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POST HARVEST LOSSES AND LABOUR REQUIRMENT OF RICE CROP IN TWO SELECTED VILLAGES OF MYMENSINGH DISTRICT

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Abstract

A field survey was conducted to study the post-harvest losses and labour employment of rice crops in two selected villages of Mymensingh district' during Aus and Aman seasons in 1999. Data were collected through pretested questionnaire of the common post-harvest operations such as threshing by animal treading, hand beating and pedal threshers; cleaning of threshed paddy by traditional winnowing; sun drying of paddy on mud ground, bamboo mat, at court yard and on roadside; parboiling by soaking paddy in clay pots; steaming in aluminum or burned clay pots and milling of paddy in huller mill. The total estimated paddy loss during threshing, cleaning, sun drying and parboiling operations were 9.49% and 7.79% for Aus and Aman crops respectively with weighted average of 8.62%. The average milling loss was 3.23%. Therefore, a total of 11.85% loss was accounted for the post harvest operations (threshing to milling). The low loss estimates (less than 0.93%) in pedal threshing was comparable to hand beating. The losses were caused mainly due to improper handling, incomplete threshing, scattering, bird and domestic animals eating the grains, improper soaking, parboiling and drying, use of inefficient steel huller for both husking and polishing etc. The average labour employment for threshing and cleaning operations of paddy were 14 and 7 man-days /ha respectively. Similarly parboiling, drying and milling operations required 6, 2 and 2 man-days/ ton respectively.

INTRODUCTION

Agriculture is the major occupation of the people of Bangladesh. The future economic development of the country will depend largely on the progress made and goals achieved in this sector. About 73% of the total cultivated area (about 7.2 million hectares) is used for rice cultivation which produces over 18.72 million metric tons of rough rice annually (BBS, 1998 and the amount produces in Bangladesh is not sufficient to feed over 125 million population (BBS, 1998). Today's crying need is to increase production and reduce losses during various operations. Different post-harvest operations are practiced at the farm and village level in Bangladesh .It can be noted that paddy from the field undergoes a series of operations such as threshing, cleaning, parboiling, drying and milling before it is sold, consumed or used as seeds. High amount of post-harvest grain loss occurs in every stage of operations.

Farouk (1975) reported that the estimated post-harvest losses of paddy about 8% to as high as 22% counting all the processes between the harvest and retailing. Bala (1978)

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mentioned that the total losses in drying range from 1.56% to 5% in Bangladesh while the estimated post-harvest losses in drying , storage and milling ranges from 2 to 5%, 2 to 6% and 2 to 10% respectively in South Asia (De Padua,1978). Greely (1981) conducted a study in Bangladesh and found that the total physical losses in the operation from harvesting to sundrying did not exceeded 7%. Choudhury (1984) mentioned from the preliminary results that the farm level rice post-harvest losses from harvest to milling operations did not exceed 15%. Haque et al. (1991) reported that the total loss in Bangladesh from threshing to sundrying varied between 3.1% to 4.0% in three seasons studied with a weighted average of 3.5%. Loss in threshing and winnowing operation did not exceed 1.0% except in hand beating with 1.6% weighed loss. In another report they mentioned that the total paddy losses in Bangladesh from parboiling to milling were 5.7, 7.7 and 6.7% for the Aman, 'Boro' and Aus seasons respectively with the weighted average of 6.7%. Parboiling loss was high due to domestic animals and birds feeding during drying and also due to scattering. Milling loss was 3.8% (Haque et al.,1997).

The grain loss in Bangladesh from harvesting to milling was found to be about 13% (BRRI and FAO, 1985). At this rate the estimated loss from 18.72 million tons of rice is about 2.43 million tons per year, which is equivalent to US$ 556 million (at the rate of Tk. 12500/- per ton). Thus it seems that the reduction of losses in the rice post-harvest operations is one of the methods to increase the availability of food. Post-harvest practices in the country are primitive and traditional which varies between localities depending on the existing cultural practices and climatic condition of the area.

The major objectives of the present study were:

1. To assess field losses of existing post harvest operations.
2. To find out labour requirement in post-production activities.

METHODS

The selected sites were located at Kotwali thana of Mymensingh district. The two selected villages were Shutiakhali and Boira. A field survey was conducted during the Aus and Aman season of 1999. A pretested survey questionnaire was used for this purpose. Data were collected by personal contact at the site. Each respondent was given a brief introduction about the purpose of the study. Questionnaires were completed item by item in a very simple and understable manner. All data were collected in local units and then converted to international units. The collected information were tabulated and summarized to calculate losses. Major part of the analysis was carried out using tabular approach and standard methods. All grain weights were converted to standard 14% moisture content (wet basis) before loss calculations.

Loss measurement

Manual and pedal thresher

After the threshing operation by both manual and pedal threshers, the unthreshed and unseparated grains were separated manually from the straw. This was done by inspecting and stripping any filled grain left with the straw and by collecting unseparated grains.

The farmer did the usual sweeping of the floor or surrounding areas of the grain pile to gather grains scattered during the threshing operation. When the farmer had finished sweeping, all the matured grains remaining in the threshing area were collected. After collecting the unseparated and scattered grains, they were cleaned, weighed and the moisture content readings were recorded. Threshed grain were cleaned by winnowing and weighed as final yield. Then threshing loss was calculated using the following formula:

$$\% \text{ Threshing loss} = \frac{Ww \times MCF}{Wtw \times MCF} \times 100$$

Where,

W_w = Unthresed & unseperated grains + Scattered grain (wet weight)

Wtw = Total yield (wet weight)

MCF = Moisture content fraction

Cleaning

Cleaning loss was calculated as:

$$\% \text{ Threshing loss} = \frac{Wcw \times MCF}{Wctw \times MCF} \times 100$$

Where,

W_{cw} = Scattered grain + grain lost with Chaff and straw (wet weight)

W_{ctw} = Total cleaned grain (wet weight)

Paddy parboiling

The parboiling loss was calculated as:

$$\% \text{ Parboiling loss} = \frac{W_{pab} - W_{pad}}{W_{pab}} \times 100$$

Adjustable weight of paddy before parboiling, $W_{pab} = W_{pb} \times MCF$

W_{pb} =Wet weight of paddy

Adjustable weight of paddy fter parboiling, $W_{pad} = W_{pa} \times MCF$

W_{pa} = Wet weight of paddy

Drying

Drying loss was calculated as:

% Drying loss = % parboiling loss - % (Soaking + steaming) loss.

$$\% \text{ Soaking + Steaming loss} = \frac{W_{sa}}{W_{pab}} \times 100$$

Soaking + Steaming loss (adj. Weight), $W_{sa} = W_{sw} \times MCF$

W_{sw} = Soaking + Steaming loss (wet weight)

Milling

The milling loss was calculated as:

$$\% \text{ Milling loss} = \frac{W_L}{W_m} \times 100$$

Loss, $W_L = W_m - (W_h + W_{hb} + W_b)$

Where

W_m= Weight of Paddy before milling, kg

W_h= Weight of head rice after milling, kg

W_{hb}= Weight of husk/bran after milling , kg

W_b= Weight of broken rice after milling, kg

Labour employment

The labour employment was calculated from the collected information for threshing and cleaning operations in man-days/ha. The labour employment was also estimated for drying, parboiling and milling operations in man-days/ton.

RESULTS AND DISCUSSION

Threshing

Uncollected scattered grain lost during the threshing operation was negligible in all seasons. The unthreshed and unseparated grain from the straw, however, significantly varied with methods. Hand beating, resulted higher loss values in the Aus (1.29%) and Aman (0.945%) compared to the threshing values for Aus (0.98) and Aman (0.526%) as shown in Table 1. In Malaysia, the reported loss in threshing operation was 2.15% (Mohammed, 1981) but only 1% in Korea (Lee, 1984).

Table 1. Chronological information on threshing operation

A:Aus

Type of threshing operation		Farmers	variety code	Yied (kg)	%MC	Abjustable weight (kg)	Amount of unthreshed grainlkg)	%MC	Abjustable weight(kg)	% loss
Hand beating	Cement floor	01	Hygac	112	18.6	106	1.28	18.90	1.207	1.138
	Cemented floor	02	Pajam	667	19.1	627.45	9.17	18.80	8.658	1.379
	Mud floor	03	Mala	185	18.5	175.32	3.189	18.90	3.000	1.715
	Big stone	04	Mala	222	19.4	208.06	1.45	19.50	1.350	0.648
	On drum	05	Pajam	204	21.73	185.74	2.90	21.30	2.650	1.430
	On drum	06	Pajam	296	21.00	271.90	4.35	21.63	3.965	1.458
Average					**19.72**			**19.83**		**1.29**
Pedal threshing		07	Pajam	2.45	18.7	2.315	0.014	18.13	0.133	0.576
		,,	,,	3.3	19.5	3.088	0.0193	19.03	0.0182	0.588
		,,	,,	1.5	17.2	1.44	0.0275	17.86	0.0263	1.810
		,,	,,	1.7	17.4	1.633	0.0254	18.00	0.0254	1.480
		,,	,,	2.95	18.8	2.785	0.013	18.70	0.0123	0.445
Average					**18.32**			**18.34**		**0.98**

B:Aman

Hand Beating	Cement floor	01	BR11	148	20.9	136.13	1.35	20.90	1.242	0.912
	Round wood	02	BR11	86	20.3	79.7	0.515	20.30	0.477	0.600
	Mud floor	03	BR7	108	18.40	102.47	1.69	18.30	1.61	1.570
	Big stone	04	BR29	144	18.50	136.47	1.047	18.70	0.989	0.725
	On drum	09	BR11	300	17.30	288.48	3.3	17.00	3.18	1.100
	On drum	10	BR11	71	21.90	64.47	0.54	20.70	0.490	0.760
Average					19.50			19.32		0.945
Pedal threshing		11	BR11	1.5	19.0	1.413	0.008	21.70	0.0073	0.520
		12	,,	0.9	18.0	0.858	0.005	19.00	0.0047	0.550
		13	,,	0.8	20.0	0.744	0.004	15.40	0.0039	0.528
		14	,,	1.0	18.5	0.95	0.005	18.60	0.0047	0.498
		15	,,	0.75	19.5	0.702	0.004	19.00	0.0038	0.536
Average					**19.00**			**18.74**		**0.526**

Cleaning

The loss observed in cleaning / winnowing operation was much less. Average loss found in cleaning/ winnowing operation was 0.91% in Aus and 0.741% in Aman (Table 2).

Table 2. Chronological information on cleaning operation

A: Aus

Type of cleaning operation	Farmers code	Variety	Amount of cleanec grain (kg)	%MC	Adjustable weight (kg)	Amount of unthreshed grainIkg)	%MC	Adjustable weight(kg)	% loss
Winowing by Kula	01	Hygac	112	18.6	106	0.64	19.03	0.6028	0.568
,,	02	Pajam	667	19.1	627.45	5.00	18.90	4.715	0.751
,,	03	Mala	185	18.5	175.32	1.275	18.10	1.215	0.693
,,	04	Mala	222	19.4	208.06	0.965	20.40	0.893	0.429
,,	05	Pajam	204	21.7	185.74	1.16	22.30	1.049	0.565
,,	06	Pajam	296	21	71.9	2.61	21.63	2.380	0.875
Mannual	07	Pajam	2.45	18.7	2.32	0.0342	18.70	0.03233	1.390
,,	08,	,,	3.3	19.5	3.088	0.047	19.23	0.04242	1.420
,,	,,	,,	1.5	17.2	1.44	0.0132	17.60	0.01265	0.875
,,	,,	,,	1.7	17.4	1.633	0.0187	17.63	0.01792	1.090
,,	,,	,,	2.95	18.8	2.785	0.04	19.13	0.03763	1.350
Average				**19.08**			**19.33**		**0.91**

B: Aman

Winowing by Kula	01	BR11	148	20.9	136.13	1.14	21.20	1.04	0.760
,,	02	BR11	86	20.3	79.7	0.351	20.60	0.324	0.400
,,	03	BR7	108	18.4	102.47	0.926	18.40	0.879	0.857
,,	04	BR29	144	18.5	136.47	0.785	18.40	0.745	0.546
,,	09	IRRI	300	17.3	288.48	2.1	16.80	2.030	0.700
,,	10	BR11	71	21.9	64.47	0.644	20.70	0.590	0.920
,,	11	,,	1.5	19.0	1.413	0.01	20.70	0.0092	0.650
,,	12	,,	0.9	18.0	0.858	0.008	18.90	0.0075	0.879
,,	13	,,	0.8	20.0	0.744	0.009	17.90	0.0086	1.150
,,	14	,,	1.0	18.5	0.95	0.004	18.40	0.0038	0.399
,,	15	,,	0.75	19.5	0.702	0.006	18.50	0.0057	0.890
Average				**19.30**			**19.05**		**0.741**

Drying

The losses in drying operation were found 3.58% and 3.01% for Aus and Aman crops of 1999 season respectively. The average loss was 3.3% for both rice crops (Table 3). It was observed that the possible causes of loss were the domestic animals (goats and cows) and birds feeding on the grain during drying, grains spillage and scattering. In the Aman season farmers required about 8-10 hours drying because low moisture content of grain. The farmers dried the grain more for longer storage period. In Aus season drying took longer periods because the expected bright sunshine hours was less. The air was damp and frequent rains occured during this season.

Table 3. Chronological information on drying operation

Type of Drying operation	Farmer code	crop	Variety	Grain weight before Drying (kg)	% MC	Adjust able Weight (kg)	Grain weight after drying (kg)	% MC	Adjst able weight (kg)	% of parb oiling loss	% soaking +steam ing loss	% Drying loss
Sun drying	02	Aus	Pajam	41.00	17.50	39.33	37.00	13.20	37.34	5.04	0.15	4.89
,,	04	,,	Mala	10.00	24.13	8.826	8.50	13.70	8.529	3.35	0.385	2.97
,,	08	,,	Mala	9.50	22.10	8.60	8.45	15.30	8.32	3.23	0.285	2.945
,,	09	,,	Pajam	31.00	14.80	30.71	29.00	12.40	29.534	3.4	0.276	3.524
Average					**19.63**			**13.65**		**3.86**	**0.274**	**3.58**
Sun drying	02	Aman	BR11	41000	18.50	38.86	38.00	14.40	37.78	2.67	0.17	2.50
,,	04	,,	BR29	10.00	17.50	9.59	9.20	13.20	9.29	3.13	0.438	2.69
,,	08	,,	BR29	9.60	17.60	9.19	8.90	14.40	8.858	3.61	0.23	3.38
,,	09	,,	IRRI	31.00	16.70	30.03	29.00	14.30	28.89	3.75	0.19	3.56
,,	10	,,	BR11	22.00	21.40	20.11	19.40	13.60	19.49	3.08	0.19	2.89
Average					**18.34**			**13.98**		**3.25**		**3.01**

Parboiling

The result of the study indicated that parboiling losses were as high as 3.86%, and 3.25% for the Aus and Aman seasons respectively (Table 3). Although grain losses occurred around the working area, inside and outside the steaming and soaking tanks, the combined loss (0.26% and less) in these operations were observed negligible.

Milling

Results of the study showed that when the farmers were able to dry or processes their grain properly, the loss from Aus crop in milling operation was 3.23% (Table 4). Overdried grain is brittle while underdried grain is soft. In these cases the grain breaks or the machine scours and remove more bran than usual milling process. The high amount of broken grains observed in the milled rice in the village indicates poor condition of the grain before milling.

Table 4. Chronological information on milling operation (Engelburg Huller)

Code No.	Crop	Variety	Head rice (kg)	Broken rice (kg)	Husk+Bran (kg)	Total paddy (kg)	% loss
1.	Aus	Pajam	13	1.5	5	20	2.500
2.	,,	Mala	24.8	2.75	11.4	40	2.625
3.	,,	Mala	25	1.5	11.85	40	4.125
4.	,,	Pajam	16.5	2.75	7.85	28	3.21
5.	,,	Pajam	21.25	2.00	9.5	34	3.68
Average							**3.23**

Post-harvest loss

The total loss estimates in threshing, cleaning, drying, parboiling and milling operations were 11.85%. In terms of actual grain loss this was equivalent to 2.22 million metric tons

of estimated production of 18.72 million metric tons processed rice in 1999. This implies that awareness among farmers need to be improved in minimizing losses as different post harvest operations.

Labour employment for post-harvest processing of paddy

It is widely believed that in rice farming practices most of the farm activities are performed by causal labour. However, due to seasonality of agricultural operations, farm household members can only work full time for a few months of the year. The housewives mostly do cleaning operations. The labour requirement for post harvest processing of paddy is reported to be to the tune of 41 per cent to 49 per cent of total man-days required for its production upto harvest (Ahmed, 1981) and about one-fourth of all agricultural employment (Greely, 1980). According to the findings of the present study the labour requirement for threshing Aus and Aman crop was 14 and 13 man-days/ha respectively (Table 5 and 6) and for cleaning operation on an average 7 man-days/ha was required for both Aus and Aman crops. The finding of the study also showed that average labour requirement for parboiling, drying and milling operations were 6, 2 and 2 man-days/ton respectively.

Table 5. Labour employment in different post harvest operations for Aus

Farmer's code / Information		01	02	03	04	05	06	08	09	Average
Threshing	Labour hours/ha	102.20	98.80	121.60	128.00	88.81	144.80	-	-	114.04
	Man-days/ha	13	12	15	16	11	18	-	-	14
Cleaning	Labour hours/ha	56.89	49.02	83.6	60.25	65.75	50.50	-	-	60.99
	Man-days/ha	7	6	10	7	8	6	-	-	7
Parboiling	Labour hours/ha		47	36				42.1	38.7	40.95
	Man-days/ton		6	5				5	4	5
Drying	Labour hrs/ton		17.00	14.85				13.82	16.50	15.54
	Man-days/ton		2	2				2	2	2
Milling	Labour hrs/ton	25.00	16.75	20.75	16.07	14.70				18.66
	Man-days/ton	3	2	3	2	2				2

Table 6. Labour employment in different post harvest operations for Aman

Farmer's code / Information		01	02	03	04	08	09	10	Average
Threshing	Labour hours/ha	131.44	90.8	94.57	156.88		87.61	122.74	113.84
	Man-days/ha	16	11	11	19		11	15	13
Cleaning	Labour hours/ha	56.7	47.5	66.63	76.09		55.1	63.46	60.9
	Man-days/ha	7	6	8	9		7	8	7
Parboiling	Labour hours/ton		48.78	45.00		36.45	48.38	56.82	47.1
	Man-days/ton		6	6		5	6	7	6
Drying	Labour hours/ton		18.00	15.00		17.50	14.00	8.25	14.55
	Man-days/ton		2	2		2	2	1	2

CONCLUSION

The study has demonstrated that total loss estimation for threshing, cleaning, sundrying, parboiling operations were found 9.49% and 7.74% for Aus and Aman crops respectively with weighted average of 8.62%. The milling loss was 3.23% for Aus crop. Therefore, a total of 11.85% loss was accounted for the post harvest operations (threshing to milling). The low loss figures (less than 0.93%) in Pedal threshing was comparable to hand beating. Earlier studies by Haque et. al. (1997) found 10.2% and Choudhury (1984) reported 15% total loss from threshing to milling. The present study also confirms that the post harvest losses for both crops vary between 10 to 15%.

The study has also demonstrated that the average labour requirement for threshing and cleaning operations of paddy were 14 man-days/ha and 7 man-days/ha respectively. The findings of the study also showed that farmers required 6, 2 and 2 man-days per ton of labour for parboiling, drying and milling operations respectively.

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