82.72 | 82.60 | 85.00 | 83.06 |

Appendix 4.2.1 : Feed Used in Specialized Farms During 1988-89.

| Region | Name of the Farm | No. of Cattle | No. of Poultry Birds | Qty. of Feed Ingredients (kg) | | | | | | | | | | Total Feed | Source of Rice | | Source of Wheat | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Rice | Wheat | Rice bran/ polish | Wheat bran | Oil cake | Fish meal | Salt | Oyster shell | Maize | Vitamins | | Local | Imported/ Food Dept. | Local | Imported/ Food Dept. |
| Chittagong | Poultry Farm,Satkania | | 400 | - | 7300 | 4380 | - | 1460 | 365 | - | 365 | 1460 | - | 15330 | | | 7300 | |
| Chittagong | Poultry Farm,Satkania | | 690 | - | 9417 | - | - | 1726 | 1570 | 78 | 471 | 2355 | 78 | 15695 | | | | |
| Mymensingh-Kishoregonj-Jamalpur | Poultry Farm, Bagadia (Govt.) | | 3544 | - | 63598 | 39748 | - | 15900 | 10600 | 662 | 1324 | - | 663 | 132495 | | | | |
| Mymensingh-Kishoregonj-Jamalpur | Poultry Farm, Barabugh | | 5000 | - | 38325 | 31937 | - | 10950 | 7300 | 457 | 1825 | - | 456 | 91250 | | | | |
| Dhaka-Tangail | Phoenix Poultry Ltd. | | 45000 | - | 1067625 | 748143 | - | 296700 | 189800 | 11862 | 23725 | 22325 | 12320 | 2372500 | | | 1068000 | |
| Dhaka-Tangail | Govt. Duck Farm | | 6000 | - | 175200 | 111000 | - | 42300 | 29200 | 1825 | 3650 | - | 1825 | 365000 | | | | |
| Dhaka-Tangail | Tulip Dairy Farm | 150 | - | - | - | 27880 | 75440 | 22960 | - | 1640 | - | 36080 | - | 164000 | | | | |
| Dhaka-Tangail | Dairy Farm,savar | 2441 | - | - | - | 410625 | 1231875 | 383250 | - | 27375 | - | 684375 | - | 2737500 | | | | |
| Dhaka-Tangail | Poultry Farm,Mirpur | | 16420 | - | 350400 | 219000 | - | 87600 | 58400 | 3650 | 7300 | - | 3650 | 730000 | | | | |
| Comilla-Sylhet | Echilee Poultry Farm | | 1250 | - | 23817 | 16936 | - | 6351 | 4498 | 265 | 794 | - | 264 | 52925 | | | | |
| Comilla-Sylhet | Echilee cattle Farm | 45 | | - | - | 7391 | 22174 | 7391 | - | 493 | - | 11826 | - | 49275 | | | | |
| Comilla-sylhe | National dev.poultry | | 450 | - | 6935 | 4672 | - | 1460 | 1022 | - | 292 | - | 219 | 14600 | | | 7000 | |
| Comilla-sylhe | Dhanty Poultry Farm | | 1500 | 17320 | 18050 | 4543 | - | 4928 | 2956 | - | 985 | - | 493 | 49275 | | | 18100 | |
| Raj-Bog-Pabna | Raypara cattle farm | 145 | - | - | - | 22229 | 71449 | 23021 | - | 2382 | - | 39694 | - | 158775 | | | | |
| Raj-Bog-Pabna | Govt. Poultry Farm | | 9465 | - | 62200 | 33719 | - | 8728 | 14972 | 839 | 4102 | 1365 | - | 125925 | | | 17825 | 44375 |
| Rang-Dinajpur | Govt. Poultry Farm | | 5091 | - | 58546 | 36792 | - | 14717 | 9811 | 613 | 1226 | - | 935 | 122640 | | | 22650 | 35896 |
| Rang-Dinajpur | Monranjan Poultry Far | | 2106 | - | 25112 | 17425 | - | 7307 | 5059 | 281 | 562 | - | 464 | 56210 | | | 40077 | |
| Jess-Kush-Khu | Govt. Poultry farm | | 8927 | - | 128704 | 49187 | - | 30000 | 49000 | 1017 | 1500 | - | - | 259408 | | | 97709 | 31995 |
| Bari-Far-Patu | Basudevpara Poultry | | 156 | 730 | 2628 | 1861 | - | 745 | 132 | 32 | 77 | - | - | 6205 | | | | |
| Total | | 2781 | 105993 | 18050 | 2037857 | 1787468 | 1400936 | 967494 | 384685 | 53471 | 48198 | 27505 | 21367 | 7519008 | | | | |

Appendix 4.2.2 : Feed in Ingredients Used in Feed Mill During 1988-89.

| Name of Feed Mills | Ingredients Used in Poultry and Cattle Feed (kg) | | | | | | | | | | | | Total Feed prepared during 1989-90 (Kg.) | Source of Rice | | Source of Wheat | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rice | Rice Polish | Wheat | Wheat bran | Maize | Pulse | Oilcake | Fish Meal | Oyster shell | Salt | Premix | Others | | Local | Imported/ Food Dept. | Local | Imported/ Food Dept. |
| Poultry Feed Mill, Mirpur. | - | 1080000 | 1728000 | - | - | - | 432000 | 288000 | 36000 | 18000 | 18000 | - | 3600000 | - | - | 948000 | 780000 |
| Cattle Feed Mill, Saver | - | 90000 | - | 270000 | - | 150000 | 84000 | - | - | 6000 | - | - | 600000 | - | - | - | - |

Appendix 4.2.3 : Storage Loss in Feed Mills (1989-90).

| Name of Feed mill | Storage loss of Rice (kg) | | | | | | | | Total storage loss (Rice) | Storage loss of wheat (kg) | | | | | | | | Total storage loss (wheat) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Qty stored | months | Qty Released | Evapo-ration | Rodent | Insect | Fungus | Others | | Qty storied | Months | Qty Released | Evapo-ration | Rodent | Insect | Fungus | Others | |
| Cattle Feed Mill, Savar. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Poultry Feed Mill, Mirpur | - | - | - | - | - | - | - | - | - | 20000 | 2 | 19800 | 40 | 40 | 40 | 40 | 40 | 200 |

## Appendix 4.3.1 : Aus Crop at Different Stage of Post Harvest Operation Loss by Region

| REGION | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BOLLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHT.-NOAKHALI | 712 | 252 | 218 | 672 | 9 | 521 | 0 | 667 | 736 | 149 | 3936 | 98520 |
| MEAN | 4.91 | 1.74 | 1.50 | 4.64 | .06 | 3.59 | 0.00 | 4.60 | 5.08 | 1.03 | 27.15 | 679.45 |
| % | .72 | .26 | .22 | .68 | .01 | .53 | 0.00 | .68 | .75 | .15 | 4.00 | |
| MYM+KISHORE+JAMA | 1301 | 2465 | 1736 | 288 | 1229 | 0 | 0 | 1456 | 1415 | 146 | 10035 | 226949 |
| MEAN | 5.68 | 10.76 | 7.58 | 1.26 | 5.37 | 0.00 | 0.00 | 6.36 | 6.18 | .64 | 43.82 | 991.04 |
| % | .57 | 1.09 | .76 | .13 | .54 | 0.00 | 0.00 | .64 | .62 | .06 | 4.42 | |
| DHAKA+TANGAIL | 223 | 85 | 0 | 187 | 0 | 0 | 0 | 95 | 230 | 85 | 905 | 30866 |
| MEAN | 2.12 | .81 | .00 | 1.78 | 0.00 | 0.00 | 0.00 | .91 | 2.19 | .81 | 8.62 | 293.96 |
| % | .72 | .27 | .00 | .60 | 0.00 | 0.00 | 0.00 | .31 | .74 | .28 | 2.93 | |
| COMILLA+SYLHET | 172 | 823 | 647 | 216 | 276 | 315 | 0 | 680 | 647 | 289 | 4064 | 105975 |
| MEAN | 1.09 | 5.24 | 4.12 | 1.38 | 1.76 | 2.01 | 0.00 | 4.33 | 4.12 | 1.84 | 25.88 | 675.00 |
| % | .16 | .78 | .61 | .20 | .26 | .30 | 0.00 | .64 | .61 | .27 | 3.83 | |
| RAJ+BOGRA+PABNA | 300 | 319 | 19 | 320 | 3 | 25 | 0 | 402 | 448 | 183 | 2019 | 51501 |
| MEAN | 2.38 | 2.53 | .15 | 2.54 | .02 | .20 | 0.00 | 3.19 | 3.55 | 1.45 | 16.02 | 408.74 |
| % | .58 | .62 | .04 | .62 | .01 | .05 | 0.00 | .78 | .87 | .36 | 3.92 | |
| RANGPUR+DINAJPUR | 104 | 255 | 284 | 1 | 69 | 0 | 2 | 120 | 141 | 2 | 977 | 26331 |
| MEAN | .51 | 1.26 | 1.40 | .00 | .34 | 0.00 | .01 | .59 | .69 | .01 | 4.81 | 129.71 |
| % | .39 | .97 | 1.08 | .00 | .26 | 0.00 | .01 | .46 | .54 | .01 | 3.71 | |
| JESS+KUSH+KHULNA | 0 | 2532 | 1348 | 0 | 0 | 0 | 0 | 1251 | 922 | 0 | 6053 | 130757 |
| MEAN | 0.00 | 26.38 | 14.04 | 0.00 | 0.00 | 0.00 | 0.00 | 13.03 | 9.60 | 0.00 | 63.05 | 1362.1 |
| % | 0.00 | 1.94 | 1.03 | 0.00 | 0.00 | 0.00 | 0.00 | .96 | .71 | 0.00 | 4.63 | |
| BAR+FAR+PATUAKHA | 108 | 358 | 206 | 234 | 77 | 39 | 0 | 222 | 304 | 64 | 1612 | 36506 |
| MEAN | .95 | 3.14 | 1.81 | 2.05 | .67 | .34 | 0.00 | 1.95 | 2.66 | .56 | 14.14 | 320.23 |
| % | .30 | .98 | .56 | .64 | .21 | .11 | 0.00 | .61 | .83 | .18 | 4.42 | |
| TOTAL | 2918 | 7089 | 4458 | 1917 | 1662 | 900 | 2 | 4895 | 4841 | 919 | 29601 | 707405 |
| MEAN | 2.48 | 6.03 | 3.79 | 1.63 | 1.41 | .77 | .00 | 4.17 | 4.12 | .78 | 25.19 | 602.05 |
| % | .41 | 1.00 | .63 | .27 | .23 | .13 | .00 | .69 | .68 | .13 | 4.18 | |
| S.E. MEAN | 0.153 | 0.329 | 0.215 | 0.147 | 0.115 | 0.126 | 0.000 | 0.196 | 0.172 | 0.081 | 0.943 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.3.2 : Loss of Aus Crop at Different Stage of Post Harvest Operation by Upazilas.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGUNIA | 71 | 35 | 11 | 0 | 0 | 136 | 0 | 52 | 81 | 0 | 386 | 12485 |
| MEAN | 1.51 | .75 | .23 | 0.00 | 0.00 | 2.90 | 0.00 | 1.11 | 1.72 | 0.00 | 8.22 | 265.64 |
| % | .57 | .28 | .09 | 0.00 | 0.00 | 1.09 | 0.00 | .42 | .65 | 0.00 | 3.09 | |
| SATKANIA | 222 | 90 | 135 | 654 | 0 | 0 | 0 | 273 | 426 | 0 | 1802 | 49237 |
| MEAN | 4.54 | 1.85 | 2.75 | 13.35 | 0.00 | 0.00 | 0.00 | 5.58 | 8.70 | 0.00 | 36.77 | 1004.8 |
| % | .45 | .18 | .27 | 1.33 | 0.00 | 0.00 | 0.00 | .55 | .87 | 0.00 | 3.66 | |
| FENI | 419 | 126 | 72 | 18 | 9 | 385 | 0 | 342 | 229 | 149 | 1748 | 36798 |
| MEAN | 8.55 | 2.57 | 1.47 | .36 | .18 | 7.85 | 0.00 | 6.98 | 4.66 | 3.05 | 35.68 | 750.98 |
| % | 1.14 | .34 | .20 | .05 | .02 | 1.05 | 0.00 | .93 | .62 | .41 | 4.75 | |
| TRISHAL | 1255 | 1148 | 969 | 246 | 648 | 0 | 0 | 630 | 935 | 146 | 5976 | 127701 |
| MEAN | 11.84 | 10.83 | 9.14 | 2.32 | 6.12 | 0.00 | 0.00 | 5.94 | 8.82 | 1.38 | 56.38 | 1204.7 |
| % | .98 | .90 | .76 | .19 | .51 | 0.00 | 0.00 | .49 | .73 | .11 | 4.68 | |
| KISHOREGONJ | 0 | 1293 | 764 | 2 | 576 | 0 | 0 | 807 | 463 | 0 | 3905 | 94546 |
| MEAN | 0.00 | 18.22 | 10.76 | .03 | 8.12 | 0.00 | 0.00 | 11.36 | 6.52 | 0.00 | 55.00 | 1331.6 |
| % | 0.00 | 1.37 | .81 | .00 | .61 | 0.00 | 0.00 | .85 | .49 | 0.00 | 4.13 | |
| SARISHABARI | 46 | 24 | 4 | 39 | 4 | 0 | 0 | 20 | 17 | 0 | 154 | 4702 |
| MEAN | .88 | .45 | .07 | .76 | .08 | 0.00 | 0.00 | .38 | .33 | 0.00 | 2.96 | 90.42 |
| % | .98 | .50 | .07 | .84 | .09 | 0.00 | 0.00 | .42 | .37 | 0.00 | 3.27 | |
| KALIAKAIR | 71 | 31 | 0 | 66 | 0 | 0 | 0 | 35 | 75 | 49 | 327 | 10636 |
| MEAN | 1.62 | .70 | 0.00 | 1.50 | 0.00 | 0.00 | 0.00 | .80 | 1.70 | 1.11 | 7.44 | 241.73 |
| % | .67 | .29 | 0.00 | .62 | 0.00 | 0.00 | 0.00 | .33 | .70 | .46 | 3.08 | |
| KALIHATI | 151 | 54 | 0 | 121 | 0 | 0 | 0 | 60 | 155 | 36 | 578 | 20230 |
| MEAN | 2.48 | .88 | .01 | 1.98 | 0.00 | 0.00 | 0.00 | .98 | 2.54 | .59 | 9.47 | 331.64 |
| % | .75 | .27 | .00 | .60 | 0.00 | 0.00 | 0.00 | .30 | .77 | .18 | 2.86 | |
| CHANDINA | 0 | 353 | 53 | 49 | 0 | 315 | 0 | 357 | 217 | 279 | 1623 | 48952 |
| MEAN | 0.00 | 5.19 | .77 | .72 | 0.00 | 4.63 | 0.00 | 5.24 | 3.20 | 4.10 | 23.86 | 719.88 |
| % | 0.00 | .72 | .11 | .10 | 0.00 | .64 | 0.00 | .73 | .44 | .57 | 3.31 | |
| CHANDPUR | 3 | 3 | 3 | 9 | 0 | 0 | 0 | 3 | 15 | 0 | 36 | 783 |
| MEAN | .07 | .07 | .06 | .19 | 0.00 | 0.00 | 0.00 | .06 | .33 | .01 | .78 | 17.02 |
| % | .38 | .42 | .34 | 1.13 | 0.00 | 0.00 | 0.00 | .35 | 1.91 | .06 | 4.60 | |
| HABIGONJ | 169 | 467 | 591 | 158 | 276 | 0 | 0 | 321 | 414 | 9 | 2405 | 56240 |
| MEAN | 3.92 | 10.85 | 13.75 | 3.68 | 6.41 | 0.00 | 0.00 | 7.46 | 9.63 | .22 | 55.93 | 1307.9 |
| % | .30 | .83 | 1.05 | .28 | .49 | 0.00 | 0.00 | .57 | .74 | .02 | 4.28 | |

Appendix 4.3.2 : Contd.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GABTALI | 0 | 13 | 13 | 0 | 0 | 0 | 0 | 8 | 13 | 0 | 47 | 896 |
| MEAN | 0.00 | .24 | .24 | 0.00 | 0.00 | 0.00 | 0.00 | .15 | .24 | 0.00 | .87 | 16.59 |
| % | 0.00 | 1.45 | 1.45 | 0.00 | 0.00 | 0.00 | 0.00 | .89 | 1.45 | 0.00 | 5.25 | |
| SHAHJADPUR | 300 | 306 | 6 | 320 | 3 | 25 | 0 | 394 | 435 | 183 | 1972 | 50605 |
| MEAN | 4.16 | 4.25 | .08 | 4.44 | .04 | .34 | 0.00 | 5.48 | 6.04 | 2.54 | 27.39 | 702.85 |
| % | .59 | .61 | .01 | .63 | .01 | .05 | 0.00 | .78 | .86 | .36 | 3.90 | |
| MITHAPUKUR | 103 | 131 | 188 | 0 | 69 | 0 | 2 | 48 | 28 | 0 | 566 | 16660 |
| MEAN | .78 | .99 | 1.42 | 0.00 | .52 | 0.00 | .02 | .36 | .21 | 0.00 | 4.29 | 126.21 |
| % | .62 | .78 | 1.13 | 0.00 | .41 | 0.00 | .01 | .29 | .17 | 0.00 | 3.40 | |
| CHIRIRBANDAR | 1 | 125 | 96 | 1 | 0 | 0 | 0 | 73 | 114 | 2 | 411 | 9671 |
| MEAN | .01 | 1.76 | 1.35 | .01 | 0.00 | 0.00 | 0.00 | 1.02 | 1.60 | .03 | 5.79 | 136.21 |
| % | .01 | 1.29 | .99 | .01 | 0.00 | 0.00 | 0.00 | .75 | 1.17 | .02 | 4.25 | |
| MANIRAMPUR | 0 | 1512 | 827 | 0 | 0 | 0 | 0 | 706 | 505 | 0 | 3551 | 78218 |
| MEAN | 0.00 | 23.26 | 12.73 | 0.00 | 0.00 | 0.00 | 0.00 | 10.87 | 7.78 | 0.00 | 54.63 | 1203.4 |
| % | 0.00 | 1.93 | 1.06 | 0.00 | 0.00 | 0.00 | 0.00 | .90 | .65 | 0.00 | 4.54 | |
| MEHERPUR | 0 | 1020 | 520 | 0 | 0 | 0 | 0 | 545 | 416 | 0 | 2502 | 52539 |
| MEAN | 0.00 | 32.92 | 16.78 | 0.00 | 0.00 | 0.00 | 0.00 | 17.58 | 13.43 | 0.00 | 80.71 | 1694.8 |
| % | 0.00 | 1.94 | .99 | 0.00 | 0.00 | 0.00 | 0.00 | 1.04 | .79 | 0.00 | 4.76 | |
| GAURNAD | 108 | 358 | 206 | 234 | 77 | 39 | 0 | 222 | 304 | 64 | 1612 | 36506 |
| MEAN | .95 | 3.14 | 1.81 | 2.05 | .67 | .34 | 0.00 | 1.95 | 2.66 | .56 | 14.14 | 320.23 |
| % | .30 | .98 | .56 | .64 | .21 | .11 | 0.00 | .61 | .83 | .18 | 4.42 | |
| TOTAL | 2918 | 7089 | 4458 | 1917 | 1662 | 900 | 2 | 4895 | 4841 | 919 | 29601 | 707405 |
| MEAN | 2.48 | 6.03 | 3.79 | 1.63 | 1.41 | .77 | .00 | 4.17 | 4.12 | .78 | 25.19 | 602.05 |
| % | .41 | 1.00 | .63 | .27 | .23 | .13 | .00 | .69 | .68 | .13 | 4.18 | |

Appendix 4.3.3 : Loss of Aus Crop at Different Stage of Post Harvest Operation by Variety.

| CROP AND VARIETY | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BULLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AUS LOCAL | 1047 | 3204 | 1922 | 811 | 656 | 115 | 2 | 1997 | 2017 | 360 | 12131 | 276091 |
| MEAN | 2.43 | 7.43 | 4.46 | 1.88 | 1.52 | .27 | .00 | 4.63 | 4.68 | .83 | 28.15 | 640.58 |
| % | .38 | 1.16 | .70 | .29 | .24 | .04 | .00 | .72 | .73 | .13 | 4.39 | |
| AUS MODERN | 1785 | 3715 | 2491 | 965 | 1000 | 775 | 0 | 2760 | 2645 | 502 | 16639 | 407205 |
| MEAN | 5.83 | 12.14 | 8.14 | 3.15 | 3.27 | 2.53 | 0.00 | 9.02 | 8.64 | 1.64 | 54.38 | 1330.7 |
| % | .44 | .91 | .61 | .24 | .25 | .19 | 0.00 | .68 | .65 | .12 | 4.09 | |
| MIXED AUS | 86 | 171 | 45 | 141 | 5 | 9 | 0 | 138 | 179 | 57 | 830 | 24109 |
| MEAN | 1.83 | 3.63 | .95 | 3.00 | .11 | .19 | 0.00 | 2.93 | 3.81 | 1.21 | 17.66 | 512.95 |
| % | .36 | .71 | .18 | .59 | .02 | .04 | 0.00 | .57 | .74 | .24 | 3.44 | |
| TOTAL | 2918 | 7089 | 4458 | 1917 | 1662 | 900 | 2 | 4895 | 4841 | 919 | 29601 | 707405 |
| MEAN | 3.72 | 9.04 | 5.69 | 2.45 | 2.12 | 1.15 | .00 | 6.24 | 6.18 | 1.17 | 37.76 | 902.30 |
| % | .41 | 1.00 | .63 | .27 | .23 | .13 | .00 | .69 | .68 | .13 | 4.18 | |

## Appendix 4.3.4 : Loss of Aman Crop at Different Stages of Post Harvest Operation by Region.

| REGION | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BOLLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHT.-NOAKHALI | 4382 | 1662 | 3995 | 74 | 2176 | 3252 | 229 | 6486 | 2381 | 0 | 24636 | 481578 |
| MEAN | 30.22 | 11.46 | 27.55 | .51 | 15.00 | 22.42 | 1.58 | 44.73 | 16.42 | 0.00 | 169.90 | 3321.23 |
| % | .91 | .35 | .83 | .02 | .45 | .68 | .05 | 1.35 | .49 | 0.00 | 5.12 | |
| MYM+KISHORE+JAMA | 4743 | 2151 | 3493 | 1977 | 1610 | 0 | 0 | 3979 | 4068 | 11 | 22033 | 531714 |
| MEAN | 20.71 | 9.39 | 15.25 | 8.63 | 7.03 | 0.00 | 0.00 | 17.38 | 17.76 | .05 | 96.21 | 2321.90 |
| % | .89 | .40 | .66 | .37 | .30 | 0.00 | 0.00 | .75 | .77 | .00 | 4.14 | |
| DHAKA+TANGAIL | 1782 | 1006 | 265 | 766 | 225 | 61 | 0 | 632 | 857 | 0 | 5592 | 148256 |
| MEAN | 16.97 | 9.58 | 2.52 | 7.30 | 2.14 | .58 | 0.00 | 6.02 | 8.16 | 0.00 | 53.26 | 1411.96 |
| % | 1.20 | .68 | .18 | .52 | .15 | .04 | 0.00 | .43 | .58 | 0.00 | 3.77 | |
| COMILLA+SYLHET | 2494 | 1327 | 1208 | 570 | 767 | 554 | 11 | 2025 | 1598 | 0 | 10553 | 221723 |
| MEAN | 15.88 | 8.45 | 7.69 | 3.63 | 4.89 | 3.53 | .07 | 12.90 | 10.18 | 0.00 | 67.21 | 1412.25 |
| % | 1.12 | .60 | .54 | .26 | .35 | .25 | .00 | .91 | .72 | 0.00 | 4.76 | |
| RAJ+BOGRA+PABNA | 1478 | 1385 | 518 | 404 | 481 | 0 | 0 | 857 | 823 | 5 | 5951 | 150512 |
| MEAN | 11.73 | 10.99 | 4.11 | 3.21 | 3.82 | 0.00 | 0.00 | 6.80 | 6.53 | .04 | 47.23 | 1194.54 |
| % | .98 | .92 | .34 | .27 | .32 | 0.00 | 0.00 | .57 | .55 | .00 | 3.95 | |
| RANGPUR+DINAJPUR | 12716 | 5707 | 7569 | 0 | 2443 | 0 | 0 | 5532 | 43 | 0 | 34010 | 775304 |
| MEAN | 62.64 | 28.11 | 37.28 | 0.00 | 12.03 | 0.00 | 0.00 | 27.25 | .21 | 0.00 | 167.53 | 3819.23 |
| % | 1.64 | .74 | .98 | 0.00 | .32 | 0.00 | 0.00 | .71 | .01 | 0.00 | 4.39 | |
| JESS+KUSH+KHULNA | 1179 | 3166 | 1372 | 2754 | 577 | 11 | 633 | 2372 | 1570 | 28 | 13664 | 333212 |
| MEAN | 12.28 | 32.98 | 14.30 | 28.69 | 6.01 | .12 | 6.60 | 24.71 | 16.35 | .29 | 142.33 | 3470.96 |
| % | .35 | .95 | .41 | .83 | .17 | .00 | .19 | .71 | .47 | .01 | 4.10 | |
| BAR+FAR+PATUAKHA | 592 | 340 | 26 | 73 | 10 | 406 | 0 | 349 | 239 | 0 | 2035 | 55228 |
| MEAN | 5.19 | 2.99 | .23 | .64 | .09 | 3.56 | 0.00 | 3.06 | 2.10 | 0.00 | 17.85 | 484.46 |
| % | 1.07 | .62 | .05 | .13 | .02 | .74 | 0.00 | .63 | .43 | 0.00 | 3.69 | |
| TOTAL | 29364 | 16744 | 18447 | 6618 | 8289 | 4283 | 873 | 22231 | 11579 | 45 | 118473 | 2697527 |
| MEAN | 24.99 | 14.25 | 15.70 | 5.63 | 7.05 | 3.65 | .74 | 18.92 | 9.85 | .04 | 100.83 | 2295.77 |
| % | 1.09 | .62 | .68 | .25 | .31 | .16 | .03 | .82 | .43 | .00 | 4.39 | |
| S.E. MEAN | 0.976 | 0.502 | 0.805 | 0.401 | 0.398 | 0.476 | 0.127 | 0.772 | 0.445 | 0.017 | 3.336 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.3.5 : Loss of Aman Crop at Different Stages of Post Harvest Operation by Upazila.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGUNIA | 1339 | 493 | 1773 | 0 | 1140 | 1286 | 20 | 3730 | 831 | 0 | 10612 | 199151 |
| MEAN | 28.50 | 10.50 | 37.72 | 0.00 | 24.25 | 27.36 | .43 | 79.36 | 17.69 | 0.00 | 225.80 | 4237.26 |
| % | .67 | .25 | .89 | 0.00 | .57 | .65 | .01 | 1.87 | .42 | 0.00 | 5.33 | |
| SATKANIA | 1489 | 544 | 2052 | 0 | 929 | 220 | 209 | 1327 | 569 | 0 | 7340 | 127455 |
| MEAN | 30.39 | 11.10 | 41.89 | 0.00 | 18.97 | 4.49 | 4.26 | 27.08 | 11.62 | 0.00 | 149.80 | 2601.12 |
| % | 1.17 | .43 | 1.61 | 0.00 | .73 | .17 | .16 | 1.04 | .45 | 0.00 | 5.76 | |
| FENI | 1553 | 625 | 170 | 74 | 106 | 1746 | 0 | 1429 | 980 | 0 | 6683 | 154972 |
| MEAN | 31.70 | 12.75 | 3.48 | 1.51 | 2.17 | 35.62 | 0.00 | 29.17 | 20.00 | 0.00 | 136.39 | 3162.69 |
| % | 1.00 | .40 | .11 | .05 | .07 | 1.13 | 0.00 | .92 | .63 | 0.00 | 4.31 | |
| TRISHAL | 2332 | 625 | 660 | 1974 | 377 | 0 | 0 | 2222 | 2339 | 11 | 10541 | 278086 |
| MEAN | 22.00 | 5.90 | 6.23 | 18.62 | 3.56 | 0.00 | 0.00 | 20.96 | 22.07 | .11 | 99.44 | 2623.45 |
| % | .84 | .22 | .24 | .71 | .14 | 0.00 | 0.00 | .80 | .84 | .00 | 3.79 | |
| KISHOREGONJ | 1513 | 985 | 2611 | 0 | 841 | 0 | 0 | 1489 | 1178 | 0 | 8617 | 175911 |
| MEAN | 21.32 | 13.87 | 36.78 | 0.00 | 11.85 | 0.00 | 0.00 | 20.97 | 16.59 | 0.00 | 121.36 | 2477.62 |
| % | .86 | .56 | 1.48 | 0.00 | .48 | 0.00 | 0.00 | .85 | .67 | 0.00 | 4.90 | |
| SARISHABARI | 898 | 541 | 222 | 3 | 392 | 0 | 0 | 269 | 551 | 0 | 2875 | 77717 |
| MEAN | 17.27 | 10.41 | 4.26 | .06 | 7.53 | 0.00 | 0.00 | 5.17 | 10.59 | 0.00 | 55.29 | 1494.56 |
| % | 1.16 | .70 | .29 | .00 | .50 | 0.00 | 0.00 | .35 | .71 | 0.00 | 3.70 | |
| KALIAKAIR | 587 | 353 | 205 | 43 | 219 | 61 | 0 | 320 | 376 | 0 | 2163 | 60625 |
| MEAN | 13.33 | 8.02 | 4.67 | .98 | 4.97 | 1.38 | 0.00 | 7.28 | 8.55 | 0.00 | 49.17 | 1377.84 |
| % | .97 | .58 | .34 | .07 | .36 | .10 | 0.00 | .53 | .62 | 0.00 | 3.57 | |
| KALIHATI | 1195 | 653 | 60 | 723 | 6 | 0 | 0 | 311 | 481 | 0 | 3429 | 87631 |
| MEAN | 19.59 | 10.70 | .98 | 11.85 | .10 | 0.00 | 0.00 | 5.11 | 7.88 | 0.00 | 56.21 | 1436.57 |
| % | 1.36 | .75 | .07 | .83 | .01 | 0.00 | 0.00 | .36 | .55 | 0.00 | 3.91 | |
| CHANDINA | 1115 | 594 | 100 | 244 | 72 | 388 | 0 | 604 | 497 | 0 | 3614 | 80351 |
| MEAN | 16.40 | 8.73 | 1.47 | 3.59 | 1.06 | 5.71 | 0.00 | 8.88 | 7.31 | 0.00 | 53.15 | 1181.63 |
| % | 1.39 | .74 | .12 | .30 | .09 | .48 | 0.00 | .75 | .62 | 0.00 | 4.50 | |
| CHANDPUR | 425 | 169 | 9 | 51 | 13 | 165 | 11 | 176 | 201 | 0 | 1221 | 24825 |
| MEAN | 9.24 | 3.68 | .19 | 1.12 | .28 | 3.59 | .24 | 3.83 | 4.37 | 0.00 | 26.54 | 539.67 |
| % | 1.71 | .68 | .03 | .21 | .05 | .67 | .04 | .71 | .81 | 0.00 | 4.92 | |
| HABIGONJ | 953 | 564 | 1099 | 274 | 682 | 0 | 0 | 1245 | 900 | 0 | 5718 | 116547 |
| MEAN | 22.17 | 13.11 | 25.56 | 6.37 | 15.87 | 0.00 | 0.00 | 28.95 | 20.93 | 0.00 | 132.97 | 2710.40 |
| % | .82 | .48 | .94 | .24 | .59 | 0.00 | 0.00 | 1.07 | .77 | 0.00 | 4.91 | |

Appendix 4.3.5 : Contd.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GABTALI | 856 | 630 | 441 | 6 | 383 | 0 | 0 | 434 | 116 | 0 | 2866 | 78681 |
| MEAN | 15.86 | 11.67 | 8.16 | .12 | 7.10 | 0.00 | 0.00 | 8.03 | 2.14 | 0.00 | 53.08 | 1457.06 |
| % | 1.09 | .80 | .56 | .01 | .49 | 0.00 | 0.00 | .55 | .15 | 0.00 | 3.64 | |
| SHAHJADPUR | 621 | 755 | 78 | 398 | 98 | 0 | 0 | 423 | 708 | 5 | 3085 | 71831 |
| MEAN | 8.63 | 10.48 | 1.08 | 5.52 | 1.36 | 0.00 | 0.00 | 5.88 | 9.83 | .07 | 42.84 | 997.65 |
| % | .86 | 1.05 | .11 | .55 | .14 | 0.00 | 0.00 | .59 | .99 | .01 | 4.29 | |
| MITHAPUKUR | 8377 | 3507 | 5037 | 0 | 2443 | 0 | 0 | 3794 | 0 | 0 | 23158 | 492995 |
| MEAN | 63.46 | 26.57 | 38.16 | 0.00 | 18.51 | 0.00 | 0.00 | 28.74 | 0.00 | 0.00 | 175.44 | 3734.81 |
| % | 1.70 | .71 | 1.02 | 0.00 | .50 | 0.00 | 0.00 | .77 | 0.00 | 0.00 | 4.70 | |
| CHIRIRBANDAR | 4339 | 2200 | 2532 | 0 | 0 | 0 | 0 | 1738 | 43 | 0 | 10852 | 282309 |
| MEAN | 61.12 | 30.98 | 35.66 | 0.00 | 0.00 | 0.00 | 0.00 | 24.48 | .61 | 0.00 | 152.84 | 3976.18 |
| % | 1.54 | .78 | .90 | 0.00 | 0.00 | 0.00 | 0.00 | .62 | .02 | 0.00 | 3.84 | |
| MANIRAMPUR | 0 | 2519 | 819 | 2175 | 366 | 0 | 633 | 1512 | 889 | 28 | 8940 | 217020 |
| MEAN | 0.00 | 38.75 | 12.60 | 33.45 | 5.63 | 0.00 | 9.74 | 23.26 | 13.67 | .44 | 137.54 | 3338.77 |
| % | 0.00 | 1.16 | .38 | 1.00 | .17 | 0.00 | .29 | .70 | .41 | .01 | 4.12 | |
| MEHERPUR | 1179 | 648 | 553 | 580 | 211 | 11 | 0 | 860 | 681 | 0 | 4723 | 116192 |
| MEAN | 38.04 | 20.89 | 17.85 | 18.70 | 6.81 | .36 | 0.00 | 27.75 | 21.98 | 0.00 | 152.36 | 3748.13 |
| % | 1.01 | .56 | .48 | .50 | .18 | .01 | 0.00 | .74 | .59 | 0.00 | 4.07 | |
| GAURNADI | 592 | 340 | 26 | 73 | 10 | 406 | 0 | 349 | 239 | 0 | 2035 | 55228 |
| MEAN | 5.19 | 2.99 | .23 | .64 | .09 | 3.56 | 0.00 | 3.06 | 2.10 | 0.00 | 17.85 | 484.46 |
| % | 1.07 | .62 | .05 | .13 | .02 | .74 | 0.00 | .63 | .43 | 0.00 | 3.69 | |
| TOTAL | 29364 | 16744 | 18447 | 6618 | 8289 | 4283 | 873 | 22231 | 11579 | 45 | 118473 | 2697527 |
| MEAN | 24.99 | 14.25 | 15.70 | 5.63 | 7.05 | 3.65 | .74 | 18.92 | 9.85 | .04 | 100.83 | 2295.77 |
| % | 1.09 | .62 | .68 | .25 | .31 | .16 | .03 | .82 | .43 | .00 | 4.39 | |

## Appendix 4.3.6 : Loss of Aman Crop at Different Stage of Post Harvest Operation by Variety.

| CROP AND VARIETY | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BULLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B.AMAN LOC | 2123 | 2732 | 305 | 1843 | 304 | 430 | 415 | 1823 | 1648 | 17 | 11640 | 260052 |
| MEAN | 6.74 | 8.67 | .97 | 5.85 | .97 | 1.37 | 1.32 | 5.79 | 5.23 | .06 | 36.95 | 825.56 |
| % | .82 | 1.05 | .12 | .71 | .12 | .17 | .16 | .70 | .63 | .01 | 4.48 | |
| MIXED AUS- | 495 | 265 | 57 | 272 | 10 | 15 | 0 | 195 | 219 | 0 | 1528 | 36510 |
| MEAN | 18.34 | 9.81 | 2.12 | 10.08 | .38 | .54 | 0.00 | 7.22 | 8.12 | 0.00 | 56.61 | 1352.22 |
| % | 1.36 | .73 | .16 | .75 | .03 | .04 | 0.00 | .53 | .60 | 0.00 | 4.19 | |
| T.AMAN LOC | 8643 | 4615 | 4841 | 1299 | 1662 | 95 | 0 | 4325 | 2122 | 5 | 27609 | 696732 |
| MEAN | 21.39 | 11.42 | 11.98 | 3.22 | 4.11 | .24 | .00 | 10.71 | 5.25 | .01 | 68.34 | 1724.58 |
| % | 1.24 | .66 | .69 | .19 | .24 | .01 | .00 | .62 | .30 | .00 | 3.96 | |
| T.AMAN MOD | 18103 | 9132 | 13243 | 3203 | 6312 | 3743 | 458 | 15888 | 7591 | 22 | 77696 | 1704233 |
| MEAN | 26.24 | 13.24 | 19.19 | 4.64 | 9.15 | 5.42 | .66 | 23.03 | 11.00 | .03 | 112.60 | 2462.76 |
| % | 1.06 | .54 | .78 | .19 | .37 | .22 | .03 | .93 | .45 | .00 | 4.56 | |
| TOTAL | 29364 | 16744 | 18447 | 6618 | 8289 | 4283 | 873 | 22231 | 11579 | 45 | 118473 | 2697527 |
| MEAN | 20.45 | 11.66 | 12.85 | 4.61 | 5.77 | 2.98 | .61 | 15.48 | 8.06 | .03 | 82.50 | 1875.89 |
| % | 1.09 | .62 | .68 | .25 | .31 | .16 | .03 | .82 | .43 | .00 | 4.39 | |

Conversion ratio, Paddy to Rice 0.679.

## Appendix 4.3.7 : Loss of Boro Crop at Different Stage of Post-harvest Operation by Region.

| REGION | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BOLLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CHT.-NOAKHALI | 1273 | 451 | 114 | 18 | 5 | 2234 | 0 | 1191 | 1401 | 37 | 6724 | 175575 |
| MEAN | 8.78 | 3.11 | .79 | .12 | .03 | 15.41 | 0.00 | 8.22 | 9.66 | .25 | 46.38 | 1210.86 |
| % | .72 | .26 | .07 | .01 | .00 | 1.27 | 0.00 | .68 | .80 | .02 | 3.83 | |
| MYM+KISHORE+JAMA | 2416 | 2543 | 1365 | 71 | 1208 | 0 | 35 | 1433 | 2063 | 101 | 11235 | 316372 |
| MEAN | 10.55 | 11.11 | 5.96 | .31 | 5.27 | 0.00 | .15 | 6.26 | 9.01 | .44 | 49.06 | 1381.54 |
| % | .76 | .80 | .43 | .02 | .38 | 0.00 | .01 | .45 | .65 | .03 | 3.55 | |
| DHAKA+TANGAIL | 4393 | 1373 | 1248 | 0 | 303 | 0 | 0 | 1072 | 2545 | 1259 | 12193 | 287335 |
| MEAN | 41.84 | 13.08 | 11.89 | 0.00 | 2.89 | 0.00 | 0.00 | 10.21 | 24.24 | 11.99 | 116.12 | 2736.52 |
| % | 1.53 | .48 | .43 | 0.00 | .11 | 0.00 | 0.00 | .37 | .89 | .44 | 4.24 | |
| COMILLA+SYLHET | 423 | 441 | 77 | 74 | 2 | 514 | 9 | 588 | 878 | 104 | 3110 | 82658 |
| MEAN | 2.69 | 2.81 | .49 | .47 | .02 | 3.27 | .06 | 3.75 | 5.59 | .66 | 19.81 | 526.48 |
| % | .51 | .53 | .09 | .09 | .00 | .62 | .01 | .71 | 1.06 | .13 | 3.76 | |
| RAJ+BOGRA+PABNA | 1391 | 2351 | 1969 | 0 | 510 | 0 | 0 | 1678 | 2283 | 681 | 10863 | 394871 |
| MEAN | 11.04 | 18.66 | 15.63 | 0.00 | 4.05 | 0.00 | 0.00 | 13.31 | 18.12 | 5.40 | 86.21 | 3133.90 |
| % | .35 | .60 | .50 | 0.00 | .13 | 0.00 | 0.00 | .42 | .58 | .17 | 2.75 | |
| RANGPUR+DINAJPUR | 3618 | 4959 | 5448 | 0 | 642 | 33 | 0 | 2031 | 1497 | 2 | 18230 | 362529 |
| MEAN | 17.82 | 24.43 | 26.84 | 0.00 | 3.16 | .16 | 0.00 | 10.01 | 7.37 | .01 | 89.81 | 1785.86 |
| % | 1.00 | 1.37 | 1.50 | 0.00 | .18 | .01 | 0.00 | .56 | .41 | .00 | 5.03 | |
| JESS+KUSH+KHULNA | 3434 | 4047 | 2269 | 4 | 0 | 0 | 1 | 1683 | 1536 | 25 | 12999 | 305671 |
| MEAN | 35.78 | 42.15 | 23.64 | .04 | 0.00 | 0.00 | .01 | 17.53 | 16.00 | .26 | 135.40 | 3184.07 |
| % | 1.12 | 1.32 | .74 | .00 | 0.00 | 0.00 | .00 | .55 | .50 | .01 | 4.25 | |
| BAR+FAR+PATUAKHA | 974 | 752 | 33 | 177 | 0 | 597 | 0 | 650 | 1079 | 24 | 4286 | 126304 |
| MEAN | 8.55 | 6.59 | .29 | 1.55 | 0.00 | 5.24 | 0.00 | 5.70 | 9.46 | .21 | 37.60 | 1107.93 |
| % | .77 | .59 | .03 | .14 | 0.00 | .47 | 0.00 | .51 | .85 | .02 | 3.39 | |
| TOTAL | 17922 | 16916 | 12524 | 343 | 2671 | 3379 | 44 | 10327 | 13281 | 2232 | 79640 | 2051315 |
| MEAN | 15.25 | 14.40 | 10.66 | .29 | 2.27 | 2.88 | .04 | 8.79 | 11.30 | 1.90 | 67.78 | 1745.80 |
| % | .87 | .82 | .61 | .02 | .13 | .16 | .00 | .50 | .65 | .11 | 3.88 | |
| S.E MEAN | 1.133 | 1.223 | 1.412 | 0.076 | 0.172 | 0.319 | 0.024 | 0.406 | 0.475 | 0.028 | 4.24 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

Appendix 4.3.8 : Loss of Boro Crop at Different Stage of Post-harvest Operation by Upazila.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS OURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RANGUNIA | 692 | 303 | 12 | 9 | 0 | 1698 | 0 | 705 | 1117 | 19 | 4555 | 120350 |
| MEAN | 14.72 | 6.45 | .25 | .19 | 0.00 | 36.12 | 0.00 | 15.00 | 23.77 | .40 | 96.91 | 2560.64 |
| % | .57 | .25 | .01 | .01 | 0.00 | 1.41 | 0.00 | .59 | .93 | .02 | 3.78 | |
| SATKANIA | 4 | 2 | 5 | 9 | 0 | 0 | 0 | 4 | 8 | 0 | 32 | 1055 |
| MEAN | .08 | .04 | .10 | .18 | 0.00 | 0.00 | 0.00 | .08 | .16 | 0.00 | .65 | 21.53 |
| % | .38 | .19 | .47 | .85 | 0.00 | 0.00 | 0.00 | .38 | .76 | 0.00 | 3.04 | |
| FENI | 577 | 146 | 98 | 0 | 5 | 537 | 0 | 483 | 275 | 18 | 2138 | 54170 |
| MEAN | 11.77 | 2.97 | 1.99 | 0.00 | .10 | 10.95 | 0.00 | 9.85 | 5.62 | .36 | 43.63 | 1105.51 |
| % | 1.07 | .27 | .18 | 0.00 | .01 | .99 | 0.00 | .89 | .51 | .03 | 3.95 | |
| TRISHAL | 826 | 1045 | 501 | 0 | 301 | 0 | 0 | 408 | 1237 | 80 | 4398 | 109134 |
| MEAN | 7.79 | 9.86 | 4.73 | 0.00 | 2.84 | 0.00 | 0.00 | 3.85 | 11.67 | .75 | 41.49 | 1029.57 |
| % | .76 | .96 | .46 | 0.00 | .28 | 0.00 | 0.00 | .37 | 1.13 | .07 | 4.03 | |
| KISHOREGONJ | 4 | 328 | 495 | 71 | 296 | 0 | 35 | 639 | 209 | 0 | 2077 | 52110 |
| MEAN | .06 | 4.62 | 6.97 | 1.00 | 4.17 | 0.00 | .49 | 8.99 | 2.94 | 0.00 | 29.25 | 733.94 |
| % | .01 | .63 | .95 | .14 | .57 | 0.00 | .07 | 1.23 | .40 | 0.00 | 3.99 | |
| SARISHABARI | 1586 | 1170 | 368 | 0 | 610 | 0 | 0 | 387 | 618 | 22 | 4761 | 155128 |
| MEAN | 30.51 | 22.50 | 7.08 | 0.00 | 11.73 | 0.00 | 0.00 | 7.44 | 11.88 | .42 | 91.56 | 2983.23 |
| % | 1.02 | .75 | .24 | 0.00 | .39 | 0.00 | 0.00 | .25 | .40 | .01 | 3.07 | |
| KALIAKAIR | 1794 | 648 | 491 | 0 | 115 | 0 | 0 | 446 | 937 | 566 | 4997 | 117219 |
| MEAN | 40.77 | 14.73 | 11.16 | 0.00 | 2.62 | 0.00 | 0.00 | 10.13 | 21.29 | 12.87 | 113.58 | 2664.07 |
| % | 1.53 | .55 | .42 | 0.00 | .10 | 0.00 | 0.00 | .38 | .80 | .48 | 4.26 | |
| KALIHATI | 2599 | 725 | 757 | 0 | 188 | 0 | 0 | 626 | 1608 | 692 | 7196 | 170116 |
| MEAN | 42.60 | 11.88 | 12.41 | 0.00 | 3.09 | 0.00 | 0.00 | 10.27 | 26.36 | 11.35 | 117.96 | 2788.79 |
| % | 1.53 | .43 | .45 | 0.00 | .11 | 0.00 | 0.00 | .37 | .95 | .41 | 4.23 | |
| CHANDINA | 94 | 203 | 18 | 5 | 0 | 234 | 9 | 177 | 132 | 46 | 917 | 31241 |
| MEAN | 1.38 | 2.98 | .26 | .07 | 0.00 | 3.44 | .13 | 2.60 | 1.95 | .67 | 13.49 | 459.43 |
| % | .30 | .65 | .06 | .02 | 0.00 | .75 | .03 | .57 | .42 | .15 | 2.94 | |
| CHANDPUR | 322 | 171 | 3 | 2 | 1 | 280 | 0 | 185 | 486 | 58 | 1508 | 36205 |
| MEAN | 7.00 | 3.72 | .06 | .04 | .01 | 6.09 | 0.00 | 4.03 | 10.56 | 1.27 | 32.78 | 787.07 |
| % | .89 | .47 | .01 | .01 | .00 | .77 | 0.00 | .51 | 1.34 | .16 | 4.16 | |
| HABIGONJ | 7 | 67 | 56 | 67 | 2 | 0 | 0 | 226 | 260 | 0 | 686 | 15212 |
| MEAN | .17 | 1.55 | 1.31 | 1.56 | .05 | 0.00 | 0.00 | 5.25 | 6.05 | 0.00 | 15.94 | 353.77 |
| % | .05 | .44 | .37 | .44 | .01 | 0.00 | 0.00 | 1.49 | 1.71 | 0.00 | 4.51 | |
| GABTALI | 0 | 1055 | 957 | 0 | 40 | 0 | 0 | 534 | 748 | 64 | 3398 | 115618 |
| MEAN | 0.00 | 19.54 | 17.72 | 0.00 | .74 | 0.00 | 0.00 | 9.89 | 13.86 | 1.19 | 62.93 | 2141.07 |
| % | 0.00 | .91 | .83 | 0.00 | .03 | 0.00 | 0.00 | .46 | .65 | .06 | 2.94 | |

Appendix 4.3.8 : Contd.

| UPAZILA NAME | STACK LOSS IN KG | LOSS OURING CARRY-ING | LOSS OURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SHAHJAOPUR | 1391 | 1296 | 1012 | 0 | 470 | 0 | 0 | 1144 | 1534 | 617 | 7463 | 279253 |
| MEAN | 19.31 | 17.99 | 14.06 | 0.00 | 6.53 | 0.00 | 0.00 | 15.88 | 21.31 | 8.57 | 103.66 | 3878.51 |
| % | .50 | .46 | .36 | 0.00 | .17 | 0.00 | 0.00 | .41 | .55 | .22 | 2.67 | |
| MITHAPUKUR | 1220 | 2292 | 1903 | 0 | 591 | 33 | 0 | 1174 | 1197 | 2 | 8411 | 230687 |
| MEAN | 9.24 | 17.36 | 14.42 | 0.00 | 4.48 | .25 | 0.00 | 8.90 | 9.07 | .02 | 63.72 | 1747.63 |
| % | .53 | .99 | .83 | 0.00 | .26 | .01 | 0.00 | .51 | .52 | .00 | 3.65 | |
| CHIRIRBANDAR | 2399 | 2668 | 3545 | 0 | 51 | 0 | 0 | 857 | 300 | 0 | 9819 | 131842 |
| MEAN | 33.79 | 37.57 | 49.93 | 0.00 | .72 | 0.00 | 0.00 | 12.07 | 4.22 | 0.00 | 138.30 | 1856.93 |
| % | 1.82 | 2.02 | 2.69 | 0.00 | .04 | 0.00 | 0.00 | .65 | .23 | 0.00 | 7.45 | |
| HANIRAMPUR | 3254 | 3858 | 2072 | 4 | 0 | 0 | 0 | 1513 | 1385 | 23 | 12107 | 284356 |
| MEAN | 50.06 | 59.36 | 31.87 | .06 | 0.00 | 0.00 | 0.00 | 23.27 | 21.30 | .35 | 186.26 | 4374.71 |
| % | 1.14 | 1.36 | .73 | .00 | 0.00 | 0.00 | 0.00 | .53 | .49 | .01 | 4.26 | |
| MEHERPUR | 181 | 188 | 198 | 0 | 0 | 0 | 1 | 171 | 151 | 2 | 892 | 21315 |
| MEAN | 5.83 | 6.08 | 6.38 | 0.00 | 0.00 | 0.00 | .02 | 5.51 | 4.88 | .06 | 28.76 | 687.58 |
| % | .85 | .88 | .93 | 0.00 | 0.00 | 0.00 | .00 | .80 | .71 | .01 | 4.18 | |
| GAURNADI | 974 | 752 | 33 | 177 | 0 | 597 | 0 | 650 | 1079 | 24 | 4286 | 126304 |
| MEAN | 8.55 | 6.59 | .29 | 1.55 | 0.00 | 5.24 | 0.00 | 5.70 | 9.46 | .21 | 37.60 | 1107.93 |
| % | .77 | .59 | .03 | .14 | 0.00 | .47 | 0.00 | .51 | .85 | .02 | 3.39 | |
| TOTAL | 17922 | 16916 | 12524 | 343 | 2671 | 3379 | 45 | 10327 | 13281 | 2232 | 79640 | 2051315 |
| MEAN | 15.25 | 14.40 | 10.66 | .29 | 2.27 | 2.88 | .04 | 8.79 | 11.30 | 1.90 | 67.78 | 1745.80 |
| % | .87 | .82 | .61 | .02 | .13 | .16 | .00 | .50 | .65 | .11 | 3.88 | |

## Appendix 4.3.9 : Loss of Boro Crop at Different Stage of Post-harvest Operation by Variety.

| CROP AND VARIETY | STACK LOSS IN KG | LOSS OURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BULLOCK THRESHING ABEATING | LOSS OURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BORO LOCAL | 1200 | 1872 | 1150 | 0 | 24 | 21 | 1 | 1019 | 884 | 21 | 6192 | 149291 |
| MEAN | 16.67 | 26.01 | 15.97 | 0.00 | .34 | .29 | .01 | 14.15 | 12.28 | .29 | 85.99 | 2073.49 |
| % | .80 | 1.25 | .77 | D.00 | .02 | .01 | .00 | .68 | .59 | .01 | 4.15 | |
| BORO MODERN | 16722 | 15044 | 11374 | 343 | 2647 | 3358 | 44 | 9309 | 12397 | 2211 | 73449 | 1902024 |
| MEAN | 15.16 | 13.64 | 10.31 | .31 | 2.40 | 3.04 | .04 | 8.44 | 11.24 | 2.00 | 66.59 | 1724.41 |
| % | .88 | .79 | .60 | .02 | .14 | .18 | .00 | .49 | .65 | .12 | 3.86 | |
| TOTAL | 17922 | 16916 | 12524 | 343 | 2671 | 3379 | 44 | 10327 | 13281 | 2232 | 79640 | 2051315 |
| MEAN | 15.25 | 14.40 | 10.66 | .29 | 2.27 | 2.88 | .04 | 8.79 | 11.30 | 1.90 | 67.78 | 1745.80 |
| % | .87 | .82 | .61 | .02 | .13 | .16 | .00 | .50 | .65 | .11 | 3.88 | |

## Appendix 4.3.10 : Loss of Wheat Crop at Different Stage of Post Harvest Operation by Region.

| REGION | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BOLLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-DWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MYM+KISHORE+JAHA | 0 | 40 | 125 | 65 | 21 | 0 | 3 | 200 | 161 | 0 | 616 | 16381 |
| MEAN | 0.00 | .61 | 1.89 | .99 | .32 | 0.00 | .05 | 3.04 | 2.44 | 0.00 | 9.34 | 248.20 |
| % | 0.00 | .24 | .76 | .40 | .13 | 0.00 | .02 | 1.22 | .98 | 0.00 | 3.76 | |
| DHAKA+TANGAIL | 85 | 33 | 65 | 1 | 0 | 0 | 0 | 33 | 121 | 23 | 361 | 14061 |
| MEAN | 1.49 | .57 | 1.13 | .02 | 0.00 | 0.00 | 0.00 | .59 | 2.13 | .40 | 6.33 | 246.68 |
| % | .60 | .23 | .46 | .01 | 0.00 | 0.00 | 0.00 | .24 | .86 | .16 | 2.57 | |
| COMILLA+SYLHET | 49 | 146 | 134 | 20 | 1 | 3 | 86 | 212 | 226 | 4 | 881 | 25108 |
| MEAN | .46 | 1.38 | 1.27 | .19 | .01 | .03 | .81 | 2.00 | 2.13 | .03 | 8.31 | 236.87 |
| % | .19 | .58 | .53 | .08 | .00 | .01 | .34 | .84 | .90 | .01 | 3.51 | |
| RAJ+BOGRA+PABNA | 57 | 68 | 58 | 1 | 18 | 0 | 0 | 57 | 73 | 28 | 360 | 14124 |
| MEAN | 3.38 | 4.00 | 3.39 | .06 | 1.08 | 0.00 | 0.00 | 3.34 | 4.30 | 1.66 | 21.20 | 830.82 |
| % | .41 | .48 | .41 | .01 | .13 | 0.00 | 0.00 | .40 | .52 | .20 | 2.55 | |
| RANGPUR+DINAJPUR | 141 | 122 | 399 | 0 | 1 | 0 | 0 | 265 | 34 | 0 | 962 | 36104 |
| MEAN | 1.72 | 1.49 | 4.86 | 0.00 | .01 | 0.00 | 0.00 | 3.23 | .42 | 0.00 | 11.74 | 440.29 |
| % | .39 | .34 | 1.10 | 0.00 | .00 | 0.00 | 0.00 | .73 | .09 | 0.00 | 2.67 | |
| JESS+KUSH+KHULNA | 607 | 579 | 364 | 0 | 0 | 0 | 6 | 327 | 212 | 2 | 2097 | 67971 |
| MEAN | 9.63 | 9.19 | 5.78 | 0.00 | 0.00 | 0.00 | .10 | 5.20 | 3.36 | .03 | 33.29 | 1078.9 |
| % | .89 | .85 | .54 | 0.00 | 0.00 | 0.00 | .01 | .48 | .31 | .00 | 3.09 | |
| BAR+FAR+PATUAKHA | 3 | 7 | 1 | 2 | 0 | 5 | 0 | 9 | 5 | 0 | 31 | 888 |
| MEAN | .75 | 1.63 | .25 | .50 | 0.00 | 1.25 | 0.00 | 2.13 | 1.25 | 0.00 | 7.75 | 222.00 |
| % | .34 | .73 | .11 | .23 | 0.00 | .56 | 0.00 | .96 | .56 | 0.00 | 3.49 | |
| TOTAL | 943 | 994 | 1145 | 90 | 41 | 8 | 95 | 1103 | 833 | 57 | 5309 | 174637 |
| MEAN | 2.39 | 2.52 | 2.90 | .23 | .10 | .02 | .24 | 2.79 | 2.11 | .14 | 13.44 | 442.12 |
| % | .54 | .57 | .66 | .05 | .02 | .00 | .05 | .63 | .48 | .03 | 3.04 | |
| S.E. MEAN | 0.268 | 0.287 | 0.209 | 0.057 | 0.036 | 0.010 | 0.053 | 0.189 | 0.149 | 0.045 | 0.884 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.3.11 : Loss of Wheat Crop at Different Stage of Post Harvest Operation by Upazila.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TRISHAL | 0 | 34 | 48 | 0 | 16 | 0 | 0 | 32 | 82 | 0 | 213 | 4948 |
| MEAN | 0.00 | 1.56 | 2.19 | 0.00 | .75 | 0.00 | 0.00 | 1.46 | 3.74 | 0.00 | 9.69 | 224.91 |
| % | 0.00 | .69 | .97 | 0.00 | .33 | 0.00 | 0.00 | .65 | 1.66 | 0.00 | 4.31 | |
| KISHOREGONJ | 0 | 6 | 77 | 65 | 5 | 0 | 3 | 168 | 79 | 0 | 403 | 11433 |
| MEAN | 0.00 | .13 | 1.74 | 1.49 | .11 | 0.00 | .07 | 3.83 | 1.80 | 0.00 | 9.16 | 259.84 |
| % | 0.00 | .05 | .67 | .57 | .04 | 0.00 | .03 | 1.47 | .69 | 0.00 | 3.52 | |
| KALIAKAIR | 27 | 10 | 18 | 0 | 0 | 0 | 0 | 10 | 42 | 1 | 109 | 3936 |
| MEAN | 1.35 | .50 | .92 | 0.00 | 0.00 | 0.00 | 0.00 | .52 | 2.12 | .07 | 5.47 | 196.80 |
| % | .69 | .25 | .47 | 0.00 | 0.00 | 0.00 | 0.00 | .26 | 1.08 | .04 | 2.78 | |
| KALIHATI | 58 | 23 | 46 | 1 | 0 | 0 | 0 | 23 | 79 | 21 | 251 | 10125 |
| MEAN | 1.57 | .61 | 1.25 | .03 | 0.00 | 0.00 | 0.00 | .62 | 2.13 | .58 | 6.79 | 273.65 |
| % | .57 | .22 | .46 | .01 | 0.00 | 0.00 | 0.00 | .23 | .78 | .21 | 2.48 | |
| CHANDINA | 45 | 92 | 115 | 19 | 1 | 2 | 1 | 58 | 68 | 4 | 405 | 11387 |
| MEAN | .71 | 1.46 | 1.83 | .30 | .02 | .03 | .02 | .91 | 1.09 | .06 | 6.42 | 180.75 |
| % | .39 | .81 | 1.01 | .17 | .01 | .02 | .01 | .51 | .60 | .03 | 3.55 | |
| CHANDPUR | 3 | 2 | 16 | 2 | 0 | 1 | 0 | 10 | 13 | 0 | 47 | 1170 |
| MEAN | .23 | .18 | 1.22 | .12 | 0.00 | .11 | 0.00 | .75 | .98 | 0.00 | 3.58 | 90.00 |
| % | .26 | .20 | 1.35 | .13 | 0.00 | .12 | 0.00 | .83 | 1.09 | 0.00 | 3.98 | |
| HABIGONJ | 1 | 52 | 3 | 0 | 0 | 0 | 85 | 144 | 145 | 0 | 430 | 12551 |
| MEAN | .03 | 1.73 | .10 | 0.00 | 0.00 | 0.00 | 2.82 | 4.81 | 4.83 | 0.00 | 14.33 | 418.37 |
| % | .01 | .41 | .02 | 0.00 | 0.00 | 0.00 | .67 | 1.15 | 1.16 | 0.00 | 3.43 | |
| GABTALI | 0 | 6 | 7 | 0 | 0 | 0 | 0 | 7 | 8 | 0 | 27 | 641 |
| MEAN | 0.00 | 1.20 | 1.40 | 0.00 | 0.00 | 0.00 | 0.00 | 1.30 | 1.50 | 0.00 | 5.40 | 128.20 |
| % | 0.00 | .94 | 1.09 | 0.00 | 0.00 | 0.00 | 0.00 | 1.01 | 1.17 | 0.00 | 4.21 | |
| SHAHJADPUR | 57 | 62 | 51 | 1 | 18 | 0 | 0 | 50 | 66 | 28 | 333 | 13483 |
| MEAN | 4.79 | 5.16 | 4.22 | .08 | 1.53 | 0.00 | 0.00 | 4.19 | 5.46 | 2.35 | 27.78 | 1123.6 |
| % | .43 | .46 | .38 | .01 | .14 | 0.00 | 0.00 | .37 | .49 | .21 | 2.47 | |
| MITHAPUKUR | 50 | 44 | 143 | 0 | 0 | 0 | 0 | 88 | 20 | 0 | 346 | 17821 |
| MEAN | 1.03 | .91 | 2.93 | 0.00 | 0.00 | 0.00 | 0.00 | 1.79 | .41 | 0.00 | 7.06 | 363.69 |
| % | .28 | .25 | .80 | 0.00 | 0.00 | 0.00 | 0.00 | .49 | .11 | 0.00 | 1.94 | |
| CHIRIRBANDAR | 91 | 78 | 255 | 0 | 1 | 0 | 0 | 177 | 14 | 0 | 617 | 18283 |
| MEAN | 2.76 | 2.36 | 7.74 | 0.00 | .02 | 0.00 | 0.00 | 5.38 | .43 | 0.00 | 18.68 | 554.03 |
| % | .50 | .43 | 1.40 | 0.00 | .00 | 0.00 | 0.00 | .97 | .08 | 0.00 | 3.37 | |

Appendix 4.3.11 : Contd.

| UPAZILA NAME | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS DURING SECOND BEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS I KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MANIRAMPUR | 265 | 358 | 158 | 0 | 0 | 0 | 0 | 161 | 120 | 0 | 1062 | 30086 |
| MEAN | 8.27 | 11.19 | 4.95 | 0.00 | 0.00 | 0.00 | 0.00 | 5.02 | 3.76 | 0.00 | 33.19 | 940.19 |
| % | .88 | 1.19 | .53 | 0.00 | 0.00 | 0.00 | 0.00 | .53 | .40 | 0.00 | 3.53 | |
| MEHERPUR | 342 | 221 | 206 | 0 | 0 | 0 | 6 | 167 | 91 | 2 | 1036 | 37885 |
| MEAN | 11.04 | 7.13 | 6.64 | 0.00 | 0.00 | 0.00 | .19 | 5.38 | 2.95 | .06 | 33.40 | 1222.1 |
| % | .90 | .58 | .54 | 0.00 | 0.00 | 0.00 | .02 | .44 | .24 | .01 | 2.73 | |
| GAURNADI | 3 | 7 | 1 | 2 | 0 | 5 | 0 | 9 | 5 | 0 | 31 | 888 |
| MEAN | .75 | 1.63 | .25 | .50 | 0.00 | 1.25 | 0.00 | 2.13 | 1.25 | 0.00 | 7.75 | 222.00 |
| % | .34 | .73 | .11 | .23 | 0.00 | .56 | 0.00 | .96 | .56 | 0.00 | 3.49 | |
| TOTAL | 943 | 994 | 1145 | 90 | 41 | 8 | 95 | 1103 | 833 | 57 | 5309 | 174637 |
| MEAN | 2.39 | 2.52 | 2.90 | .23 | .10 | .02 | .24 | 2.79 | 2.11 | .14 | 13.44 | 442.12 |
| % | .54 | .57 | .66 | .05 | .02 | .00 | .05 | .63 | .48 | .03 | 3.04 | |

## Appendix 4.3.12 : Loss of Wheat Crop at Different Stage of Post Harvest Operation by Variety.

| CROP AND VARIETY | STACK LOSS IN KG | LOSS DURING CARRY-ING | LOSS DURING BEATING | LOSS DURING THRES-HING | LOSS BULLOCK THRESHING ABEATING | LOSS DURING PADDLE THRESH | OTHER LOSSES IN KGS | WINN-OWING LOSS | DRY-ING LOSS | LOSS DUE W-EATHER | TOTAL LOSS IN KGS | TOTAL PROD-UCTION IN KGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| WHEAT MODERN | 943 | 994 | 1145 | 90 | 41 | 8 | 95 | 1103 | 833 | 57 | 5309 | 174637 |
| MEAN | 2.39 | 2.52 | 2.90 | .23 | .10 | .02 | .24 | 2.79 | 2.11 | .14 | 13.44 | 442.12 |
| % | .54 | .57 | .66 | .05 | .02 | .00 | .05 | .63 | .48 | .03 | 3.04 | |
| TOTAL | 943 | 994 | 1145 | 90 | 41 | 8 | 95 | 1103 | 833 | 57 | 5309 | 174637 |
| MEAN | 2.39 | 2.52 | 2.90 | .23 | .10 | .02 | .24 | 2.79 | 2.11 | .14 | 13.44 | 442.12 |
| % | .54 | .57 | .66 | .05 | .02 | .00 | .05 | .63 | .48 | .03 | 3.04 | |

## Appendix 4.4.1 : Loss in kg During Parboiling & Drying by Region for Aus Grains

| NAME OF REGION:- | QUANTITY BEFORE PARBOIL & DRYING | QUANTITY AFTER PARBOIL & DRYING | TOTAL LOSS IN SOAKING | LOSS DUE TO POULTRY EATING | LOSS DUE TO CATTLE EATING | LOSS DUE TO OTHER REASONS | TOTAL LOSS DUE TO ALL CASES | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|
| CHITTAGONG/NOAKHA | 25310 | 24963 | 209 | 138 | 0 | 0 | 346 | 145 |
| DIVIDE | 174.55 | 172.16 | 1.44 | .95 | .00 | 0.00 | 2.39 | |
| % | 100 | 98.63 | 0.82 | 0.55 | 0.00 | 0.00 | 1.37 | |
| MYMEN/KISHORE/JAM | 121108 | 119984 | 452 | 575 | 20 | 78 | 1125 | 229 |
| DIVIDE | 528.86 | 523.95 | 1.97 | 2.51 | .09 | .34 | 4.91 | |
| % | 100 | 99.07 | 0.37 | 0.47 | 0.02 | 0.07 | 0.93 | |
| DHAKA/TANGAIL | 5315 | 5274 | 13 | 18 | 7 | 3 | 41 | 105 |
| DIVIDE | 50.62 | 50.23 | .12 | .18 | .07 | .03 | .39 | |
| % | 100 | 99.23 | 0.24 | 0.34 | 0.13 | 0.06 | 0.77 | |
| COMILLA/SYLHET | 70952 | 70155 | 421 | 305 | 54 | 17 | 797 | 157 |
| DIVIDE | 451.92 | 446.85 | 2.68 | 1.94 | .35 | .11 | 5.08 | |
| % | 100 | 98.88 | 0.59 | 0.43 | 0.08 | 0.02 | 1.12 | |
| RAJSHAHI/BOGRA/PA | 20886 | 20695 | 38 | 138 | 16 | 0 | 191 | 126 |
| DIVIDE | 165.76 | 164.25 | .30 | 1.10 | .12 | 0.00 | 1.52 | |
| % | 100 | 99.09 | 0.18 | 0.66 | 0.07 | 0.00 | 0.91 | |
| RANGPUR/DINAJPUR | 16722 | 16562 | 111 | 29 | 10 | 11 | 160 | 203 |
| DIVIDE | 82.37 | 81.59 | .54 | .14 | .05 | .05 | .79 | |
| % | 100 | 99.04 | 0.66 | 0.17 | 0.06 | 0.07 | 0.96 | |
| JES/KUSHTIA/KHULN | 79183 | 78669 | 278 | 169 | 61 | 7 | 514 | 96 |
| DIVIDE | 824.82 | 819.47 | 2.89 | 1.76 | .64 | .07 | 5.35 | |
| % | 100 | 99.35 | 0.35 | 0.21 | 0.08 | 0.01 | 0.65 | |
| BAR/FAR/PATUAKHAL | 16869 | 16653 | 124 | 91 | 1 | 0 | 216 | 114 |
| DIVIDE | 147.97 | 146.08 | 1.09 | .79 | .01 | 0.00 | 1.89 | |
| % | 100 | 98.72 | 0.73 | 0.54 | 0.01 | 0.00 | 1.28 | |
| TOTAL | 356345 | 352955 | 1644 | 1462 | 169 | 115 | 3390 | 1175 |
| DIVIDE | 303.27 | 300.39 | 1.40 | 1.24 | .14 | .10 | 2.89 | |
| % | 100 | 99.05 | 0.46 | 0.41 | 0.05 | 0.03 | 0.95 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.2 : Loss in kg During Parboiling & Drying by Region for Aman Grains

| NAME OF REGION:- | QUANTITY BEFORE PARBOIL & DRYING | QUANTITY AFTER PARBOIL & DRYING | TOTAL LOSS IN SOAKING | LOSS DUE TO POULTRY EATING | LOSS DUE TO CATTLE EATING | LOSS DUE TO OTHER REASONS | TOTAL LOSS DUE TO ALL CASES | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|
| CHITTAGONG/NOAKHA | 76894 | 75543 | 746 | 606 | 0 | 0 | 1351 | 145 |
| DIVIDE | 530.30 | 520.98 | 5.14 | 4.18 | 0.00 | 0.00 | 9.32 | |
| % | 100 | 98.24 | 0.97 | 0.79 | 0.00 | 0.00 | 1.76 | |
| MYMEN/KISHORE/JAM | 322368 | 315654 | 4563 | 1951 | 120 | 81 | 6714 | 229 |
| DIVIDE | 1407.72 | 1378.40 | 19.93 | 8.52 | .52 | .35 | 29.32 | |
| % | 100 | 97.92 | 1.41 | 0.60 | 0.04 | 0.03 | 2.08 | |
| DHAKA/TANGAIL | 82399 | 79754 | 1152 | 1444 | 23 | 26 | 2645 | 105 |
| DIVIDE | 784.75 | 759.56 | 10.97 | 13.75 | .21 | .25 | 25.19 | |
| % | 100 | 96.79 | 1.40 | 1.75 | 0.03 | 0.03 | 3.21 | |
| COMILLA/SYLHET | 135777 | 132347 | 1765 | 1345 | 129 | 191 | 3430 | 157 |
| DIVIDE | 864.82 | 842.98 | 11.24 | 8.57 | .82 | 1.22 | 21.85 | |
| % | 100 | 97.47 | 1.30 | 0.99 | 0.10 | 0.14 | 2.53 | |
| RAJSHAHI/BOGRA/PA | 55938 | 54621 | 536 | 766 | 15 | 0 | 1316 | 126 |
| DIVIDE | 443.95 | 433.50 | 4.25 | 6.08 | .12 | 0.00 | 10.45 | . |
| % | 100 | 97.65 | 0.96 | 1.37 | 0.02 | 0.00 | 2.35 | |
| RANGPUR/DINAJPUR | 266084 | 260861 | 3326 | 1533 | 339 | 25 | 5223 | 203 |
| DIVIDE | 1310.76 | 1285.03 | 16.39 | 7.55 | 1.67 | .12 | 25.73 | |
| % | 100 | 98.04 | 1.25 | 0.57 | 0.13 | 0.01 | 1.96 | |
| JES/KUSHTIA/KHULN | 186918 | 183783 | 1119 | 1757 | 174 | 86 | 3135 | 96 |
| DIVIDE | 1947.06 | 1914.40 | 11.65 | 18.30 | 1.81 | .89 | 32.66 | |
| % | 100 | 98.32 | 0.60 | 0.94 | 0.09 | 0.05 | 1.68 | |
| BAR/FAR/PATUAKHAL | 41690 | 40459 | 954 | 246 | 26 | 5 | 1231 | 114 |
| DIVIDE | 365.70 | 354.90 | 8.37 | 2.15 | .23 | .05 | 10.80 | |
| % | 100 | 97.05 | 2.29 | 0.59 | 0.06 | 0.01 | 2.95 | |
| TOTAL | 1168067 | 1143021 | 14161 | 9647 | 824 | 414 | 25046 | 1175 |
| DIVIDE | 994.10 | 972.78 | 12.05 | 8.21 | .70 | .35 | 21.32 | |
| % | 100 | 98.86 | 1.21 | 0.83 | 0.07 | 0.03 | 2.14 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.3 : Loss in kg During Parboiling & Drying by Region for Boro Crops

| NAME OF REGION:- | QUANTITY BEFORE PARBOIL & DRYING | QUANTITY AFTER PARBOIL & DRYING | TOTAL LOSS IN SOAKING | LOSS DUE TO POULTRY EATING | LOSS DUE TO CATTLE EATING | LOSS DUE TO OTHER REASONS | TOTAL LOSS DUE TO ALL CASES | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|
| CHITTAGONG/NOAKHA | 30366 | 29996 | 231 | 140 | 0 | 0 | 371 | 145 |
| DIVIDE | 209.42 | 206.87 | 1.59 | .97 | 0.00 | 0.00 | 2.56 | |
| % | | 98.78 | .76 | .46 | 0.00 | 0.00 | 1.22 | |
| MYMEN/KISHORE/JAM | 178012 | 174663 | 2202 | 1029 | 64 | 55 | 3350 | 229 |
| DIVIDE | 777.35 | 762.72 | 9.62 | 4.49 | .28 | .24 | 14.63 | |
| % | | 98.12 | 1.24 | .58 | .03 | .03 | 1.88 | |
| DHAKA/TANGAIL | 87986 | 84926 | 2192 | 780 | 84 | 4 | 3060 | 105 |
| DIVIDE | 837.96 | 808.82 | 20.88 | 7.43 | .80 | .04 | 29.14 | |
| % | | 96.52 | 2.49 | .89 | .10 | .00 | 3.48 | |
| COMILLA/SYLHET | 55142 | 53981 | 754 | 325 | 37 | 46 | 1162 | 157 |
| DIVIDE | 351.22 | 343.83 | 4.80 | 2.07 | .23 | .30 | 7.40 | |
| % | | 97.89 | 1.37 | .59 | .07 | .08 | 2.11 | |
| RAJSHAHI/BOGRA/PABNA | 123665 | 121679 | 394 | 1536 | 55 | 0 | 1986 | 126 |
| DIVIDE | 981.47 | 965.71 | 3.13 | 12.19 | .44 | 0.00 | 15.76 | |
| % | | 98.40 | .32 | 1.24 | .04 | 0.00 | 1.60 | |
| RANGPUR/DINAJPUR | 145969 | 143835 | 1313 | 713 | 7 | 100 | 2134 | 203 |
| DIVIDE | 719.06 | 708.55 | 6.47 | 3.51 | .04 | .49 | 10.51 | |
| % | | 98.54 | .90 | .49 | .01 | .07 | 1.46 | |
| JES/KUSTIA/KHULNA | 115483 | 114457 | 636 | 311 | 78 | 0 | 1026 | 96 |
| DIVIDE | 1202.95 | 1192.26 | 6.63 | 3.24 | .82 | 0.00 | 10.68 | |
| % | | 99.11 | .55 | .27 | .07 | 0.00 | .89 | |
| BAR/FAR/PATUAKHAL | 66342 | 64533 | 1090 | 684 | 34 | 0 | 1809 | 114 |
| DIVIDE | 581.95 | 566.08 | 9.56 | 6.00 | .30 | 0.00 | 15.86 | |
| % | | 97.27 | 1.65 | 1.03 | .05 | 0.00 | 2.73 | |
| TOTAL | 802966 | 788070 | 8813 | 5517 | 360 | 206 | 14896 | 1175 |
| DIVIDE | 683.38 | 670.70 | 7.50 | 4.70 | .31 | .18 | 12.68 | |
| % | | 98.14 | 1.10 | .69 | .04 | .03 | 1.86 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.4 : Parboiling and Drying Loss (kg) by Region and Crop-variety at Millers Level

| REGION | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| CHITTAGONG-NOAKHALI | AUS LOCAL | 78564 | 77491 | 745 | 308 | 20 | 0 | 1073 |
| | MEAN | 78564.00 | 77491.00 | 745.00 | 308.00 | 20.00 | 0.00 | 1073.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .95 | .39 | .03 | 0.00 | 1.37 |
| | AUS MODERN | 220044 | 217097 | 1846 | 1070 | 31 | 0 | 2947 |
| | MEAN | 220044.0 | 217097.0 | 1846.00 | 1070.00 | 31.00 | 0.00 | 2947.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .84 | .49 | .01 | 0.00 | 1.34 |
| | B.AMAN LOCAL | 113366 | 111392 | 1240 | 707 | 27 | 0 | 1974 |
| | MEAN | 113366.0 | 111392.0 | 1240.00 | 707.00 | 27.00 | 0.00 | 1974.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.09 | .62 | .02 | 0.00 | 1.74 |
| | T.AMAN LOCAL | 107946 | 106096 | 1157 | 670 | 23 | 0 | 1850 |
| | MEAN | 107946.0 | 106096.0 | 1157.00 | 670.00 | 23.00 | 0.00 | 1850.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.07 | .62 | .02 | 0.00 | 1.71 |
| | T.AMAN MODERN | 226600 | 222594 | 2776 | 1174 | 56 | 0 | 4006 |
| | MEAN | 226600.0 | 222594.0 | 2776.00 | 1174.00 | 56.00 | 0.00 | 4006.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.23 | .52 | .02 | 0.00 | 1.77 |
| | BORO LOCAL | 46284 | 45665 | 412 | 186 | 21 | 0 | 619 |
| | MEAN | 46284.00 | 45665.00 | 412.00 | 186.00 | 21.00 | 0.00 | 619.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .89 | .40 | .05 | 0.00 | 1.34 |
| | BORO MODERN | 326976 | 322772 | 2248 | 1896 | 60 | 0 | 4204 |
| | MEAN | 326976.0 | 322772.0 | 2248.00 | 1896.00 | 60.00 | 0.00 | 4204.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .69 | .58 | .02 | 0.00 | 1.29 |
| SUM | | 1119780 | 1103107 | 10424 | 6011 | 238 | 0 | 16673 |
| MEAN | | 159968.6 | 157586.7 | 1489.14 | 858.71 | 34.00 | 0.00 | 2381.86 |
| VALIDN | | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| % | | | | .93 | .54 | .02 | 0.00 | 1.49 |
| MYMENSINGH-KISHOREGONJ-JAMALPUR | BORO MODERN | 679335 | 677138 | 1728 | 181 | 288 | 0 | 2197 |
| | MEAN | 339667.5 | 338568.8 | 864.14 | 90.51 | 144.03 | 0.00 | 1098.68 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .25 | .03 | .04 | 0.00 | .32 |

Appendix 4.4.4 : Contd.

| REGION | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| SUM | | 679335 | 677138 | 1728 | 181 | 288 | 0 | 2197 |
| MEAN | | 339667.5 | 338568.8 | 864.14 | 90.51 | 144.03 | 0.00 | 1098.68 |
| VALIDN | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | .25 | .03 | .04 | 0.00 | .32 |
| DHAKA-TANGAIL | AUS LOCAL | 7464 | 7364 | 50 | 40 | 6 | 4 | 100 |
| | MEAN | 7464.00 | 7364.00 | 50.00 | 40.00 | 6.00 | 4.00 | 100.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .67 | .54 | .08 | .05 | 1.34 |
| | T.AMAN LOCAL | 597120 | 592144 | 2900 | 1076 | 600 | 400 | 4976 |
| | MEAN | 597120.0 | 592144.0 | 2900.00 | 1076.00 | 600.00 | 400.00 | 4976.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .49 | .18 | .10 | .07 | .83 |
| | T.AMAN MODERN | 373200 | 368999 | 2100 | 1200 | 700 | 201 | 4201 |
| | MEAN | 186600.0 | 184499.5 | 1050.00 | 600.00 | 350.00 | 100.50 | 2100.50 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .56 | .32 | .19 | .05 | 1.13 |
| | BORO MODERN | 1903320 | 1885980 | 9000 | 4340 | 2750 | 1250 | 17340 |
| | MEAN | 634440.0 | 628660.0 | 3000.00 | 1446.67 | 916.67 | 416.67 | 5780.00 |
| | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | % | | | .47 | .23 | .14 | .07 | .91 |
| SUM | | 2881104 | 2854487 | 14050 | 6656 | 4056 | 1855 | 26617 |
| MEAN | | 411586.3 | 407783.9 | 2007.14 | 950.86 | 579.43 | 265.00 | 3802.43 |
| VALIDN | | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| % | | | | .49 | .23 | .14 | .06 | .92 |
| COMILLA-SYLHET | AUS MODERN | 277500 | 276500 | 200 | 200 | 600 | 0 | 1000 |
| | MEAN | 277500.0 | 276500.0 | 200.00 | 200.00 | 600.00 | 0.00 | 1000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .07 | .07 | .22 | 0.00 | .36 |
| | B.AMAN LOCAL | 820000 | 813559 | 4955 | 1486 | 0 | 0 | 6441 |
| | MEAN | 820000.0 | 813558.9 | 4954.68 | 1486.40 | 0.00 | 0.00 | 6441.08 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .60 | .18 | 0.00 | 0.00 | .79 |
| | T.AMAN MODERN | 1473358 | 1462103 | 5835 | 2247 | 3173 | 0 | 11255 |
| | MEAN | 491119.3 | 487367.8 | 1944.91 | 748.84 | 1057.79 | 0.00 | 3751.54 |
| | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | % | | | .40 | .15 | .22 | 0.00 | .76 |

Appendix 4.4.4 : Contd.

| REGION | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| | BORO MODERN | 3568578 | 3513585 | 42958 | 10821 | 1000 | 214 | 54993 |
| | MEAN | 892144.5 | 878396.2 | 10739.50 | 2705.16 | 250.00 | 53.60 | 13748.28 |
| | VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | % | | | 1.20 | .30 | .03 | .01 | 1.54 |
| SUM | | 6139436 | 6065747 | 53947 | 14754 | 4773 | 214 | 73689 |
| MEAN | | 682159.6 | 673971.9 | 5994.16 | 1639.28 | 530.37 | 23.82 | 8187.64 |
| VALIDN | | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| % | | | | .88 | .24 | .08 | .00 | 1.20 |
| RAJSHAHI-BOGRA-PABNA | AUS MODERN | 8212 | 8172 | 20 | 20 | 0 | 0 | 40 |
| | MEAN | 4106.00 | 4086.00 | 10.00 | 10.00 | 0.00 | 0.00 | 20.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .24 | .24 | 0.00 | 0.00 | .49 |
| | T.AMAN MODERN | 74660 | 74366 | 150 | 144 | 0 | 0 | 294 |
| | MEAN | 37330.00 | 37183.00 | 75.00 | 72.00 | 0.00 | 0.00 | 147.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .20 | .19 | 0.00 | 0.00 | .39 |
| | BORO MODERN | 48539 | 48189 | 175 | 175 | 0 | 0 | 350 |
| | MEAN | 24269.50 | 24094.50 | 87.50 | 87.50 | 0.00 | 0.00 | 175.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .36 | .36 | 0.00 | 0.00 | .72 |
| SUM | | 131411 | 130727 | 345 | 339 | 0 | 0 | 684 |
| MEAN | | 21901.83 | 21787.83 | 57.50 | 56.50 | 0.00 | 0.00 | 114.00 |
| VALIDN | | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | .26 | .26 | 0.00 | 0.00 | .52 |
| RANGPUR-DINAJPUR | AUS LOCAL | 676770 | 672393 | 1095 | 1665 | 1117 | 500 | 4377 |
| | MEAN | 169192.5 | 168098.3 | 273.78 | 416.20 | 279.24 | 125.00 | 1094.22 |
| | VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | % | | | .16 | .25 | .17 | .07 | .65 |
| | AUS MODERN | 2000000 | 1980000 | 12000 | 5000 | 3000 | 0 | 20000 |
| | MEAN | 2000000 | 1980000 | 12000.00 | 5000.00 | 3000.00 | 0.00 | 20000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .60 | .25 | .15 | 0.00 | 1.00 |
| | T.AMAN LOCAL | 249600 | 248497 | 250 | 250 | 503 | 100 | 1103 |
| | MEAN | 124800.0 | 124248.5 | 125.00 | 125.00 | 251.50 | 50.00 | 551.50 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .10 | .10 | .20 | .04 | .44 |

Appendix 4.4.4 : Contd.

| REGION | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| | T.AMAN MODERN | 1492720 | 1479677 | 8976 | 3801 | 267 | 0 | 13043 |
| | MEAN | 746360.0 | 739838.4 | 4487.85 | 1900.46 | 133.34 | 0.00 | 6521.65 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .60 | .25 | .02 | 0.00 | .87 |
| | BORO MODERN | 97058 | 96105 | 650 | 303 | 0 | 0 | 953 |
| | MEAN | 97058.00 | 96104.75 | 649.94 | 303.31 | 0.00 | 0.00 | 953.25 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .67 | .31 | 0.00 | 0.00 | .98 |
| SUM | | 4516148 | 4476672 | 22971 | 11019 | 4887 | 600 | 39476 |
| MEAN | | 451614.8 | 447667.2 | 2297.08 | 1101.90 | 488.66 | 60.00 | 3947.64 |
| VALIDN | | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| % | | | | .51 | .24 | .11 | .01 | .87 |
| TOTAL | | 15467214 | 15307877 | 103465 | 38960 | 14242 | 2669 | 159337 |
| MEAN | | 377249.1 | 373362.9 | 2523.55 | 950.23 | 347.37 | 65.11 | 3886.26 |
| VALIDN | | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| % | | | | .67 | .25 | .09 | .02 | 1.03 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix - 4.4.5 : Parboiling and Drying Loss (kg) by Upazila and Crop-variety at Millers Level.

| NAME OF UPAZILA | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| FENI | AUS LOCAL | 78564 | 77491 | 745 | 308 | 20 | 0 | 1073 |
| | MEAN | 78564.00 | 77491.00 | 745.00 | 308.00 | 20.00 | 0.00 | 1073.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .95 | .39 | .03 | 0.00 | 1.37 |
| | AUS MODERN | 220144 | 217097 | 1846 | 1070 | 31 | 0 | 2947 |
| | MEAN | 220044.0 | 217097.0 | 1846.00 | 1070.00 | 31.00 | 0.00 | 2947.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .84 | .49 | .01 | 0.00 | 1.34 |
| | B.AMAN LOCAL | 113366 | 111392 | 1240 | 707 | 27 | 0 | 1974 |
| | MEAN | 113366.0 | 111392.0 | 1240.00 | 707.00 | 27.00 | 0.00 | 1974.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.09 | .62 | .02 | 0.00 | 1.74 |
| | T.AMAN LOCAL | 107946 | 106096 | 1157 | 670 | 23 | 0 | 1850 |
| | MEAN | 107946.0 | 106096.0 | 1157.00 | 670.00 | 23.00 | 0.00 | 1850.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.07 | .62 | .02 | 0.00 | 1.71 |
| | T.AMAN MODERN | 226600 | 222594 | 2776 | 1174 | 56 | 0 | 4006 |
| | MEAN | 226600.0 | 222594.0 | 2776.00 | 1174.00 | 56.00 | 0.00 | 4006.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 1.23 | .52 | .02 | 0.00 | 1.77 |
| | BORO LOCAL | 46284 | 45665 | 412 | 186 | 21 | 0 | 619 |
| | MEAN | 46284.00 | 45665.00 | 412.00 | 186.00 | 21.00 | 0.00 | 619.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .89 | .40 | .05 | 0.00 | 1.34 |
| | BORO MODERN | 326976 | 322772 | 2248 | 1896 | 60 | 0 | 4204 |
| | MEAN | 326976.0 | 322772.0 | 2248.00 | 1896.00 | 60.00 | 0.00 | 4204.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .69 | .58 | .02 | 0.00 | 1.29 |
| SUM | | 1119780 | 1103107 | 10424 | 6011 | 238 | 0 | 16673 |
| MEAN | | 159968.6 | 157586.7 | 1489.14 | 858.71 | 34.00 | 0.00 | 2381.86 |
| VALIDN | | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| % | | | | .93 | .54 | .02 | 0.00 | 1.49 |

Appendix 4.4.5 : Contd.

| NAME OF UPAZILA | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| KIHSOREGUNJ | BORO MODERN | 7466 | 7429 | 0 | 37 | 0 | 0 | 37 |
| | MEAN | 7466.00 | 7429.00 | 0.00 | 37.00 | 0.00 | 0.00 | 37.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | 0.00 | .50 | 0.00 | 0.00 | .50 |
| SUM | | 7466 | 7429 | 0 | 37 | 0 | 0 | 37 |
| MEAN | | 7466.00 | 7429.00 | 0.00 | 37.00 | 0.00 | 0.00 | 37.00 |
| VALIDN | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | 0.00 | .50 | 0.00 | 0.00 | .50 |
| SARISHABARI | BORO MODERN | 671869 | 669709 | 1728 | 144 | 288 | 0 | 2160 |
| | MEAN | 671869.0 | 669708.7 | 1728.28 | 144.02 | 288.05 | 0.00 | 2160.35 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .26 | .02 | .04 | 0.00 | .32 |
| SUM | | 671869 | 669709 | 1728 | 144 | 288 | 0 | 2160 |
| MEAN | | 671869.0 | 669708.7 | 1728.28 | 144.02 | 288.05 | 0.00 | 2160.35 |
| VALIDN | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | .26 | .02 | .04 | 0.00 | .32 |
| KALIAKAIR | AUS LOCAL | 7464 | 7364 | 50 | 40 | 6 | 4 | 100 |
| | MEAN | 7464.00 | 7364.00 | 50.00 | 40.00 | 6.00 | 4.00 | 100.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .67 | .54 | .08 | .05 | 1.34 |
| | T.AMAN MODERN | 373200 | 368999 | 2100 | 1200 | 700 | 201 | 4201 |
| | MEAN | 186600.0 | 184499.5 | 1050.00 | 600.00 | 350.00 | 100.50 | 2100.50 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .56 | .32 | .19 | .05 | 1.13 |
| | BORO MODERN | 410520 | 405620 | 2600 | 1300 | 750 | 250 | 4900 |
| | MEAN | 205260.0 | 202810.0 | 1300.00 | 650.00 | 375.00 | 125.00 | 2450.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .63 | .32 | .18 | .06 | 1.19 |
| SUM | | 791184 | 781983 | 4750 | 2540 | 1456 | 455 | 9201 |
| MEAN | | 158236.8 | 156396.6 | 950.00 | 508.00 | 291.20 | 91.00 | 1840.20 |
| VALIDN | | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| % | | | | .60 | .32 | .18 | .06 | 1.16 |
| KALIHATI | T.AMAN LOCAL | 597120 | 592144 | 2900 | 1076 | 600 | 400 | 4976 |
| | MEAN | 597120.0 | 592144.0 | 2900.00 | 1076.00 | 600.00 | 400.00 | 4976.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .49 | .18 | .10 | .07 | .83 |

Appendix 4.4.5 : Contd.

| NAME OF UPAZILA | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| | BORO MODERN | 1492800 | 1480360 | 6400 | 3040 | 2000 | 1000 | 12440 |
| | MEAN | 1492800 | 1480360 | 6400.00 | 3040.00 | 2000.00 | 1000.00 | 12440.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .43 | .20 | .13 | .07 | .83 |
| SUM | | 2089920 | 2072504 | 9300 | 4116 | 2600 | 1400 | 17416 |
| MEAN | | 1044960 | 1036252 | 4650.00 | 2058.00 | 1300.00 | 700.00 | 8708.00 |
| VALIDN | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | .44 | .20 | .12 | .07 | .83 |
| CHANDPUR | B.AMAN LOCAL | 820000 | 813559 | 4955 | 1486 | 0 | 0 | 6441 |
| | MEAN | 820000.0 | 813558.9 | 4954.68 | 1486.40 | 0.00 | 0.00 | 6441.08 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .60 | .18 | 0.00 | 0.00 | .79 |
| | T.AMAN MODERN | 1195858 | 1185603 | 5535 | 2047 | 2673 | 0 | 10255 |
| | MEAN | 97929.0 | 592801.7 | 2767.37 | 1023.26 | 1336.69 | 0.00 | 5127.31 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .46 | .17 | .22 | 0.00 | .86 |
| | BORO MODERN | 3013578 | 2960585 | 42358 | 10421 | 0 | 214 | 52993 |
| | MEAN | 1004526 | 986861.6 | 14119.33 | 3473.55 | 0.00 | 71.46 | 17664.37 |
| | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | % | | | 1.41 | .35 | 0.00 | .01 | 1.76 |
| SUM | | 5029436 | 4959747 | 52847 | 13954 | 2673 | 214 | 69689 |
| MEAN | | 38239.3 | 826624.5 | 8807.90 | 2325.59 | 445.56 | 35.73 | 11614.80 |
| VALIDN | | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | 1.05 | .28 | .05 | .00 | 1.39 |
| HABIGUNJ | AUS MODERN | 277500 | 276500 | 200 | 200 | 600 | 0 | 1000 |
| | MEAN | 277500.0 | 276500.0 | 200.00 | 200.00 | 600.00 | 0.00 | 1000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .07 | .07 | .22 | 0.00 | .36 |
| | T.AMAN MODERN | 277500 | 276500 | 300 | 200 | 500 | 0 | 1000 |
| | MEAN | 277500.0 | 276500.0 | 300.00 | 200.00 | 500.00 | 0.00 | 1000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .11 | .07 | .18 | 0.00 | .36 |
| | BORO MODERN | 555000 | 553000 | 600 | 400 | 1000 | 0 | 2000 |
| | MEAN | 555000.0 | 553000.0 | 600.00 | 400.00 | 1000.00 | 0.00 | 2000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .11 | .07 | .18 | 0.00 | .36 |

Appendix 4.4.5 : Contd.

| NAME OF UPAZILA | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| SUM | | 1110000 | 1106000 | 1100 | 800 | 2100 | 0 | 4000 |
| MEAN | | 370000.0 | 368666.7 | 366.67 | 266.67 | 700.00 | 0.00 | 1333.33 |
| VALIDN | | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .10 | .07 | .19 | 0.00 | .36 |
| GABTALI | AUS MODERN | 8212 | 8172 | 20 | 20 | 0 | 0 | 40 |
| | MEAN | 4106.00 | 4086.00 | 10.00 | 10.00 | 0.00 | 0.00 | 20.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .24 | .24 | 0.00 | 0.00 | .49 |
| | T.AMAN MODERN | 74660 | 74366 | 150 | 144 | 0 | 0 | 294 |
| | MEAN | 37330.00 | 37183.00 | 75.00 | 72.00 | 0.00 | 0.00 | 147.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .20 | .19 | 0.00 | 0.00 | .39 |
| | BORO MODERN | 48539 | 48189 | 175 | 175 | 0 | 0 | 350 |
| | MEAN | 24269.50 | 24094.50 | 87.50 | 87.50 | 0.00 | 0.00 | 175.00 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .36 | .36 | 0.00 | 0.00 | .72 |
| SUM | | 131411 | 130727 | 345 | 339 | 0 | 0 | 684 |
| MEAN | | 21901.83 | 21787.83 | 57.50 | 56.50 | 0.00 | 0.00 | 114.00 |
| VALIDN | | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | .26 | .26 | 0.00 | 0.00 | .52 |
| MITHAPUKUR | AUS LOCAL | 53150 | 52666 | 342 | 85 | 57 | 0 | 484 |
| | MEAN | 53150.00 | 52665.78 | 341.80 | 85.45 | 56.97 | 0.00 | 484.22 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .64 | .16 | .11 | 0.00 | .91 |
| | AUS MODERN | 2000000 | 1980000 | 12000 | 5000 | 3000 | 0 | 20000 |
| | MEAN | 2000000 | 1980000 | 12000.00 | 5000.00 | 3000.00 | 0.00 | 20000.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .60 | .25 | .15 | 0.00 | 1.00 |
| | T.AMAN MODERN | 1269220 | 1256977 | 8842 | 3401 | 0 | 0 | 12243 |
| | MEAN | 1269220 | 1256977 | 8842.37 | 3400.91 | 0.00 | 0.00 | 12243.30 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .70 | .27 | 0.00 | 0.00 | .96 |
| | BORO MODERN | 97058 | 96105 | 650 | 303 | 0 | 0 | 953 |
| | MEAN | 97058.00 | 96104.75 | 649.94 | 303.31 | 0.00 | 0.00 | 953.25 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .67 | .31 | 0.00 | 0.00 | .98 |

Appendix 4.4.5 : Contd.

| NAME OF UPAZILA | CROP-VARIETY | TOTAL QUANTITY BEFORE PARBOIL & DRYING IN KG | TOTAL QUANTITY AFTER PARBOIL & DRYING IN KG | TOTAL LOSS IN SOAKING IN KG | LOSS DUE TO POULTRY EATING IN KG | LOSS DUE TO CATTLE EATING IN KG | LOSS DUE TO OTHER REASONS IN KG | TOTAL LOSS DUE TO ALL REASONS IN KG |
|---|---|---|---|---|---|---|---|---|
| SUM | | 3419428 | 3385747 | 21834 | 8790 | 3057 | 0 | 33681 |
| MEAN | | 854857.0 | 846436.8 | 5458.53 | 2197.42 | 764.24 | 0.00 | 8420.19 |
| VALIDN | | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| % | | | | .64 | .26 | .09 | 0.00 | .98 |
| CHIRIR BANDAR | AUS LOCAL | 623620 | 619727 | 753 | 1579 | 1060 | 500 | 3893 |
| | MEAN | 207873.3 | 206575.8 | 251.11 | 526.44 | 353.33 | 166.67 | 1297.55 |
| | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | % | | | .12 | .25 | .17 | .08 | .62 |
| | T.AMAN LOCAL | 249600 | 248497 | 250 | 250 | 503 | 100 | 1103 |
| | MEAN | 124800.0 | 124248.5 | 125.00 | 125.00 | 251.50 | 50.00 | 551.50 |
| | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | % | | | .10 | .10 | .20 | .04 | .44 |
| | T.AMAN MODERN | 223500 | 222700 | 133 | 400 | 267 | 0 | 800 |
| | MEAN | 223500.0 | 222700.0 | 133.33 | 400.00 | 266.67 | 0.00 | 800.00 |
| | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | % | | | .06 | .18 | .12 | 0.00 | .36 |
| SUM | | 1096720 | 1090924 | 1137 | 2229 | 1830 | 600 | 5796 |
| MEAN | | 182786.7 | 181820.7 | 189.44 | 371.56 | 304.95 | 100.00 | 965.94 |
| VALIDN | | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | .10 | .20 | .17 | .05 | .53 |
| TOTAL | | 15467214 | 15307877 | 103465 | 38960 | 14242 | 2669 | 159337 |
| MEAN | | 377249.1 | 373362.9 | 2523.55 | 950.23 | 347.37 | 65.11 | 3886.26 |
| VALIDN | | 41 | 41 | 41 | 41 | 41 | 41 | 41 |
| % | | | | .67 | .25 | .09 | .02 | 1.03 |

## Appendix 4.4.6 : Milling Loss in Dheki & Rice Huller by Region (Aus)

| NAME OF REGION:- | TOTAL QUANTITY BEFORE DHEKI | TOTAL QUANTIY AFTER DHEKI | TOT.HUSK BROKEN GRAINS IN DHEKI | TOT.LOSS IN DHEKI PROCESS | TOTAL QUANTITY BEFORE MILLING | TOTAL QUANTITY AFTER MILLING | TOT.HUSK BROKEN GRAINS IN MILL | TOTAL LOSS IN MILLING | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|---|
| CHITTAGONG-NOAKHALI(KG) | 4692 | 3230 | 1441 | 21 | 62799 | 43143 | 19297 | 359 | 145 |
| DIVIDE | 32.36 | 22.28 | 9.94 | 0.14 | 433.10 | 297.54 | 133.09 | 2.47 | |
| % | 100 | 68.84 | 30.72 | 0.44 | 100 | 68.70 | 30.73 | 0.57 | |
| MYMEN/KISHORE/JAM(KG) | 5964 | 4115 | 1832 | 17 | 114728 | 77251 | 37271 | 206 | 229 |
| DIVIDE | 26.04 | 17.97 | 8.00 | .07 | 501.00 | 337.34 | 162.76 | .90 | |
| % | 100 | 69.00 | 30.72 | 0.28 | 100 | 67.33 | 32.49 | 0.18 | |
| DHAKA-TANGAIL(KG) | 163 | 100 | 61 | 2 | 5111 | 3252 | 1791 | 68 | 105 |
| DIVIDE | 1.55 | .95 | .58 | .02 | 48.68 | 30.98 | 17.05 | .65 | |
| % | 100 | 61.35 | 37.42 | 1.23 | 100 | 63.63 | 35.04 | 1.33 | |
| COMILLA-SYLHET(KG) | 6692 | 4386 | 2247 | 59 | 64467 | 43225 | 20804 | 438 | 157 |
| DIVIDE | 42.63 | 27.94 | 14.31 | .38 | 410.62 | 275.32 | 132.51 | 2.79 | |
| % | 100 | 65.54 | 33.58 | 0.88 | 100 | 67.05 | 32.27 | 0.68 | |
| RAJSHAHI-BOGRA/PABNA(KG) | 0 | 0 | 0 | 0 | 21482 | 14372 | 7005 | 105 | 126 |
| OIVIDE | 0.00 | 0.00 | 0.00 | 0.00 | 170.49 | 114.06 | 55.60 | .83 | |
| % | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 66.90 | 32.61 | 0.49 | |
| RANGPUR-DINAJPUR(KG) | 0 | 0 | 0 | 0 | 16563 | 10991 | 5467 | 105 | 203 |
| DIVIDE | 0.00 | 0.00 | 0.00 | 0.00 | 81.59 | 54.14 | 26.93 | .52 | |
| % | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 66.36 | 33.01 | 0.63 | |
| JES/KUSHTIA/KHULN(KG) | 1119 | 750 | 366 | 3 | 77392 | 52933 | 23857 | 602 | 96 |
| DIVIDE | 11.66 | 7.81 | 3.81 | .03 | 806.17 | 551.39 | 248.51 | 6.27 | |
| % | 100 | 67.02 | 32.71 | 0.27 | 100 | 68.40 | 30.82 | 0.78 | |
| BAR/FAR/PATUAKHAL(KG) | 0 | 0 | 0 | 0 | 16671 | 11639 | 4986 | 46 | 114 |
| DIVIDE | 0.00 | 0.00 | 0.00 | 0.00 | 146.24 | 102.10 | 43.73 | .41 | |
| % | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 69.82 | 29.91 | 0.27 | |
| TOTAL(KG) | 18630 | 12581 | 5948 | 101 | 379213 | 256806 | 120478 | 1929 | 1175 |
| DIVIDE | 15.86 | 10.71 | 5.06 | .09 | 322.73 | 218.56 | 102.53 | 1.64 | |
| % | 100 | 67.53 | 31.93 | 0.54 | 100 | 67.72 | 31.77 | 0.51 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.7 : Milling Loss in Dheki & Rice Huller by Region (Aman)

| NAME OF REGION:- | TOTAL QUANTIT BEFORE DHEKI | TOTAL QUANTIY AFTER DHEKI | TOT.HUSK BROKEN GRAINS IN DHEKI | TOT.LOSS IN DHEKI PROCESS | TOTAL QUANTITY BEFORE MILLING | TOTAL QUANTITY AFTER MILLING | TOT.HUSK BROKEN GRAINS IN MILL | TOTAL LOSS IN MILLING | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|---|
| CHITTAGONG/NOAKHA(KG) | 0 | 0 | 0 | 0 | 193445 | 134098 | 58336 | 1017 | 145 |
| DIVIDE | 0.00 | 0.00 | 0.00 | 0.00 | 1334.10 | 924.81 | 402.32 | 7.01 | |
| % | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 69.32 | 30.16 | 0.52 | |
| MYHEN/KISHORE/JAM(KG) | 55213 | 39337 | 15629 | 246 | 68936 | 47680 | 21037 | 218 | 229 |
| DIVIDE | 241.10 | 171.78 | 68.25 | 1.08 | 301.03 | 208.21 | 91.87 | .95 | |
| % | 100 | 71.25 | 28.30 | 0.45 | 100 | 69.17 | 30.52 | 0.31 | |
| DHAKA/TANGAIL(KG) | 6621 | 4544 | 1980 | 97 | 74157 | 50824 | 22362 | 971 | 105 |
| DIVIDE | 63.06 | 43.28 | 18.85 | .92 | 706.26 | 484.03 | 212.97 | 9.25 | |
| % | 100 | 68.63 | 29.90 | 1.47 | 100 | 68.54 | 30.15 | 1.31 | |
| COMILLA/SYLHET(KG) | 1301 | 885 | 405 | 11 | 124568 | 82815 | 40861 | 893 | 157 |
| DIVIDE | 8.29 | 5.64 | 2.58 | .07 | 793.43 | 527.48 | 260.26 | 5.69 | |
| % | 100 | 68.02 | 31.13 | 0.85 | 100 | 66.48 | 32.80 | 0.72 | |
| RAJSHAHI/BOGRA/PA(KG) | 259 | 176 | 82 | 2 | 39725 | 26744 | 12726 | 254 | 126 |
| DIVIDE | 2.06 | 1.40 | .65 | .01 | 315.27 | 212.26 | 101.00 | 2.02 | |
| % | 100 | 67.57 | 31.66 | 0.77 | 100 | 67.32 | 32.04 | 0.64 | |
| RANGPUR/DINAJPUR(KG) | 2013 | 1348 | 649 | 17 | 139479 | 94041 | 44433 | 1004 | 203 |
| DIVIDE | 9.92 | 6.64 | 3.20 | .08 | 687.09 | 463.26 | 218.88 | 4.95 | |
| % | 100 | 66.92 | 32.24 | 0.84 | 100 | 67.42 | 31.86 | 0.72 | |
| JES/KUSHTIA/KHULN(KG) | 6354 | 4114 | 2214 | 26 | 171049 | 116155 | 53518 | 1376 | 96 |
| DIVIDE | 66.19 | 42.86 | 23.06 | .27 | 1781.76 | 1209.95 | 557.48 | 14.34 | |
| % | 100 | 64.75 | 34.84 | 0.41 | 100 | 67.91 | 31.29 | 0.80 | |
| BAR/FAR/PATUAKHAL(KG) | 5265 | 3588 | 1664 | 13 | 32818 | 22777 | 9950 | 91 | 114 |
| DIVIDE | 46.18 | 31.47 | 14.60 | .11 | 287.88 | 199.80 | 87.28 | .79 | |
| % | 100 | 68.15 | 31.60 | 0.25 | 100 | 69.40 | 30.32 | 0.28 | |
| TOTAL(KG) | 77026 | 53993 | 22622 | 411 | 844176 | 575134 | 263224 | 5824 | 1175 |
| DIVIDE | 65.55 | 45.95 | 19.25 | .35 | 718.45 | 489.48 | 224.02 | 4.96 | |
| % | 100 | 70.10 | 29.37 | 0.53 | 100 | 68.13 | 31.18 | 0.69 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.8 : Milling Loss in Dheki & Rice Huller by Region (Boro)

| NAME OF REGION:- | TOTAL QUANTITY BEFORE DHEKI | TOTAL QUANTIY AFTER DHEKI | HUSK BROKEN GRAINS IN DHEKI | LOSS IN DHEKI PROCESS | TOTAL QUANTITY BEFORE MILLING | TOTAL QUANTITY AFTER MILLING | HUSK, BROKEN GRAINS IN MILL | TOTAL LOSS IN MILLING | NO. OF CASES IN SAMPLE |
|---|---|---|---|---|---|---|---|---|---|
| CHITTAGONG/NOAKHA | 6817 | 4735 | 2053 | 29 | 81620 | 56480 | 24791 | 350 | 145 |
| DIVIDE | 47.01 | 32.65 | 14.16 | .20 | 562.90 | 389.52 | 170.97 | 2.41 | |
| % | | 69.46 | 30.12 | .42 | | 69.20 | 30.37 | .43 | |
| MYHEN/KISHORE/JAM | 54387 | 38047 | 16108 | 233 | 122790 | 83713 | 38234 | 843 | 229 |
| DIVIDE | 237.50 | 166.14 | 70.34 | 1.02 | 536.20 | 365.56 | 166.96 | 3.68 | |
| % | | 69.96 | 29.62 | .43 | | 68.18 | 31.14 | .69 | |
| DHAKA/TANGAIL | 722 | 468 | 241 | 13 | 87215 | 57584 | 28333 | 1297 | 105 |
| DIVIDE | 6.88 | 4.46 | 2.29 | .13 | 830.62 | 548.42 | 269.84 | 12.35 | |
| % | | 64.85 | 33.32 | 1.83 | | 66.03 | 32.49 | 1.48 | |
| COMILLA/SYLHET | 4542 | 3027 | 1482 | 33 | 50234 | 34019 | 15876 | 340 | 157 |
| DIVIDE | 28.93 | 19.28 | 9.44 | .21 | 319.96 | 216.68 | 101.12 | 2.16 | |
| % | | 66.65 | 32.62 | .73 | | 67.72 | 31.60 | .68 | |
| RAJSHAHI/BOGRA/PA | 4215 | 2714 | 1445 | 56 | 120416 | 79528 | 40221 | 668 | 126 |
| DIVIDE | 33.45 | 21.54 | 11.47 | .45 | 955.68 | 631.17 | 319.21 | 5.30 | |
| % | | 64.39 | 34.27 | 1.33 | | 66.04 | 33.40 | .55 | |
| RANGPUR/DINAJPUR | 0 | 0 | 0 | 0 | 145901 | 98500 | 46149 | 1252 | 203 |
| DIVIDE | 0.00 | 0.00 | 0.00 | 0.00 | 718.72 | 485.22 | 227.33 | 6.17 | |
| % | .00 | .00 | .00 | .00 | 67.51 | 31.63 | .86 | | |
| JES/KUSTIA/KHULNA | 289 | 214 | 71 | 4 | 115320 | 83390 | 30886 | 1044 | 96 |
| DIVIDE | 3.01 | 2.23 | .74 | .04 | 1201.25 | 868.65 | 321.73 | 10.88 | |
| % | | 73.97 | 24.66 | 1.37 | | 72.31 | 26.78 | .91 | |
| BAR/FAR/PATUAKHAL | 739 | 540 | 191 | 7 | 65550 | 45525 | 19525 | 500 | 114 |
| DIVIDE | 6.48 | 4.74 | 1.68 | .06 | 575.00 | 399.34 | 171.28 | 4.38 | |
| % | | 73.12 | 25.90 | .97 | | 69.45 | 29.79 | .76 | |
| TOTAL | 71711 | 49745 | 21590 | 375 | 789046 | 538738 | 244014 | 6293 | 1175 |
| DIVIDE | 61.03 | 42.34 | 18.37 | .32 | 671.53 | 458.50 | 207.67 | 5.36 | |
| % | | 69.37 | 30.11 | .52 | | 68.28 | 30.93 | .80 | |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.4.9 : Milling Loss at Millers Level by Region & Crop-variety

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| CHITTAGONG-NOAKHALI | AUS LOCAL | 124943 | 84582 | 39830 | 531 |
| | MEAN | 13882.56 | 9397.96 | 4425.59 | 59.01 |
| | VALIDN | 9 | 9 | 9 | 9 |
| | % | | | | .43 |
| | AUS MODERN | 267999 | 182169 | 85019 | 811 |
| | MEAN | 66999.75 | 45542.36 | 21254.67 | 202.72 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | .30 |
| | B.AMAN LOCAL | 178422 | 119314 | 58167 | 941 |
| | MEAN | 44605.50 | 29828.49 | 14541.80 | 235.21 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | .53 |
| | T.AMAN LOCAL | 124577 | 83735 | 40337 | 505 |
| | MEAN | 62288.50 | 41867.50 | 20168.50 | 252.50 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .41 |
| | T.AMAN MODERN | 627495 | 425620 | 198249 | 3626 |
| | MEAN | 57045.00 | 38692.74 | 18022.61 | 329.65 |
| | VALIDN | 11 | 11 | 11 | 11 |
| | % | | | | .58 |
| | BORO LOCAL | 46277 | 30994 | 15109 | 174 |
| | MEAN | 23138.50 | 15497.00 | 7554.50 | 87.00 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .38 |
| | BORO MODERN | 565585 | 393939 | 166841 | 2805 |
| | MEAN | 52053.18 | 35812.68 | 15349.17 | 254.97 |
| | VALIDN | 11 | 11 | 11 | 11 |
| | % | | | | .49 |
| | WHEAT MODERN | 3000 | 2959 | 0 | 41 |
| | MEAN | 3000.00 | 2959.46 | 0.00 | 40.54 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | 1.35 |
| SUM | | 1935298 | 1323312 | 605552 | 9433 |
| MEAN | | 44211.32 | 30075.30 | 13762.54 | 214.39 |
| VALIDN | | 44 | 44 | 44 | 44 |
| % | | | | | .48 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| MYMENSINGH- | AUS LOCAL | 278680 | 188448 | 89230 | 1002 |
| KISHOREGONJ- | MEAN | 46446.67 | 31407.98 | 14871.63 | 167.06 |
| JAMALPUR | VALIDN | 6 | 6 | 6 | 6 |
| | % | | | | .36 |
| | AUS MODERN | 235088 | 157897 | 75881 | 1310 |
| | MEAN | 47017.60 | 31579.46 | 15176.23 | 261.92 |
| | VALIDN | 5 | 5 | 5 | 5 |
| | % | | | | .56 |
| | B.AMAN LOCAL | 244793 | 170541 | 73368 | 884 |
| | MEAN | 48958.60 | 34108.23 | 14673.54 | 176.93 |
| | VALIDN | 5 | 5 | 5 | 5 |
| | % | | | | .36 |
| | T.AMAN LOCAL | 89420 | 63299 | 25795 | 325 |
| | MEAN | 29806.67 | 21099.76 | 8598.46 | 108.45 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .35 |
| | T.AMAN MODERN | 767078 | 519674 | 242229 | 5175 |
| | MEAN | 127846.3 | 86612.35 | 40371.43 | 862.55 |
| | VALIDN | 6 | 6 | 6 | 6 |
| | % | | | | .67 |
| | BORO MODERN | 1182043 | 820372 | 359335 | 2336 |
| | MEAN | 131338.1 | 91152.45 | 39926.10 | 259.57 |
| | VALIDN | 9 | 9 | 9 | 9 |
| | % | | | | .20 |
| | WHEAT MODERN | 215695 | 214164 | 0 | 1531 |
| | MEAN | 23966.11 | 23795.95 | 0.00 | 170.16 |
| | VALIDN | 9 | 9 | 9 | 9 |
| | % | | | | .71 |
| SUM | | 3012797 | 2134395 | 865837 | 12564 |
| MEAN | | 70065.05 | 49637.10 | 20135.75 | 292.19 |
| VALIDN | | 43 | 43 | 43 | 43 |
| % | | | | | .42 |
| DHAKA-TANGAIL | AUS LOCAL | 14928 | 9674 | 5111 | 143 |
| | MEAN | 4976.00 | 3224.59 | 1703.75 | 47.66 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .96 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| | B.AMAN LOCAL | 11942 | 7608 | 4254 | 80 |
| | MEAN | 5971.00 | 3803.85 | 2127.16 | 39.99 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .67 |
| | T.AMAN LOCAL | 607072 | 414617 | 188439 | 4016 |
| | MEAN | 303536.0 | 207308.50 | 94219.50 | 2008.00 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .66 |
| | T.AMAN MODERN | 376301 | 262997 | 110862 | 2442 |
| | MEAN | 125433.7 | 87665.67 | 36954.00 | 814.00 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .65 |
| | BORO MODERN | 2005404 | 1343979 | 645838 | 15587 |
| | MEAN | 286486.3 | 191997.00 | 92262.53 | 2226.76 |
| | VALIDN | 7 | 7 | 7 | 7 |
| | % | | | | .78 |
| | WHEAT MODERN | 29856 | 29491 | 0 | 365 |
| | MEAN | 7464.00 | 7372.63 | 0.00 | 91.37 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | 1.22 |
| SUM | | 3045503 | 2068365 | 954504 | 22634 |
| MEAN | | 145024.0 | 98493.57 | 45452.59 | 1077.80 |
| VALIDN | | 21 | 21 | 21 | 21 |
| % | | | | | .74 |
| | | | | | . |
| COMILLA-SYLHET | AUS LOCAL | 59110 | 38089 | 20450 | 572 |
| | MEAN | 19703.33 | 12696.17 | 6816.54 | 190.63 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .97 |
| | AUS MODERN | 618986 | 415071 | 198951 | 4964 |
| | MEAN | 103164.3 | 69178.51 | 33158.56 | 827.26 |
| | VALIDN | 6 | 6 | 6 | 6 |
| | % | | | | .80 |
| | B.AMAN LOCAL | 936500 | 635896 | 297471 | 3133 |
| | MEAN | 187300.0 | 127179.20 | 59494.19 | 626.60 |
| | VALIDN | 5 | 5 | 5 | 5 |
| | % | | | | .33 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| | T.AMAN LOCAL | 69340 | 44554 | 24253 | 533 |
| | MEAN | 23113.33 | 14851.33 | 8084.33 | 177.67 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .77 |
| | T.AMAN MODERN | 1792178 | 1227241 | 555247 | 9690 |
| | MEAN | 224022.3 | 153405.10 | 69405.84 | 1211.31 |
| | VALIDN | 8 | 8 | 8 | 8 |
| | % | | | | .54 |
| | BORO MODERN | 3702683 | 2555052 | 1125567 | 22063 |
| | MEAN | 370268.3 | 255505.25 | 112556.74 | 2206.32 |
| | VALIDN | 10 | 10 | 10 | 10 |
| | % | | | | .60 |
| | WHEAT MODERN | 106512 | 105212 | 0 | 1300 |
| | MEAN | 15216.00 | 15030.24 | 0.00 | 185.76 |
| | VALIDN | 7 | 7 | 7 | 7 |
| | % | | | | 1.22 |
| SUM | | 7285309 | 5021114 | 2221939 | 42255 |
| MEAN | | 173459.7 | 119550.34 | 52903.31 | 1006.08 |
| VALIDN | | 42 | 42 | 42 | 42 |
| % | | | | | .58 |
| RAJSHAHI-BOGRA-PABNA | AUS LOCAL | 3733 | 2500 | 1218 | 15 |
| | MEAN | 3733.00 | 2500.00 | 1218.00 | 15.00 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | .40 |
| | AUS MODERN | 15638 | 10473 | 5095 | 70 |
| | MEAN | 5212.67 | 3491.00 | 1698.33 | 23.33 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .45 |
| | T.AMAN LOCAL | 11199 | 7500 | 3649 | 50 |
| | MEAN | 11199.00 | 7500.00 | 3649.00 | 50.00 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | .45 |
| | T.AMAN MODERN | 93025 | 62299 | 30351 | 375 |
| | MEAN | 31008.33 | 20766.33 | 10117.00 | 125.00 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .40 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| | BORO MODERN | 121719 | 79111 | 42006 | 602 |
| | MEAN | 11065.36 | 7191.89 | 3818.75 | 54.72 |
| | VALIDN | 11 | 11 | 11 | 11 |
| | % | | | | .49 |
| | WHEAT MODERN | 22022 | 21800 | 1 | 221 |
| | MEAN | 3670.33 | 3633.29 | .17 | 36.88 |
| | VALIDN | 6 | 6 | 6 | 6 |
| | % | | | | 1.00 |
| SUM | | 267336 | 183683 | 82320 | 1333 |
| MEAN | | 10693.44 | 7347.30 | 3292.81 | 53.33 |
| VALIDN | | 25 | 25 | 25 | 25 |
| % | | | | | .50 |
| RANGPUR-DINAJPUR | AUS LOCAL | 876106 | 578216 | 287147 | 10743 |
| | MEAN | 125158.0 | 82602.34 | 41020.97 | 1534.68 |
| | VALIDN | 7 | 7 | 7 | 7 |
| | % | | | | 1.23 |
| | AUS MODERN | 2305595 | 1552386 | 743364 | 9346 |
| | MEAN | 768531.7 | 517628.59 | 247787.89 | 3115.18 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .41 |
| | B.AMAN LOCAL | 8393 | 5618 | 2707 | 68 |
| | MEAN | 8393.00 | 5617.90 | 2707.42 | 67.69 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | .81 |
| | T.AMAN LOCAL | 409696 | 274576 | 129405 | 5714 |
| | MEAN | 136565.3 | 91525.46 | 43135.12 | 1904.76 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | 1.39 |
| | T.AMAN MODERN | 2159021 | 1475585 | 663460 | 19977 |
| | MEAN | 308431.6 | 210797.82 | 94779.95 | 2853.80 |
| | VALIDN | 7 | 7 | 7 | 7 |
| | % | | | | .93 |
| | BORO MODERN | 140343 | 94846 | 44901 | 596 |
| | MEAN | 46781.00 | 31615.24 | 14967.02 | 198.74 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .42 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| | WHEAT MODERN | 115952 | 115312 | 0 | 640 |
| | MEAN | 28988.00 | 28828.07 | 0.00 | 159.92 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | .55 |
| SUM | | 6015106 | 4097039 | 1870984 | 47083 |
| MEAN | | 214825.2 | 146322.83 | 66820.86 | 1681.53 |
| VALIDN | | 28 | 28 | 28 | 28 |
| % | | | | | .78 |
| JESSORE-KUSHTIA-KHULNA | AUS LOCAL | 197082 | 139706 | 54397 | 2979 |
| | MEAN | 39416.40 | 27941.26 | 10879.32 | 595.82 |
| | VALIDN | 5 | 5 | 5 | 5 |
| | % | | | | 1.51 |
| | AUS MODERN | 47031 | 32922 | 13521 | 588 |
| | MEAN | 47031.00 | 32921.70 | 13521.41 | 587.89 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | 1.25 |
| | B.AMAN LOCAL | 288904 | 212842 | 71910 | 4152 |
| | MEAN | 72226.00 | 53210.50 | 17977.46 | 1038.04 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | 1.44 |
| | T.AMAN LOCAL | 29861 | 22598 | 6860 | 404 |
| | MEAN | 29861.00 | 22597.51 | 6859.96 | 403.53 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | 1.35 |
| | T.AMAN MODERN | 8958 | 6495 | 2351 | 112 |
| | MEAN | 8958.00 | 6494.55 | 2351.47 | 111.97 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | 1.25 |
| | BORO LOCAL | 120937 | 89023 | 30594 | 1320 |
| | MEAN | 60468.50 | 44511.54 | 15297.09 | 659.88 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | 1.09 |
| | BORO MODERN | 176179 | 131367 | 41910 | 2602 |
| | MEAN | 44044.75 | 32916.80 | 10477.40 | 650.56 |
| | VALIDN | 4 | 4 | 4 | 4 |
| | % | | | | 1.48 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| | WHEAT MODERN | 345639 | 340949 | 0 | 4690 |
| | MEAN | 57606.50 | 56824.81 | 0.00 | 781.69 |
| | VALIDN | 6 | 6 | 6 | 6 |
| | % | | | | 1.36 |
| SUM | | 1214591 | 976201 | 221543 | 16847 |
| MEAN | | 50607.96 | 40675.05 | 9230.96 | 701.95 |
| VALIDN | | 24 | 24 | 24 | 24 |
| % | | | | | 1.39 |
| BARISAL-FARIDPUR-PATUAKHALI | AUS LOCAL | 12000 | 8125 | 3808 | 66 |
| | MEAN | 6000.00 | 4062.73 | 1904.04 | 33.22 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .55 |
| | AUS MODERN | 8000 | 5359 | 2602 | 39 |
| | MEAN | 4000.00 | 2679.47 | 1301.23 | 19.30 |
| | VALIDN | 2 | 2 | 2 | 2 |
| | % | | | | .48 |
| | B.AMAN LOCAL | 21000 | 14082 | 6809 | 109 |
| | MEAN | 7000.00 | 4693.87 | 2269.79 | 36.34 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .52 |
| | T.AMAN LOCAL | 5000 | 3447 | 1526 | 27 |
| | MEAN | 5000.00 | 3447.12 | 1526.10 | 26.77 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | .54 |
| | T.AMAN MODERN | 34000 | 23200 | 10537 | 263 |
| | MEAN | 11333.33 | 7733.34 | 3512.48 | 87.51 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .77 |
| | BORO MODERN | 89000 | 60674 | 27987 | 339 |
| | MEAN | 29666.67 | 20224.58 | 9329.03 | 113.06 |
| | VALIDN | 3 | 3 | 3 | 3 |
| | % | | | | .38 |
| | WHEAT MODERN | 25000 | 24866 | 0 | 134 |
| | MEAN | 25000.00 | 24865.95 | 0.00 | 134.05 |
| | VALIDN | 1 | 1 | 1 | 1 |
| | % | | | | .54 |

Appendix 4.4.9 : Contd.

| REGION | CROP-VARIETY | TOTAL QT MILLED IN KG. | RECOVERY OF RICE/ATTA IN KG. | REMAINDER (HUSK,BRAN BROKEN GRAIN) IN KG | LOSS IN MILLING (KG) |
|---|---|---|---|---|---|
| SUM | | 194000 | 139753 | 53271 | 977 |
| MEAN | | 12933.33 | 9316.86 | 3551.37 | 65.11 |
| VALIDN | | 15 | 15 | 15 | 15 |
| % | | | | | .50 |
| TOTAL | | 22972940 | 15943864 | 6875950 | 153126 |
| MEAN | | 94958.43 | 65883.73 | 28413.02 | 632.75 |
| VALIDN | | 242 | 242 | 242 | 242 |
| % | | | | | .67 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

Appendix 4.4.10 : Crushing Loss (in kg) in Wheat Crusher by Region for Wheat

| NAME OF REGION | QUANTITY BEFORE CRUSH | QUANTITY AFTER CRUSH | QUANTITY WHEAT LOST |
|---|---|---|---|
| CHITTAGONG-NOAKHALI | 25 | 24 | 1 |
| MEAN | 25.00 | 24.50 | .50 |
| VALIDN | 1 | 1 | 1 |
| % | | 98.00 | 2.00 |
| MYMEN/KISHORE/JAM | 15704 | 15540 | 164 |
| MEAN | 172.57 | 170.76 | 1.80 |
| VALIDN | 91 | 91 | 91 |
| % | | 98.96 | 1.04 |
| DHAKA/TANGAIL | 10540 | 10298 | 242 |
| MEAN | 178.65 | 174.54 | 4.11 |
| VALIDN | 59 | 59 | 59 |
| % | | 97.70 | 2.30 |
| COMILLA/SYLHET | 17114 | 16879 | 235 |
| MEAN | 159.94 | 157.75 | 2.20 |
| VALIDN | 107 | 107 | 107 |
| % | | 98.63 | 1.37 |
| RAJSHAHI/BOGRA/PA | 3573 | 3528 | 45 |
| MEAN | 178.65 | 176.43 | 2.23 |
| VALIDN | 20 | 20 | 20 |
| % | | 98.74 | 1.26 |
| RANGPUR/DINAJPUR | 863 | 850 | 13 |
| MEAN | 10.40 | 10.24 | .16 |
| VALIDN | 83 | 83 | 83 |
| % | | 98.46 | 1.54 |
| JES/KUSTIA/KHULNA | 12093 | 11907 | 185 |
| MEAN | 188.95 | 186.05 | 2.90 |
| VALIDN | 64 | 64 | 64 |
| % | | 98.47 | 1.53 |
| BAR/FAR/PATUAKHAL | 481 | 472 | 9 |
| MEAN | 120.25 | 118.00 | 2.25 |
| VALIDN | 4 | 4 | 4 |
| % | | 98.13 | 1.87 |
| TOTAL | 60392 | 59498 | 894 |
| MEAN | 140.77 | 138.69 | 2.08 |
| VALIDN | 429 | 429 | 429 |
| % | | 98.52 | 1.48 |

Appendix 4.4.11 : Recovery Percentage of Rice by Region in 1989-90*

| Region | Aus | | | Aman | | | Boro | | | All Rice | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Recovery of rice in dheki process | Recovery of rice in rice mill | Both methods | Recovery of rice in dheki process | Recovery of rice in rice mill | Both methods | Recovery of rice in dheki process | Recovery of rice in rice mill | Both methods | Recovery of rice in dheki process | Recovery of rice in rice mill | Both methods |
| Chittagog-Noakhali | 68.84 | 68.70 | 68.71 | n.a | 69.32 | 69.32 | 69.46 | 69.20 | 69.22 | 69.21 | 69.18 | 69.18 |
| Mymensingh-Kishoregonj-Jamalpur | 69.00 | 67.33 | 67.41 | 71.25 | 69.17 | 70.10 | 69.96 | 68.18 | 68.73 | 70.53 | 68.08 | 68.84 |
| Dhaka-Tangail | 62.80 | 62.18 | 62.33 | 68.63 | 68.54 | 68.55 | 65.60 | 65.28 | 65.28 | 68.10 | 66.76 | 66.83 |
| Comilla-Sylhet | 66.50 | 66.10 | 66.14 | 68.02 | 66.48 | 66.50 | 67.56 | 67.82 | 67.80 | 67.04 | 66.66 | 66.74 |
| Rajshahi-Bogra-Pabna | n.a | 66.90 | 66.90 | 67.57 | 67.32 | 67.32 | 65.39 | 65.04 | 65.05 | 65.52 | 65.76 | 65.98 |
| Rangpur-Dinajpur | n.a | 66.36 | 66.36 | 67.20 | 67.14 | 67.14 | n.a | 67.51 | 67.51 | 67.20 | 67.28 | 67.28 |
| Jessore-Kushtia-Khulna | 67.95 | 67.47 | 67.48 | 66.45 | 66.21 | 66.22 | 70.97 | 69.31 | 70.14 | 66.83 | 67.48 | 67.45 |
| Barisal-Faridpur-Patuakhali | n.a | 69.82 | 69.82 | 69.15 | 68.41 | 68.51 | 70.12 | 69.45 | 69.46 | 69.27 | 69.21 | 69.21 |
| Average | 67.94 | 67.42 | 67.44 | 70.31 | 67.70 | 67.92 | 69.45 | 67.61 | 67.76 | 69.68 | 67.61 | 67.61 |

n.a = Not available
* Weighted Average

## Appendix - 4.5.1 : Storage Loss at Primary Traders Level by Region

| REGION | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|
| CHITTAGONG-NOAKHA | 4746990 | 34 | 4730331 | 6856 | 3712 | 2563 | 2063 | 1465 | 16659 |
| MEAN | 527443.3 | 3.78 | 525592.3 | 761.78 | 412.44 | 284.78 | 229.22 | 162.8 | 1851.00 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .34 |
| COMILLA+SYLHET | 10678 | 21 | 10641 | 29 | 6 | 0 | 1 | 1 | 37 |
| MEAN | 1525.39 | 3.00 | 1520.18 | 4.14 | .86 | 0.00 | .07 | .14 | 5.21 |
| VALIDN | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| % | | | | .27 | .06 | 0.00 | .00 | .01 | .34 |
| RAJSHAHI+BOGRA+PA | 29125 | 6 | 28999 | 40 | 70 | 11 | 5 | 0 | 126 |
| MEAN | 9708.33 | 2.00 | 9666.33 | 13.33 | 23.33 | 3.67 | 1.67 | 0.00 | 42.00 |
| VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .14 | .24 | .04 | .02 | 0.00 | .44 |
| JESS+KUSHTIA+KHUL | 5550 | 1 | 5540 | 5 | 2 | 3 | 0 | 0 | 10 |
| MEAN | 5550.00 | 1.00 | 5540.00 | 5.00 | 2.00 | 3.00 | 0.00 | 0.00 | 10.00 |
| VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | .09 | .04 | .05 | 0.00 | 0.00 | .18 |
| TOTAL | 4792343 | 62 | 4775511 | 6930 | 3790 | 2577 | 2069 | 1466 | 16832 |
| MEAN | 239617.1 | 3.10 | 238775.6 | 346.50 | 189.50 | 128.85 | 103.43 | 73.30 | 841.58 |
| VALIDN | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .34 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

## Appendix 4.5.2 : Storage Loss at Primary Traders Level by Upazila

| UPAZILA | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|
| FENI | 4746990 | 34 | 4730331 | 6856 | 3712 | 2563 | 2063 | 1465 | 16659 |
| MEAN | 527443.3 | 3.78 | 525592.3 | 761.78 | 412.44 | 284.78 | 229.22 | 162.8 | 1851.00 |
| VALIDN | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .34 |
| CHANDINA | 7368 | 2 | 7344 | 18 | 5 | 0 | 0 | 1 | 24 |
| MEAN | 3683.88 | 1.00 | 3671.88 | 9.00 | 2.50 | 0.00 | 0.00 | .50 | 12.00 |
| VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | .24 | .07 | 0.00 | 0.00 | .01 | .32 |
| CHANDPUR | 670 | 16 | 664 | 6 | 1 | 0 | 1 | 0 | 7 |
| MEAN | 335.00 | 8.00 | 331.75 | 2.75 | .25 | 0.00 | .25 | 0.00 | 3.25 |
| VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | .82 | .07 | 0.00 | .07 | 0.00 | .96 |
| HABIGUNJ | 2640 | 3 | 2634 | 6 | 1 | 0 | 0 | 0 | 6 |
| MEAN | 880.00 | 1.00 | 878.00 | 1.83 | .17 | 0.00 | 0.00 | 0.00 | 2.00 |
| VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .21 | .02 | 0.00 | 0.00 | 0.00 | .23 |
| SHAZADPUR | 29125 | 6 | 28999 | 40 | 70 | 11 | 5 | 0 | 126 |
| MEAN | 9708.33 | 2.00 | 9666.33 | 13.33 | 23.33 | 3.67 | 1.67 | 0.00 | 42.00 |
| VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .14 | .24 | .04 | .02 | 0.00 | .44 |
| MANIRAMPUR | 5550 | 1 | 5540 | 5 | 2 | 3 | 0 | 0 | 10 |
| MEAN | 5550.00 | 1.00 | 5540.00 | 5.00 | 2.00 | 3.00 | 0.00 | 0.00 | 10.00 |
| VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | .09 | .04 | .05 | 0.00 | 0.00 | .18 |
| TOTAL | 4792343 | 62 | 4775511 | 6930 | 3790 | 2577 | 2069 | 1466 | 16832 |
| MEAN | 239617.1 | 3.10 | 238775.6 | 346.50 | 189.50 | 128.85 | 103.43 | 73.30 | 841.58 |
| VALIDN | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| % | | | | .14 | .08 | .05 | .04 | .03 | .34 |

## Appendix 4.5.3 : Storage Loss at Secondary Traders Level by Upazila

| UPAZILA | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|
| FENI | 2963403 | 38 | 2952705 | 5154 | 3617 | 946 | 586 | 397 | 9763 |
| MEAN | 296340.3 | 3.80 | 295270.5 | 515.40 | 361.70 | 94.60 | 58.80 | 39.70 | 976.30 |
| VALIDN | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| % | | | | .17 | .12 | .03 | .02 | .01 | .33 |
| KALIAKAIR | 85836 | 5 | 85675 | 60 | 71 | 20 | 5 | 16 | 161 |
| MEAN | 42918.00 | 2.50 | 42837.50 | 30.00 | 35.50 | 10.00 | 2.50 | 8.00 | 80.50 |
| VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | .07 | .08 | .02 | .01 | .02 | .19 |
| KALIHATI | 55980 | 2 | 55850 | 70 | 50 | 10 | 0 | 0 | 130 |
| MEAN | 55980.00 | 2.00 | 55850.00 | 70.00 | 50.00 | 10.00 | 0.00 | 0.00 | 130.00 |
| VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | .13 | .09 | .02 | 0.00 | 0.00 | .23 |
| CHANDPUR | 256455 | 5 | 255701 | 401 | 297 | 53 | 0 | 3 | 754 |
| MEAN | 51291.00 | 1.00 | 51140.20 | 80.20 | 59.40 | 10.60 | 0.00 | .60 | 150.80 |
| VALIDN | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| % | | | | .16 | .12 | .02 | 0.00 | .00 | .29 |
| HABIGUNJ | 10470 | 4 | 10444 | 12 | 9 | 2 | 4 | 2 | 26 |
| MEAN | 2617.50 | 1.00 | 2611.00 | 3.00 | 2.13 | .50 | .88 | .38 | 6.50 |
| VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| % | | | | .11 | .08 | .02 | .03 | .01 | .25 |
| SHAZADPUR | 10425 | 3 | 10392 | 10 | 20 | 2 | 1 | 0 | 33 |
| MEAN | 10425.00 | 3.00 | 10392.00 | 10.00 | 20.00 | 2.00 | 1.00 | 0.00 | 33.00 |
| VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| % | | | | .10 | .19 | .02 | .01 | | .32 |
| MANIRAMPUR | 14445 | 9 | 14305 | 105 | 23 | 12 | 0 | 0 | 140 |
| MEAN | 4815.00 | 3.00 | 4768.33 | 35.00 | 7.67 | 4.00 | 0.00 | 0.00 | 46.67 |
| VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | .73 | .16 | .08 | 0.00 | 0.00 | .97 |
| MEHERPUR | 59720 | 24 | 59330 | 314 | 56 | 20 | 0 | 0 | 390 |
| MEAN | 7465.00 | 3.00 | 7416.25 | 39.25 | 7.00 | 2.50 | 0.00 | 0.00 | 48.75 |
| VALIDN | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| % | | | | .53 | .09 | .03 | 0.00 | 0.00 | .65 |
| TOTAL | 3456734 | 90 | 3444402 | 6126 | 4142 | 1065 | 598 | 418 | 12350 |
| MEAN | 101668.6 | 2.65 | 101305.9 | 180.18 | 121.84 | 31.32 | 17.57 | 12.28 | 335.21 |
| VALIDN | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| % | | | | .18 | .12 | .03 | .02 | .01 | .36 |

## Appendix - 4.5.4 : Storage Loss at Secondary Traders Level by Container within Grain

| TYPE OF FOODGRAIN | TYPE OF CONTAINER | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|---|
| RICE | GUNNYBAG | 12572 | 7 | 12425 | 107 | 26 | 12 | 2 | 0 | 147 |
| | MEAN | 4190.67 | 2.33 | 4141.67 | 35.67 | 8.67 | 4.00 | .67 | 0.00 | 49.00 |
| | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | % | | | | .85 | .21 | .10 | .02 | 0.00 | 1.18 |
| SUM | | 12572 | 7 | 12425 | 107 | 26 | 12 | 2 | 0 | 147 |
| MEAN | | 4190.67 | 2.33 | 4141.67 | 35.67 | 8.67 | 4.00 | .67 | 0.00 | 49.00 |
| VALIDN | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | | .85 | .21 | .10 | .02 | 0.00 | 1.18 |
| PADDY | GUNNYBAG | 3423124 | 73 | 3410984 | 6015 | 4097 | 1031 | 596 | 417 | 12156 |
| | MEAN | 126782.4 | 2.70 | 126332.7 | 222.78 | 151.76 | 38.19 | 22.06 | 15.46 | 415.00 |
| | VALIDN | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| | % | | | | .18 | .12 | .03 | .02 | .01 | .36 |
| SUM | | 3423124 | 73 | 3410984 | 6015 | 4097 | 1031 | 596 | 417 | 12156 |
| MEAN | | 126782.4 | 2.70 | 126332.7 | 222.78 | 151.76 | 38.19 | 22.06 | 15.46 | 415.00 |
| VALIDN | | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| % | | | | | .18 | .12 | .03 | .02 | .01 | .36 |
| WHEAT | GUNNYBAG | 21038 | 10 | 20993 | 4 | 19 | 22 | 0 | 0 | 45 |
| | MEAN | 5259.50 | 2.50 | 5248.25 | 1.00 | 4.75 | 5.50 | 0.00 | 0.00 | 11.25 |
| | VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | % | | | | .02 | .09 | .10 | 0.00 | 0.00 | .21 |
| SUM | | 21038 | 10 | 20993 | 4 | 19 | 22 | 0 | 0 | 45 |
| MEAN | | 5259.50 | 2.50 | 5248.25 | 1.00 | 4.75 | 5.50 | 0.00 | 0.00 | 11.25 |
| VALIDN | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| % | | | | | .02 | .09 | .10 | 0.00 | 0.00 | .21 |
| TOTAL | | 3456734 | 90 | 3444402 | 6126 | 4142 | 1065 | 598 | 418 | 12350 |
| MEAN | | 101668.6 | 2.65 | 101305.9 | 180.18 | 121.84 | 31.32 | 17.57 | 12.28 | 335.21 |
| VALIDN | | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| % | | | | | .18 | .12 | .03 | .02 | .01 | .36 |

Conversion ratio, Paddy to Rice 0.677.

## Appendix - 4.5.5 : Storage Loss at Secondary Traders Level by Container

| TYPE OF CONTAINER | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|
| GUNNYBAG | 3456734 | 90 | 3444402 | 6126 | 4143 | 1065 | 598 | 418 | 12350 |
| MEAN | 101668.6 | 2.65 | 101305.9 | 180.18 | 121.84 | 31.32 | 17.57 | 12.28 | 335.21 |
| VALIDN | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| % | | | | .18 | .12 | .03 | .02 | .01 | .36 |
| TOTAL | 3456734 | 90 | 3444402 | 6126 | 4143 | 1065 | 598 | 418 | 12350 |
| MEAN | 101668.6 | 2.65 | 101305.9 | 180.18 | 121.84 | 31.32 | 17.57 | 12.28 | 335.21 |
| VALIDN | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| % | | | | .18 | .12 | .03 | .02 | .01 | .36 |

## Appendix - 4.5.6 : Storage Loss at Millers Level (Boiler Mill) by Region & Crop-variety

| REGION | CONTAINER | CROP-VARIETY | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CHITTAGONG-NOAKHALI | GUNNYBAG | AUS LOCAL | 44791 | 1 | 44611 | 70 | 45 | 30 | 15 | 20 | 180 |
| | | MEAN | 44791.00 | 1.00 | 44611.00 | 70.00 | 45.00 | 30.00 | 15.00 | 20.00 | 180.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .16 | .10 | .07 | .03 | .04 | .40 |
| | | T.AMAN LOCAL | 74652 | 2 | 74292 | 92 | 93 | 75 | 75 | 25 | 360 |
| | | MEAN | 74652.00 | 1.50 | 74292.00 | 92.00 | 93.00 | 75.00 | 75.00 | 25.00 | 360.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .12 | .12 | .10 | .10 | .03 | .48 |
| | | T.AMAN MODERN | 44796 | 3 | 44380 | 202 | 135 | 27 | 22 | 30 | 416 |
| | | MEAN | 14932.00 | .83 | 14793.33 | 67.33 | 45.00 | 9.00 | 7.33 | 10.00 | 138.67 |
| | | VALIDN | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | | % | | | | .45 | .30 | .06 | .05 | .07 | .93 |
| | | BORO MODERN | 102651 | 3 | 101961 | 293 | 210 | 62 | 45 | 80 | 690 |
| | | MEAN | 25662.75 | .81 | 25490.25 | 73.25 | 52.50 | 15.50 | 11.25 | 20.00 | 172.50 |
| | | VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | % | | | | .29 | .20 | .06 | .04 | .08 | .67 |
| SUM | | | 266890 | 8 | 265244 | 657 | 483 | 194 | 157 | 155 | 1646 |
| MEAN | | | 29654.44 | .92 | 29471.56 | 73.00 | 53.67 | 21.56 | 17.44 | 17.22 | 182.89 |
| VALIDN | | | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| % | | | | | | .25 | .18 | .07 | .06 | .06 | .62 |
| MYMENSINGH-KISHOREGONJ-JAMALPUR | GUNNYBAG | AUS LOCAL | 11199 | 1 | 11099 | 50 | 30 | 10 | 5 | 5 | 100 |
| | | MEAN | 11199.00 | .50 | 11099.00 | 50.00 | 30.00 | 10.00 | 5.00 | 5.00 | 100.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .45 | .27 | .09 | .04 | .04 | .89 |
| | | AUS MODERN | 22239 | 1 | 22218 | 80 | 80 | 10 | 10 | 0 | 180 |
| | | MEAN | 22239.00 | .50 | 22218.00 | 80.00 | 80.00 | 10.00 | 10.00 | 0.00 | 180.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .36 | .36 | .04 | .04 | 0.00 | .81 |
| | | B.AMAN LOCAL | 18665 | 1 | 18505 | 80 | 40 | 10 | 10 | 20 | 160 |
| | | MEAN | 18665.00 | .50 | 18505.00 | 80.00 | 40.00 | 10.00 | 10.00 | 20.00 | 160.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .43 | .21 | .05 | .05 | .11 | .86 |
| | | T.AMAN MODERN | 11199 | 1 | 11100 | 50 | 25 | 5 | 15 | 4 | 99 |
| | | MEAN | 11199.00 | 1.00 | 11100.00 | 50.00 | 25.00 | 5.00 | 15.00 | 4.00 | 99.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .45 | .22 | .04 | .13 | .04 | .88 |

Appendix - 4.5.6 : Continued.

| REGION | CONTAINER | CROP-VARIETY | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | BORO MODERN | 37330 | 1 | 37002 | 170 | 95 | 15 | 30 | 18 | 328 |
| | | MEAN | 18665.00 | .50 | 18501.00 | 85.00 | 47.50 | 7.50 | 15.00 | 9.00 | 164.00 |
| | | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | % | | | | .46 | .25 | .04 | .08 | .05 | .88 |
| SUM | | | 100632 | 3 | 99924 | 430 | 270 | 50 | 70 | 47 | 867 |
| MEAN | | | 16772.00 | .58 | 16654.00 | 71.67 | 45.00 | 8.33 | 11.67 | 7.83 | 144.50 |
| VALIDN | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | | | .43 | .27 | .05 | .07 | .05 | .86 |
| DHAKA-TANGAIL | GUNNYBAG | BORO MODERN | 253776 | 4 | 252896 | 400 | 210 | 165 | 0 | 105 | 880 |
| | | MEAN | 126888.0 | 2.00 | 126448.0 | 200.00 | 105.00 | 82.50 | 0.00 | 52.50 | 440.00 |
| | | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | % | | | | .16 | .08 | .07 | 0.00 | .04 | .35 |
| SUM | | | 253776 | 4 | 252896 | 400 | 210 | 165 | 0 | 105 | 880 |
| MEAN | | | 126888.0 | 2.00 | 126448.0 | 200.00 | 105.00 | 82.50 | 0.00 | 52.50 | 440.00 |
| VALIDN | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | | | .16 | .08 | .07 | 0.00 | .04 | .35 |
| COMILLA-SYLHET | GUNNYBAG | T.AMAN MODERN | 74650 | 2 | 65930 | 8500 | 150 | 0 | 0 | 70 | 8720 |
| | | MEAN | 74650.00 | 1.50 | 65930.00 | 8500.00 | 150.00 | 0.00 | 0.00 | 70.00 | 8720.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | 11.39 | .20 | 0.00 | 0.00 | .09 | 11.68 |
| | | BORO MODERN | 243800 | 3 | 234872 | 8418 | 340 | 0 | 0 | 170 | 8928 |
| | | MEAN | 60950.00 | .75 | 58718.00 | 2104.50 | 85.00 | 0.00 | 0.00 | 42.50 | 2232.00 |
| | | VALIDN | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | % | | | | 3.45 | .14 | 0.00 | 0.00 | .07 | 3.66 |
| SUM | | | 318450 | 5 | 300802 | 16918 | 490 | 0 | 0 | 240 | 17648 |
| MEAN | | | 63690.00 | .90 | 60160.40 | 3383.60 | 98.00 | 0.00 | 0.00 | 48.00 | 3529.60 |
| VALIDN | | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| % | | | | | | 5.31 | .15 | 0.00 | 0.00 | .08 | 5.54 |
| RAJSHAHI-BOGRA-PABNA | GUNNYBAG | T.AMAN MODERN | 18665 | 1 | 18614 | 25 | 15 | 5 | 0 | 1 | 51 |
| | | MEAN | 18665.00 | .50 | 18614.00 | 25.00 | 15.00 | 5.00 | 0.00 | 1.00 | 51.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .13 | .08 | .03 | 0.00 | .01 | .27 |
| | | BORO MODERN | 18665 | 1 | 18534 | 40 | 20 | 10 | 5 | 5 | 80 |
| | | MEAN | 18665.00 | .50 | 18534.00 | 40.00 | 20.00 | 10.00 | 5.00 | 5.00 | 80.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .21 | .11 | .05 | .03 | .03 | .43 |

Appendix - 4.5.6 : Continued.

| REGION | CONTAINER | CROP-VARIETY | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SUM | | | 37330 | 1 | 37148 | 65 | 35 | 15 | 5 | 6 | 131 |
| MEAN | | | 18665.00 | .50 | 18574.00 | 32.50 | 17.50 | 7.50 | 2.50 | 3.00 | 65.50 |
| VALIDN | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| % | | | | | | .17 | .09 | .04 | .01 | .02 | .35 |
| RANGPUR-DINAJPUR | GUNNYBAG | AUS LOCAL | 37330 | 1 | 37180 | 80 | 50 | 10 | 10 | 0 | 150 |
| | | MEAN | 37330.00 | .50 | 37180.00 | 80.00 | 50.00 | 10.00 | 10.00 | 0.00 | 150.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .21 | .13 | .03 | .03 | 0.00 | .40 |
| | | AUS MODERN | 37330 | 1 | 37130 | 100 | 70 | 20 | 10 | 0 | 200 |
| | | MEAN | 37330.00 | .50 | 37130.00 | 100.00 | 70.00 | 20.00 | 10.00 | 0.00 | 200.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .27 | .19 | .05 | .03 | 0.00 | .54 |
| | | T.AMAN LOCAL | 114130 | 3 | 113663 | 280 | 152 | 20 | 15 | 0 | 467 |
| | | MEAN | 57065.00 | 1.25 | 56831.50 | 140.00 | 76.00 | 10.00 | 7.50 | 0.00 | 233.50 |
| | | VALIDN | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | % | | | | .25 | .13 | .02 | .01 | 0.00 | .41 |
| | | T.AMAN MODERN | 26131 | 1 | 26011 | 60 | 30 | 10 | 10 | 10 | 120 |
| | | MEAN | 26131.00 | 1.00 | 26011.00 | 60.00 | 30.00 | 10.00 | 10.00 | 10.00 | 120.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .23 | .11 | .04 | .04 | .04 | .46 |
| | | BORO MODERN | 52262 | 1 | 51962 | 150 | 100 | 20 | 20 | 10 | 300 |
| | | MEAN | 52262.00 | .50 | 51962.00 | 150.00 | 100.00 | 20.00 | 20.00 | 10.00 | 300.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .29 | .19 | .04 | .04 | .02 | .57 |
| SUM | | | 267183 | 5 | 265946 | 670 | 402 | 80 | 65 | 20 | 1237 |
| MEAN | | | 44530.50 | .83 | 44324.33 | 111.67 | 67.00 | 13.33 | 10.83 | 3.33 | 206.17 |
| VALIDN | | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| % | | | | | | .25 | .15 | .03 | .02 | .01 | .46 |
| JESSORE-KUSHTIA-KHULNA | GUNNYBAG | AUS MODERN | 11199 | 2 | 11139 | 30 | 20 | 5 | 5 | 0 | 60 |
| | | MEAN | 11199.00 | 2.00 | 11139.00 | 30.00 | 20.00 | 5.00 | 5.00 | 0.00 | 60.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .27 | .18 | .04 | .04 | 0.00 | .54 |
| | | B.AMAN LOCAL | 29864 | 1 | 29744 | 60 | 40 | 5 | 15 | 0 | 120 |
| | | MEAN | 29864.00 | .50 | 29744.00 | 60.00 | 40.00 | 5.00 | 15.00 | 0.00 | 120.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .20 | .13 | .02 | .05 | 0.00 | .40 |

Appendix - 4.5.6 : Continued.

| REGION | CONTAINER | CROP-VARIETY | QUANTITY STORED IN KG. | PERIOD OF STORAGE IN MONTHS | QUANTITY RELEASED IN KG. | EVAPORATION LOSS IN KG. | EATEN BY RODENT IN KG. | INSECT LOSS IN KG. | FUNGUS LOSS IN KG. | OTHER LOSS IN KG | TOTAL LOSS DUE TO ALL REASONS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BORO MODERN | 37300 | 1 | 37100 | 120 | 60 | 10 | 10 | 0 | 200 |
| | | MEAN | 37300.00 | .50 | 37100.00 | 120.00 | 60.00 | 10.00 | 10.00 | 0.00 | 200.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .32 | .16 | .03 | .03 | 0.00 | .54 |
| SUM | | | 78363 | 3 | 77983 | 210 | 120 | 20 | 30 | 0 | 380 |
| MEAN | | | 26121.00 | 1.00 | 25994.33 | 70.00 | 40.00 | 6.67 | 10.00 | 0.00 | 126.67 |
| VALIDN | | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| % | | | | | | .27 | .15 | .03 | .04 | 0.00 | .48 |
| BARISAL-FARIDPUR-PATUAKHALI | GUNNYBAG | BORO MODERN | 26131 | 1 | 26030 | 50 | 20 | 10 | 21 | 0 | 101 |
| | | MEAN | 26131.00 | .50 | 26030.00 | 50.00 | 20.00 | 10.00 | 21.00 | 0.00 | 101.00 |
| | | VALIDN | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | % | | | | .19 | .08 | .04 | .08 | 0.00 | .39 |
| SUM | | | 26131 | 1 | 26030 | 50 | 20 | 10 | 21 | 0 | 101 |
| MEAN | | | 26131.00 | .50 | 26030.00 | 50.00 | 20.00 | 10.00 | 21.00 | 0.00 | 101.00 |
| VALIDN | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| % | | | | | | .19 | .08 | .04 | .08 | 0.00 | .39 |
| TOTAL | | | 1348755 | 30 | 1325973 | 19400 | 2030 | 534 | 348 | 573 | 22890 |
| MEAN | | | 39669.26 | .87 | 38999.21 | 570.59 | 59.71 | 15.71 | 10.24 | 16.85 | 673.24 |
| VALIDN | | | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| % | | | | | | 1.44 | .15 | .04 | .03 | .04 | 1.70 |

For AEZ wise conversion ratio, Paddy to Rice, please see Appendix 4.4.11.

Appendix 4.7.1 : Handling Loss at Primary Market by Upazila

| Upazila | Total Quantity Handled (Kg.) | Total Handling Loss (Kg.) | Percentage Loss (%) |
|---|---|---|---|
| Rangunia | 253408.00 | 1.00 | 0.22 |
| | (42234.67) | (0.13) | |
| Satkania | 40306.00 | 2.00 | 0.73 |
| | (13435.33) | (0.82) | |
| Feni | 4746990.00 | 17921.00 | 0.38 |
| | (527443.30) | (1991.22) | |
| Kishoreganj | 261310.00 | 1151.00 | 0.44 |
| | (43551.67) | (191.83) | |
| Sarishabari | 143701.00 | 130.00 | 0.09 |
| | (17962.63) | (16.25) | |
| Kaliakair | 729606.00 | 606.00 | 0.08 |
| | (81067.33) | (67.33) | |
| Kalihati | 697886.00 | 1227.00 | 0.18 |
| | (53683.54) | (94.35) | |
| Chandina | 921967.00 | 476.00 | 0.13 |
| | (43903.20) | (22.65) | |
| Chandpur | 122485.00 | 19.00 | 0.54 |
| | (15310.63) | (2.41) | |
| Habiganj | 48820.00 | 105.00 | 0.22 |
| | (5424.44) | (11.67) | |
| Gabtali | 1073234.00 | 131.00 | 0.23 |
| | (71548.93) | (8.73) | |
| Shahzadpur | 348040.00 | 45.00 | 0.21 |
| | (24860.00) | (3.21) | |
| Mithapukur | 241041.00 | 759.00 | 0.31 |
| | (20086.75) | (63.25) | |
| Chirir Bandar | 202451.00 | 89.00 | 0.18 |
| | (22494.59) | (9.92) | |
| Manirampur | 160678.00 | 56.00 | 0.28 |
| | (10042.37) | (3.50) | |
| Meherpur | 119320.00 | 40.00 | 0.20 |
| | (7457.50) | (2.52) | |
| Gournadi | 128044.00 | 5.00 | 0.20 |
| | (12804.40) | (0.50) | |
| Total | 10239287.00 | 22763.00 | 0.31 |
| | (55648.30) | (123.71) | |

Source: Field Survey

Notes: Figures in parentheses are mean values.

Appendix 4.7.2: Handling Loss at Secondary Market by Upazila

| Upazila | Total Quantity Handled (Kg.) | Total Handling Loss (Kg.) | Percentag Loss (%) |
|---|---|---|---|
| Rangunia | 20899.00 | 64.00 | 0.31 |
| | (4179.80) | (12.77) | |
| Satkania | 99115.00 | 344.00 | 0.35 |
| | (11012.78) | (38.18) | |
| Feni | 5805961.00 | 21360.00 | 0.37 |
| | (645106.80) | (2373.33) | |
| Trishal | 791148.00 | 2806.00 | 0.35 |
| | (56510.57) | (200.41) | |
| Kishoreganj | 3415645.00 | 16405.00 | 0.48 |
| | (148506.30) | (713.26) | |
| Sarishabari | 1821511.00 | 472.00 | 0.03 |
| | (303585.20) | (78.67) | |
| Kaliakair | 989076.00 | 548.00 | 0.06 |
| | (164846.00) | (91.33) | |
| Kalihati | 925536.00 | 685.00 | 0.07 |
| | (185107.20) | (137.00) | |
| Chandina | 172790.00 | 425.00 | 0.25 |
| | (21598.75) | (53.17) | |
| Chandpur | 1664421.00 | 2540.00 | 0.15 |
| | (166442.10) | (253.99) | |
| Habiganj | 102530.00 | 243.00 | 0.24 |
| | (10253.00) | (24.30) | |
| Gabtali | 1027842.00 | 2822.00 | 0.27 |
| | (93440.18) | (256.52) | |
| Shahzadpur | 151593.00 | 408.00 | 0.27 |
| | (37898.25) | (102.03) | |
| Mithapukur | 568340.00 | 1508.00 | 0.27 |
| | (51667.27) | (137.09) | |
| Chirir Bandar | 205261.00 | 654.00 | 0.32 |
| | (34210.17) | (109.00) | |
| Manirampur | 222306.00 | 734.00 | 0.33 |
| | (27788.25) | (91.69) | |
| Gournadi | 201020.00 | 775.00 | 0.39 |
| | (33503.33) | (129.09) | |
| Total | 19618316.00 | 59560.00 | 0.30 |
| | (123385.60) | (374.59) | |

Source: Field Survey

Notes: Figures in parentheses are mean values.