

Assessment of Pre and Post Harvest Losses in Rice and Wheat in West Bengal

(Executive Summary)

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1.1 Introduction

Grains may be lost in the pre-harvest, harvest and post-harvest stages. Pre-harvest losses occur before the process of harvesting begins, and may be due to insects, weeds and rusts. Harvest losses occur between the beginning and completion of harvesting, and are primarily caused by losses due to shattering. Post-harvest losses occur between harvest and the moment of human consumption. They include on-farm losses, such as when grain is threshed, winnowed and dried, as well as losses along the chain during transportation, storage and processing. Important in many developing countries, particularly in Africa, are on-farm losses during storage, when the grain is being stored for auto-consumption or while the farmer awaits a selling opportunity or a rise in prices.

As per the available data, the crop losses caused by pests and diseases are huge. But, the knowledge on the crop loss at the farm level is very much limited. In addition to losses that occur during the growth period of the crop, there is a huge quantity of grains lost during the process of harvesting, threshing, transportation and storage. Therefore, the present study makes a comprehensive attempt to estimate the dimension of losses occurring during the pre and post harvest stages of rice and wheat in West Bengal. The study estimates yield losses due to pest and diseases in the crops namely, rice and wheat. For the pre harvest losses, generally animal pests (insects, mites, rodents, snails and birds), plant pathogens (bacteria, fungi, virus, and nematodes) and weed are collectively called pests, which cause economic damage to crops. This broader definition of pests and diseases is followed in the present study. For estimating post harvest losses, there is a need to establish the extent of losses during storage under different agro climatic conditions. Causes of storage losses include sprouting, transpiration, respiration, rot due to mould and bacteria and attack by insects. Sprouting, transpiration and respiration are physiological activities that depend on the storage environment (mainly temperature and relative humidity). These physiological changes affect the internal composition of the grains and result in destruction of edible material and changes in nutritional quality. But it would be difficult to measure the loss due to physiological changes at the farm level. Nevertheless, an attempt has also been made to estimate such losses based on the visual observations and according to farmer's estimates.

1.2 Objectives of the study

The specific objectives of the study are:

1. To estimate the physical and financial losses caused by and diseases in rice and wheat at farm level
2. To estimate the measures of pest and disease management to reduce the crop loss due to pests and diseases at farm level
3. To arrive at post harvest losses in rice and wheat under different agro climatic conditions.
4. To identify factors responsible for such losses and suggest ways and means to reduce the extent of losses in different operations national productivity.

1.3 Data base and methodology

The study has been conducted mainly based on the farm level data collected from the selected respondents in West Bengal, although some secondary data has also been used in this study. The crop production constrains particularly infestation by pests and diseases, and losses caused by them have been worked out based on the estimates provided by the farmers. As not only pests and diseases cause crop damage when their population reach beyond a threshold level, there are also other bio-economic factors like soil fertility, water scarcity, poor seed quality, high input costs and low output prices result in considerable financial loss to farmers. Thus, data on these bio-economic variables have also been collected from the farmers. The post harvest losses during the process of harvesting, collection and threshing, transportation and storage have also been quantified based on the estimates provided by the farmers. Storage material used by the farmers is generally mud, bamboo, stone, plant materials etc. it is essential to identify the structure of storage at the farmers' level and enumerate the losses occurring in the process of storage at the farmer level.

To collect the primary data, a sample survey has been conducted in four districts viz. Bankura & Burdwan for rice and Murshidabad & Uttar Dinajpur for wheat in West Bengal for the reference period rabi 2010-11 (November to May) and kharif 2011-12 (June to October). In the present study, season for the wheat crop is rabi while for rice belong to kharif season. The selected districts represent major producing districts of rice and wheat and fall in two different agro-climatic regions of the state. From each district, two villages with one nearby the market/mandi centre and one far off from the market centre have been selected for canvassing the questionnaire. A random sample of 30 farmers have been selected from each village and thus constituting a total sample of 240 farmers for two crops i.e rice and wheat from four districts and eight villages. In addition to the primary data collected from the farmers, personal visits have been made to the district office of the Department of Agriculture to compile the crop loss estimates (if any) for pre and post harvest losses.

1.4 Main Findings

The performance of agriculture in West Bengal over the last three decades has witnessed a dwindling picture. Growth rates have increased and per capita incomes have gone up. Liberalization and deregulation have yielded impressive results and the economy is increasingly integrated to the world economy. Still, agriculture continues to be the backbone of the economy of the state of West Bengal. Agriculture remains the most crucial sector of the state economy as around 72 per cent of the total population lives in rural areas and agricultural continues to be their mainstay. However, along with the structural transformation of the economy of the state, the contribution of agriculture in State Domestic Product (SDP) is observed to follow a declining trend. It contributes a significant share to the SDP as compared to other sectors of the economy even the contributions of agriculture to total SDP (at constant prices) has declined from 41.16 per cent in 1970-71 to 27.1 per cent in 2000-01.

However, West Bengal failed to sustain the high growth path as achieved during the eighties. The growth rate of production of rice and wheat declined in the subsequent periods. The area growth rate of Aman rice becomes negative during the decade of nineties and the yield growth rate also reduced significantly. As a result of which the output of Aman rice declined only to 2.51 per cent per annum. During the nineties, the output growth rate of Boro rice declined to 3.69 per cent per annum and this fall in growth rate is significant.

It has been also found that the states of HP, AP and Punjab are the efficient producers of rice in the triennium ending 2007. The farmers of AP and Punjab could produce a quintal of rice at 27 per cent and 23 per cent lower cost than that of the all-India average and they have improved efficiency of production by reducing the cost of production relative to all-India average. The obverse is true in case of Assam and M.P. Madhya Pradesh produces rice at 30 per cent higher costs. Also, farmers from Assam and Tamil Nadu are expensive in rice production, which may be impinging on their profitability seriously. Rajasthan, Punjab and Haryana are the efficient producers compared to all-India average for wheat. Here, Jharkhand, West Bengal and Chattisgarh produce wheat at whopping 87 per cent, 57 per cent and 49 per cent higher cost than all-India.

As per the socio-economic characteristics of the selected respondents are concerned, it has been found that majority of the respondents are in the middle age group. The education of the respondents is more or less concentrated to secondary education and the marketing facilities are not well developed as the distance of the main market varies from 5.84 km to 8.92 km. However, the annual family income increases with the increase in farm size.

It has been found that the net operated area (NOA) varies from 1.56 acres in marginal farms to 13.69 acres in large farms. It is very interesting to note that the gross cropped area (GCA) decreases with the increase in farm size and thereby the cropping intensity is highest in marginal farms followed by medium, large and small farms. It has been observed that in the event of leasing-in the crop sharing is a predominant phenomenon in almost all farms. Crop and cost sharing is followed in marginal, small and medium farms. Similarly, fixed rent in cash is shared by these farms. Crop and cost sharing along with fixed rent in cash are not followed by large farms. The percentage share of tenancy in net operated area, it varies from 25.91 per cent in case of marginal, 15.46 per cent in case of small, 12.18 per cent in case of medium and 3.41 per cent in case of large farms. In the event of leasing-out, the crop sharing phenomenon exists in small farm only. Crop and cost sharing exists in marginal farms. There is no case of fixed rent in cash in the event of leasing-out tendency. Rent amount varies from Rs. 5410/- per acre in case of small farms to as high as Rs. 9020/- per acre in case of medium farms. It has been found that canal + tube-wells dominate the irrigation profile of the selected farms. More than 50 per cent of the land is irrigated by these sources.

Cropping pattern of the selected farms spread over to kharif, rabi and summer cultivation. However, a small portion of the gross cropped area is cultivated by perennial crop like vegetables. In kharif season, aman paddy dominates the cropping pattern in all farms. The share of aman paddy increases with the increase in size of holdings. Similarly in rabi

season, wheat occupies a larger portion than that of other crops viz., potato, mustard and pulses. The share of summer paddy in the gross cropped area is also important in the selected districts. Similarly, it has been observed that cent per cent of HYV seeds have been adopted in almost all crops except mustard and vegetables. Even in case of aman paddy though this is not a totally irrigated rice crop but the entire area is cropped with high yielding modern varieties. The similar experience has been observed in case of wheat.

In the selected district the average productivity of aman paddy is 18.83 quintal per acre, whereas the same for boro paddy is comparatively much higher (23.98 quintal/acre). Similarly, the productivity of wheat varies from 11.72 quintal per acre in large farms to 14.87 quintal per acre in medium farms. On an average 82.11 per cent of aman paddy and 78.71 per cent of boro paddy is marketed by the selected households. The same for wheat is 84.11 per cent. The value of output and marketed surplus increases with the increase in size of holdings.

As perceived by the respondents, cent per cent of the farmers are facing constraints in rice and wheat cultivation. However, the degree of severity of these constraints varies. Among these constraints, high cost of inputs and low output price ranked first both in rice and wheat. Similarly, farmers perceived water deficiency as one of the most important constraints (55.00 per cent of respondents) in rice cultivation. The farmers in the study areas in West Bengal depended mostly on monsoon and almost all of them just cultivated rice in kharif season based on availability of rains. Despite of most of them have pumps, they could not be able to tackle this constraint due to lack of water and increase in cost of production leading to the loss in their farming business. It has been found that poor quality of seed is one of the important problems in wheat.

It has been observed that the 90 per cent of the rice farmers and 83.33 per cent of the wheat farmers are able to distinguish pests and diseases attack. However, their identification is completely restricted to qualitative assessment. They are not in a position for quantitative assessment. It has been found that BPH is very important pest in HYV rice, occurring every season and causing 3.48 per cent crop loss out of the identified pests for rice viz., BPH, GLH, LF, GH, REHB. These identified pests are occurring every season and loss of production varies from 0.87 per cent to as high as 3.48 per cent. Among diseases, SB is very important which is also occurring every season and causing crop loss in the tune of 2.55 per cent. Similarly other diseases viz., B, BLB, SR and BS are also occurring every season and causing crop loss in the tune of 0.45 per cent to 2.00 per cent. Among weeds, Lh is important which causing 1.59 per cent crop loss. Other weeds of rice are Fl, Ai, Lp, Mq and Ec. The level of crop loss due to these weeds varies from 0.49 per cent to 1.59 per cent. It has been observed that conservation farming promotes a diversity of insect life, influences pest populations and also favours many beneficial insects. The beneficial insects which act as natural control agents help to create a more stable agricultural system. Reducing cultivation and maintaining mulch provides a more favourable habitat for certain soil dwelling insect pests and disease organisms. A range of pests including caterpillars, beetles, grasshoppers,

foliage feeders and sap-sucking insects occur in all crops and pastures and will require control from time to time.

Aphid is very important pest in wheat, occurring every season and causing 1.78 per cent crop loss out of the identified pests for wheat viz., Aw and SB. These identified pests are occurring every season and loss of production varies from 0.59 per cent to as high as 1.78 per cent. Among diseases, LB is very important which is also occurring every season and causing crop loss in the tune of 1.38 per cent. Similarly other diseases viz., LR, SR and YER are also occurring every season and causing crop loss in the tune of 0.26 per cent to 0.87 per cent. Among weeds, go is important which causing 2.73 per cent crop loss. Other weeds of wheat are ca, af, and sf. The level of crop loss due to these weeds varies from 0.80 per cent to 1.99 per cent. Among pests and diseases, it is worthwhile to mention that rodent is very severe and causing maximum loss in wheat cultivation. The crop loss due to rodents is as high as 5.59 per cent.

It has been found that the magnitude of crop loss due to pests, disease and weed infestation in paddy is very high. The actual production with attack is varied from 19.36 quintal to 20.88 quintal per acre. The overall loss with attack has been found to be 3.54 quintal per acre. Similarly, the overall normal production without attack is 23.52 quintal per acre. However, the percentage loss over normal production is less (15.05 per cent) than that of percentage loss over actual production.

Similarly the magnitude of crop loss due to pests, disease and weed infestation in wheat has also been found very high. The actual production with attack is varied from 3.90 quintal to 5.96 quintal per acre. The overall loss with attack has been found to be 0.92 quintal per acre. The overall normal production without attack is 6.04 quintal per acre. However, the percentage loss over normal production is less (15.29 per cent) than that of percentage loss over actual production.

In rice cultivation cent per cent of the farmers use weedicide except marginal farms. Even the use of weedicides is very high (57.17 per cent) in marginal farm also. The cost due to application of weedicides per acre in small (Rs. 160.55/-) and marginal farms (Rs.107.09/-) is very high than that of medium (Rs. 68.45/-) and large farms (Rs. 44.81/-). Interestingly, the cost due to application of insecticides per acre is also high in small (Rs.269.42/-) and marginal farms (Rs. 164.64/-) than that of medium (Rs. 134.42/-) and large farms (Rs. 103.49/-). Surprisingly, the use of fungicides is restricted to medium and large farms only and the cost due to use of fungicides varies from Rs.27.46/- to 36.93/- per acre.

In general, the attack of pest and diseases in wheat is low than that of rice. However, it has been found that cent per cent use of weedicide is restricted to small and medium farms in wheat cultivation. Similarly, use of weedicides is also extended to majority (82.50 per cent) of the marginal farms. The cost due to application of weedicides per acre in marginal farm is very high (Rs. 188.81/-) than that of small (Rs. 137.67/-) and medium farms (Rs. 114.09/-). Interestingly, the cost due to application of insecticides is restricted to small and medium farms only. Per acre cost for insecticides varies from Rs. 120.85/- in medium farms

to Rs. 33.99/- in small farms. However, there is no evidence in use of fungicides in wheat cultivation.

It has been found that both rice and wheat farmers mostly depend on private input dealers and fellow farmers in controlling pests and diseases in crop cultivation. Surprisingly as perceived by the farmers, agricultural universities and Krishi Vigyan Kendras have no role in disseminating extension services especially in case of pests and disease control management. In general and according to the suggestions of the respondents, provision of pest and disease resistant quality seeds along with technical know-how, soil testing facility etc. are call for the day to minimize the losses at pre-harvesting stage of rice and wheat. Similarly, provision of infrastructural facilities including ware houses, marketing infrastructure and good condition of road can restrict the losses at the post-harvest stage of rice and wheat.

It has been observed that the quantity lost in harvest is 0.78 kg in rice and 1.26 kg in wheat. Quantities losses during threshing in rice and wheat are 0.32 kg and 0.26 kg, respectively. Similarly, 0.55 kg and 0.83 kg are lost during winnowing of rice and wheat. The transport lost varies from 0.55 kg in rice to 0.83 kg in wheat. Quantity losses in handling are 0.31 kg in rice and 0.63 kg in wheat and quantity lost during storage is 1.78 kg in case of rice and 3.93 kg in case of wheat. The total post harvest loss in rice has been found to be 76.84 kg per acre, whereas it is 30.59 kg per acre in case of wheat. It is worthwhile to note that the total post harvest loss increases with the increase in farm size. Therefore, it has been observed that post-harvest handling has led to considerable loss in rice and wheat. The share of storage loss has been found to be maximum than that of other losses. The improvement in storage facilities required immediate attention of the policy makers for reducing post-harvest loss in rice and wheat. It has been observed that most of the cases crop by-product is used by the farmers as roof of the storage structure and a very less percentage (31.67 per cent) of farmers use burnt brick/cemented wall in storage structure. Most of the households (82 per cent) having platform in storage of 6 to 12 inches high and they use to make expenditure for maintaining the storage every year. Sun drying is done annually by every farmer and the walls of the storage are maintained every alternative year. Removal of infested grain from storage and destroying operation is done annually by 100 per cent farmers. Smoking is also done to disinfect the storage space. However, it has been observed that there is still significant scope to boost for improvement in storage structure in the study area. There is a need to impart training to the farmers, traders and extension officials at the block level on the practical aspects of storage and preservation of food grains. It is also essential to popularise scientific techniques of storage amongst farmers, etc through demonstrations and wide publicity and to develop selected villages to serve as model villages. There is also need to arrange facilities for farmers for purchase of improved types of storage structures and to maintain liaison with State Governments and to arrange steady supply of storage structures and pesticides to the users.

1.5 Conclusions and Policy Suggestions

Pre and post-harvest losses present one of the main problems not only in rice and wheat but also in all crops. Losses can occur in rice and wheat during harvesting, threshing, winnowing, drying, storage, transportation etc. It has been estimated that the total post harvest loss in rice is 76.84 kg while in wheat it is 30.59 kg per acre. Similarly, it has been found that pre harvest losses due to pest and diseases vary according to crop to crop. It has been observed that BPH is very important pest in HYV rice, occurring every season and causing a perceptible damage to rice. In rice, the other identified pests are BPH, GLH, LF, GH, REHB. These identified pests are also occurring every season and loss of production varies from farms to farms. Among diseases, SB is very important and occurring every season and causing crop loss. Other diseases viz., B, BLB, SR and BS are also very common in rice. Among weeds, Lh is important. Other weeds of rice are Fl, Ai, Lp, Mq and Ec. The level of crop loss due to these weeds varies from 0.49 per cent to 1.59 per cent.

Aphid is very important pest in wheat, occurring every season and causing crop loss. Other identified pests in wheat are Aw and SB. Among diseases, LB is very important. Similarly other diseases viz., LR, SR and YER are also occurring every season and causing crop loss. Among weeds, go, ca, af, and sf are very important. The level of crop loss due to these weeds also varies. It is worthwhile to mention that among pests and diseases, rodent is very severe and causing maximum loss in wheat cultivation.

In view of the above, it can be concluded that if pre and post harvest losses are reduced, the farm income can be increased substantially without cultivating additional acres of land or increasing any additional expenditure on seed, fertilizer, irrigation and plant protection measure to grow the crops. Based on the findings of the study, the following policy prescriptions have been made to control the pre and post harvest losses. However, it has been observed that there is still significant scope to boost for improvement in storage structure in the study area.

1. Provision of rural godowns with sufficient infrastructure of marketing facilities may control the pre and post harvest losses in a fruitful manner (**Attn:** Directorate of Marketing, Government of India).
2. Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) practices can be popularised to control the pests and diseases during the stage of pre-harvest of crops (**Attn:** Directorate of Plant Protection, Government of India).
3. There is a need to impart training to the farmers, traders and extension officials at the block level on the practical aspects of storage and preservation of food grains (**Attn:** Agricultural Universities, Extension Wing, Department of Agriculture, Government of West Bengal).
4. It is also essential to popularise scientific techniques of storage amongst farmers, etc through demonstrations and wide publicity and to develop selected villages to serve as

model villages (**Attn:** Agricultural Universities, Extension Wing, Department of Agriculture, Government of West Bengal).

5. There is also need to arrange facilities for farmers for purchase of improved types of storage structures and to maintain liaison with State Governments and to arrange steady supply of storage structures and pesticides to the users (**Attn:** Financial Institutions, Department of Agriculture, Government of West Bengal).
6. Winnowing is one of the post harvest operations that incur high amount of loss. These losses were attributed to improper handling and inefficient machine. Care should be taken to properly handle the machine during winnowing.