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RESEARCH ARTICLE

Farm Machinery Used and Problems Associated with Rice Cultivation as Well as Farmers Expectation in Two Villages of Comilla District in Bangladesh

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Abstract

The study was undertaken to find out the real situation of modern rice cultivation in Bangladesh and to observe the demographic and socio-economic characteristics of the village and level of adoption of modern rice cultivation practices. Data were collected by sample survey method from individual farmers of two selected villages (Raichow and Hatibanda) of comilla sadar Dakkhin upazila during May 2012. From field survey, it was found 65 and 2.5 % of the farmers were categorized as small farmers and large farmers, respectively. High yielding varieties were cultivated 75% which contribute about 87% of total rice production of the country. About 77.5 and 6% tillage operation were done by power tiller and tractors in the villages, respectively. Farmer's paid on an average 5270 and Tk.4800 per hectare for land preparation and irrigation purpose, respectively. Most of the farmers preserved and used their own seed without any germination test before sowing seed. They transplanted 35-40 days (5-6 seedlings/hill) and 30-35 days (2-3 seedlings/hill) old seedlings for inbred in both Boro & T. Aman season. Farmers applied fertilizers, pesticide, herbicide and weedicide according to their own experience. About 72.5and 15% farmers controlled their weed by hand weeding method and weedicide application, respectively. During the survey, it was observed that more than 90% of the villagers were agreed that mechanization makes the rice farming easier, it saves time, reduces labor cost, human drudgery, cost of production, increases cropping intensity, overall rice production and finally made rice farming become more profitable. Farmers' got 1.7t/ha more yield and saved production cost 4260 Tk/ha by using machinery over traditional rice cultivation method. Lack of disease resistant varieties, lack of good quality seed, inadequate knowledge about machinery and modern cultivation technologies and higher input cost (Irrigation, labor, fertilizer, pesticide) were the main problems to adopt the modern rice cultivation practices.

INTRODUCTION

Rice (Oryza sativa L.) is an important food crop for over half of the world's population (Li et al., 2011; Juraimi et al., 2013). It is mostly consumed grain plays a unique role in combating global hunger (Rice Today, 2004). Global

rice production increased from 409 million tons of paddy to nearly 700 million tons between 1980 and 2011, with a compound growth rate of 1.8% per year (Adjao and Staatz, 2011). Bangladesh, being the third largest economy in South Asia, is the world's sixth largest rice producer which accounts for 77% of agricultural land use (irri.org, 2013). It has managed to triple its rice production since its independence, from 10 million Metric Ton (MT) to over 33.83 million MT (Krishi Diary, 2015. According to data from the last 40 years, the per capita rice consumption rate in Bangladesh is 153.02 Kg per person per year (Bishwajit et al., 2013).

Food and rice are the synonymous to the people of this country. During the last three and half decades rice production in Bangladesh increased more than three folds. Although net cultivated area declined to 7.84 Mha in 2011 from 8.85 Mha in 1985, the total harvested crop area increased to 14.95 Mha due to increases in annual double-, triple- and even quadruple-cropping on the same piece of land (BBS, 2012). Recently, modern varieties together cover 56% of the total rice area and account for about 74% of the total annual rice production of the country (BRRI Wikipedia. 2015). The population of Bangladesh is still growing by two million every year and may increase by another 30 million over the next 20 years. Thus, Bangladesh will require about 27.26 million tons of rice for the year 2020. During this time total rice area will also shrink to 10.28 million hectares. Rice yield therefore, needs to be increased from the present 2.74 to 3.74 t/ha (BRKB, 2011). The farmers of Bangladesh are practicing both modern and indigenous technologies. But the production is not increasing to a reasonable proportion. The average yield is 2.80 t/ha (BBS, 2012). There are many factors are behind it. In Bangladesh, very few attempts have been made to study the cause behind non-adopting of modern technologies in agriculture. Adopting modern rice cultivation practices can only produce higher yield. Thus the study was undertaken to know the existing farm machinery used at farmer's field in rice cultivation, to identify the problems in modern rice cultivation and to determine the new innovation needed for betterment of the farmers as well as sustainable development of rural community.

MATERIALS AND METHODOLOGY

The study was conducted by following sample survey method. Data were collected from individual farmers of two selected villages (Raichow and Hatibanda) of Comilla Sadar Dakkhin Upazila during May 2012. Data were taken from 40 farmers to gather information from both the villages. Random sampling technique was followed in selecting the individual farmers.Both primary and secondary data were collected in the study. Primary data from the respondents were collected through pre-tested structured questionnaire following face-to-face interviewing method. Secondary data were collected from published and unpublished manuals, articles, research reports etc. After completion of data collection, tabulation work including editing, coding and tabulation was done manually. Collected data were processed and analyzed by using simple mathematical tools like average, percentage, etc. to present the research findings in a meaningful ways. Data are expressed in percentage in a tabular form

RESULTS AND DISCUSSIONS

Socio-economic and demographic information

1. Age of the respondents

Age is considered as very important factor because young farmers perform better in agricultural works than those of older one. However, young farmers are more interested in adopting new technologies. The mean age of the respondents is 43 years. It is revealed that the highest percentage (40%) of the farmers belong to the age group of 41-50 and the lowest percentage (5%) of the farmers belong to the age group of <20 (Table 1).

Table 1 Percentage of Respondents According to their Age

Age (Years)	Frequency (n)	Percentage
<20	2	5
21-30	6	15
31-40	10	25
41-50	16	40
>50	6	15
Total	40	100

2. Level of education

Education is the backbone of a nation. Various government and non-government organizations are acting for increasing the literacy rate. The level of education of the farmers varied widely. It is revealed that about 80% of the farmers are literate among them 60% are belonging to the primary level of education. Only 20% of farmers are illiterate (Table 2). This is obviously a good sign for both the villages.

Table 2 Percent Distribution of Respondents by Their Level of Education

Level of education	Frequency	Percentage
Illiterate	8	20
Primary (1-5 Years)	24	60
Secondary (6-10 Years)	7	17.5
Higher secondary (11-12 Years)	1	2.5
Higher degree (12+)	0	0
Total	40	100

3. Pattern of land ownership

Land ownership or farm size is an important factor for adopting modern rice cultivation technologies. Generally farmers having large size farm practices diversified cropping system and adopt new technologies earlier. Average farm size of the farmers is 1.00 acre. About 65% of the farmers were categorized as small farmers whereas the number of large farmers only 2.5 % (Table 3).

Table 3 Pattern of Land Ownership of the Respondents

Farm size (acre)	Frequency	Percentage
Land less (up to 0.50)	8	20
Small (0.51-1.49)	26	65
Medium (1.50-3.49)	5	12.5
Large (3.5 or more)	1	2.5
Total	40	100

Extent of modern practices in rice cultivation

1. Use of rice variety

Variety is one of the most essential components for more rice production. High yielding varieties cultivated in 75% of rice land which contributed about 87% of total rice production of the country. Farmers of both the villages cultivated high yielding varieties as well as hybrid varieties in some extent. The varieties used in Boro season by them were BRRI dhan28, BRRI dhan29, Hybrid (ACI, Aftab, Hira) and Anamika etc. The varieties used in T. Aman season were BR11, BR22, BRRI dhan32, BRRI dhan37, BRRI dhan38, BRRI dhan40 etc.

2. Use of seed and seedling

Use of good quality seed and healthy seedling is the prerequisite for better crop production. Good quality seed germinates faster with rapid seedling growth. It was found that only by using good quality healthy seed rice yield could be increased by 10-15%. Most of the farmers preserve and use their own seed. They also collected seed from local market, seed dealer of GO, NGO and private sectors. They used 3-5 kg seed/decimal seedbed for inbred variety and 1 kg seed/decimal seedbed for hybrid variety. They did not treated seed as well as perform germination test before sowing seed. They usually transplanted 35-40 days old seedlings for inbred in both Boro & T. Aman season and 30-35 days old seedlings for hybrid rice. They transplanted 5-6 seedlings/hill for High Yielding Variety (HYV) where 2-3 seedlings/hill was enough for optimum yield and 1-2 seedlings/hill in case of hybrid variety.

3. Land preparation

Tillage practices generally have their greatest effect on plant growth during seed germination, seedling emergence, stand establishment, easy transplanting weed control, water management and even insect-pests and disease management. About 77.5% tillage operation was done by power tiller while 6% done by tractors in the villages. The farmers of both villages used power tiller or tractor for land preparation. On an average Tk. 5270 per hectare was required for land preparation. Sometimes they faced some problems in movement of tractor/power tiller when neighboring land was occupied by crops (Table 4**)**.

Table 4 Farm machinery used for land preparation at farmers field

Farm machinery used for land preparation	Frequency	Percentage
Tractor	6	15
Power tiller	31	77.5
Country plough	3	7.5
Total	40	100

4. Irrigation

Water is a crucial factor for rice production. It was the most important factor which can make a crop either success or failure. Boro rice was fully dependent on irrigation and in case of T. Aman rice supplemental irrigation. The farmers of both the villages provided irrigation on rental basis and they had to pay Tk.4800 per hectare. Among the respondents, 95% opined that they irrigated their field through shallow tubewell (Table 5).

Table 5 Water withdrawn system used for crop cultivation at farmers' field

Water withdrawn	No. of respondent	Percentage (%)
Shallow tubewell	38	95
Deep tubewell	2	5
Total	40	100

About 87.5% water was distributed through kuccha nala system and only 12.5% water was distributed through pucca nala. A major portion of irrigated water was lost due to use of kuccha nala irrigiation system but if farmers adopt modern technology such as PVC pipe, pucca nala command area of shallow or deep tubewell will be increased much more (Table 6).

Table 6 Water distribution system during crop cultivation at farmers' field

Water Distribution	No. of respondent	Percentage (%)	Water loss (%)
Kuccha nala	35	87.5	60-65
Pucca nala	5	12.5	15
P.V.C Pipe	2	5	0-6
Total	40	100	100

5. Fertilizer application

Balanced fertilization is indispensable to avoid crop yield decline and to supplement nutrient loss from the soil ecosystem. It also ensures high productivity. Most of the farmers usually applied fertilizers according to their own experience. Although they were familiar with soil health test but they do not practice it. They generally applied urea, TSP and MOP @ 220-245, 70-90 and 80-95 kg/ha respectively. Some farmers do not apply TSP as well as MOP due to higher price. Some farmers also used Zinc fertilizer @ 10-12 kg/ha. Sometimes they applied cow dung, mustard oil cake, ash etc. in their field. USG also used by the some farmers. About 95% of the farmers applied fertilizer in broadcasting method while only 5% use USG applicator in guti urea application in their field. Actually,

urea application through broadcasting was time and labor consuming; if farmers became habituated in USG applicator then it would save time and labor as well as fertilizer also to a great extent (Table 7).

Table 7 Fertilizer application method during crop cultivation at farmers field

Fertilizer application Method	No. of respondent	Percentage (%)
Broadcasting	38	95
USG applicator	2	5
Total	40	100

6. Disease and pest control

There are 31 diseases of rice recorded in Bangladesh**.** Bacterial leaf blight was a common disease of rice in this area. Yield loss due to this disease varied from 20-30% depending on the severity of infection in subtropical countries. In the tropics, the disease created a serious problem causing up to 70% yield loss. About 175 insect pests recorded in Bangladesh that feed on rice plant. On an average 18% yield loss occurred due to the infestations of major insect pests. Stem bore was common insect pest of rice in this area. It caused 20-25% yield losses. The farmers were familiar with dead heart and white head. They applied pesticides once or twice in a season. Almost every farmer used mechanical sprayer for spraying pesticide in their field.

7. Weed management

Weed was a serious pest of rice crop. Yield reduction caused by uncontrolled weed growth in low land rice ranges from 30-40% in our country. Farmers needed to employ labor and money to suppress the weed. In both the villages farmers generally practiced traditional hand weeding which was laborious, time consuming and expensive. Some farmers also used Japanese rice weeder for weed control. It was widely used in Boro season. It was available on rental basis. One weeder costs was only Tk. 20 per day. Presently, 72.5% farmers still control their weed by hand weeding method while 15% respondents control their weed by weedicide application. But, farmers agreed that application of herbicide saves some labor but it deteriorate soil quality to a great extent in the long run (Table 8).

Table 8 Mechanized weeding during crop cultivation at farmers field

Weeding method	No. of respondent	Percentage (%)
Hand weeding	29	72.5
Mechanical Weeding	2	5
Hand weeding+ Mechanical Weeding	3	7.5
Weedicides	6	15
Total	40	100

8. Harvesting

Cutting of rice was done manually and then threshing with paddle thresher. Much mechanization was gradually progressing. Farmers were not still acquainted in using reaper in crop harvesting rather they prefer to harvest through manually. But, labor problem was a great problem where reaper could be a great solution in labor crisis period. During the survey, we observed that 20% and 30% farmers had knowledge regarding reaper and combined harvester, respectively. All of them were agreed that these new technologies definitely helped them to a great extent but due to unavailability of these technologies they were not able to use them in their field (Table 9).

Table 9 Mechanized harvesting during crop cultivation at farmers field

Harvesting	Respondents knowledge		Respondents use in field	
	Frequency	Percentage	Frequency	Percentage
Reaper	8	20	0	0
Combine harvester	12	30	0	0
Manually	40	100	40	100
Total	40	100	40	100

Still, about 80% of paddy threshing done by using different types of thresher in Bangladesh. Power thresher was available on rental basis. Around Tk 490 per hectare was required for threshing paddy in different areas. Among the villagers, 75% used pedal thresher while 17.5% still thresh their paddy through drum beating. But, drum beating is always time consuming compare to pedal and close drum power thresher (Table 10).

Table 10 Post harvest machinery during crop cultivation at farmers field

Thresher	Frequency	Percentage
Pedal thresher	30	75
Close drum Power thresher	3	7.5
Drum beating	7	17.5
Total	40	100

Accessibility of Farm inputs and prices

1. Sources and timely availability of seeds

The farmer of this village preserved their own rice seed for one year. They collected seed from local market, seed dealer or neighboring farmers. Rice seeds of different seed companies were available in the dealer house. About 15% of rice seeds were procured from seed dealer or BADC dealer, while 70% seeds were preserved by the farmers from their own fields **(**Table 11**).**

Table 11 Different Sources of Rice Seed at Both the Villages

Sources of seed	Frequency	% of seed procured
Own	28	70
Neighbor's	4	10
Local market	2	5
Seed dealer/BADC	6	15
Total	40	100

The farmers collected rice seeds from different sources. Near about 83% of farmers got seeds in time to grow seedlings timely for a good harvest. But still 17.5% of the farmers faced some difficulties in procuring rice seeds timely **(**Table 12).

Table 12 Timely Availability of Rice Seeds at Both the Village

Availability	Frequency	Percentage
Timely available	33	82.5
Delay in availability	7	17.5
Not at all	0	0
Total	40	100

2. Sources and timely availability of fertilizers

There are mainly two kinds of fertilizers i.e. organic and inorganic fertilizers. Usually farmers of this village used their own organic manure in their vegetables field and other dry land crops, often in rice fields. Most of the fertilizers were available in the market in that season. About 90% of the farmers got urea timely and in proper quantity but 10% of the farmers faced some difficulties in procuring urea fertilizer timely **(**Table 13**)**.

Table 13 Timely Availability of Urea Fertilizers

Availability	Frequency	Percentage
Timely available	36	90
Delay in availability	4	10
Not at all	0	0
Total	40	100

3. Sources and timely availability of pesticides

Insect and disease infestation are almost common incidence to all crops. Many farmers often faced severe problems due to insect and disease infestation. That is why; they have no alternatives without pesticides to control disease and insect. Farmers got pesticides as well as advice from the pesticide dealers in the local market. About 85% of the farmers got required pesticides timely while 15% of the farmers faced some difficulties to get pesticides in time (Table 14**)**.

Table14 Timely availability of pesticides during crop cultivation

Availability	Frequency	Percentage
Timely available	34	85
Delay in availability	6	15
Not at all	0	0
Total	40	100

Farmer's opinion regarding mechanization in rice cultivation

Among the villagers, more than ninety per cent of the villagers were agreed that mechanization makes the rice farming easier, it saves time, reduces labor cost, human drudgery, cost of production, increases cropping intensity, overall rice production and finally made rice farming become more profitable (Table15).

Table15 Farmers opinion regarding mechanization in rice cultivation

Sl	Farmers View regarding machinery	Frequency	Percentage
1	Make farming easier	36	90.0
2	Save time	32	80.0
3	Reduced labor cost	37	92.5
4	Reduced irrigation water loss	29	72.5
5	Increase cropping intensity	33	82.5
6	Reduced human drudgery	30	75.0
7	Create new employment opportunity	33	82.5
8	Reduced cost of production	37	92.5
9	Increase rice production	38	95.0
10	Rice farming become profitable	35	87.5
	Total	**40**	**100**

Mechanization increased rice yield significantly. It was found that farmers' can get 1.7t/ha more yield by using machinery over traditional rice cultivation method (Fig. 1).

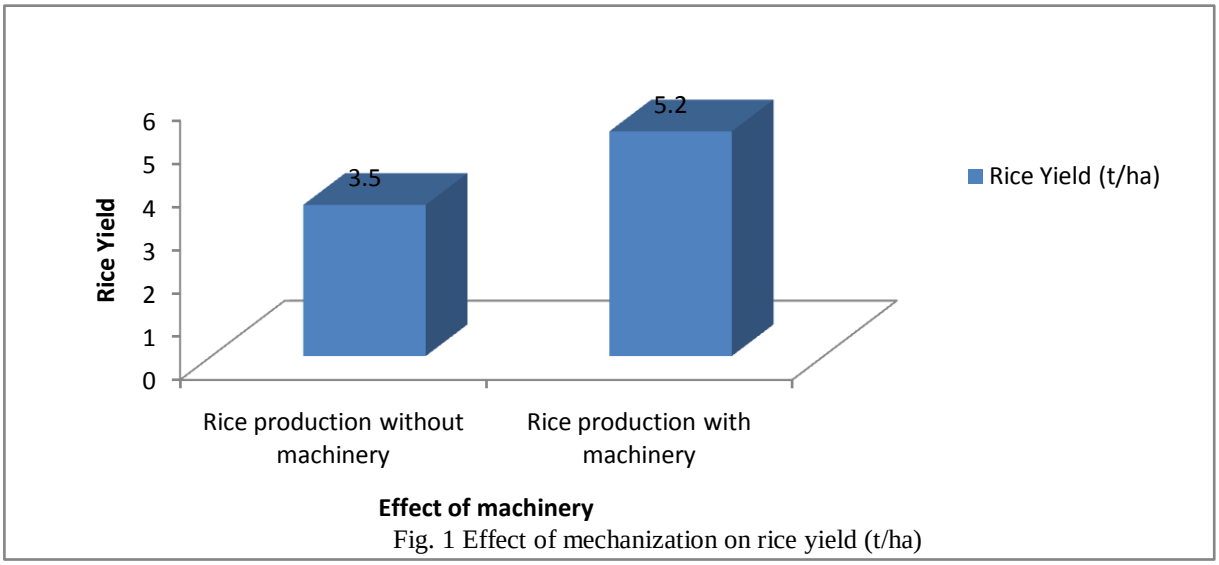

Fig. 1 Effect of mechanization on rice yield (t/ha)

Production cost of rice is now become a great concern issue for the farmers. Farmers' saved production cost 4260 Tk/ha. Minimization of rice production cost would be a great achievement for the farmers (Fig. 2).

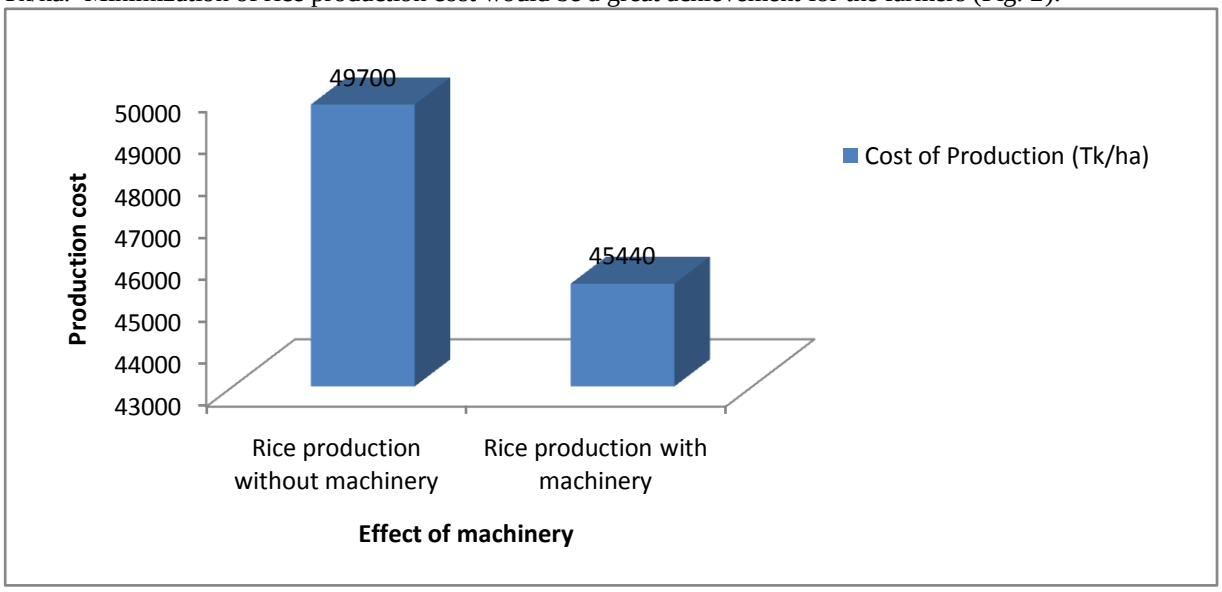

Fig. 2 Effect of mechanization on production cost ('000 tk)

About 63% of the farmers got information regarding new innovation for their socio economic upliftment from DAE personnel, 13% from neighbors' and other farmers, 8% from NGO personnel and only 5% farmers got information from relatives (Fig. 3).

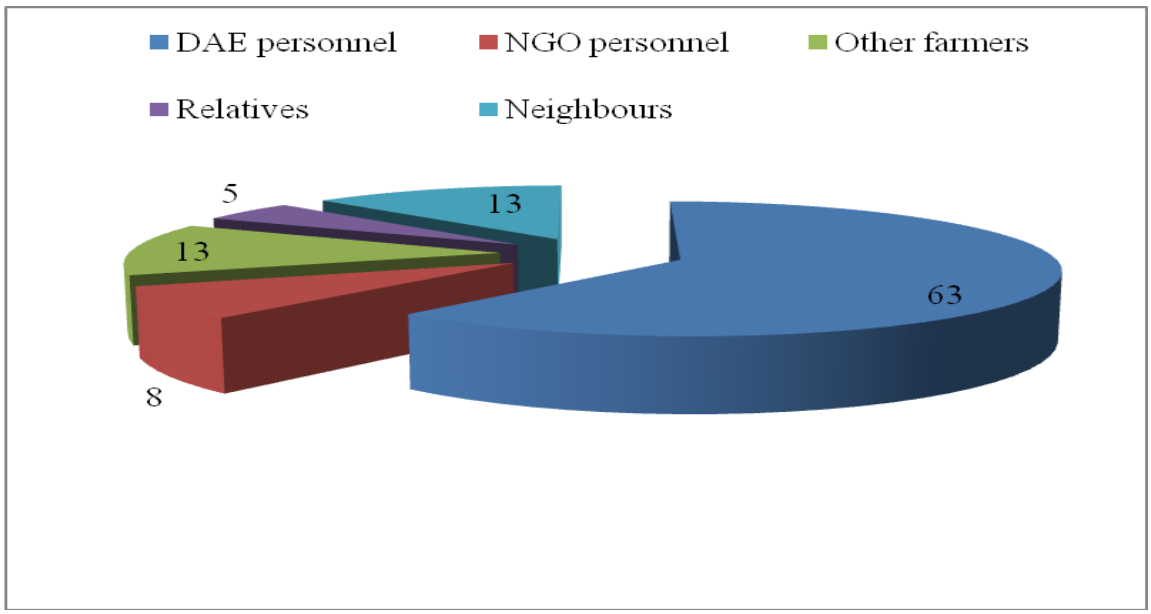

Fig. 3 Farmers get knowledge from different sources

Problems associated in modern Rice cultivation practices

Farmers always faced some problems to adopt the modern rice cultivation technologies. It needed high input and intensive care. Majority of the farmers in Bangladesh are poor. So, it is difficult for them to procure all the inputs timely and to maintain intensive care. Some important factors were hindering in both the villages. Such as, lack of sustainable and disease tolerant modern varieties. Lack of good quality seed and dissemination of high yielding varieties. Imbalance and Indiscriminate use of fertilizers, pesticides and insecticides. Higher irrigation, labor and fertilizers cost and were not available in time. Finally, inadequate knowledge in modern cultivation technologies

Farmer's expectation

Farmers viewed that they needed appropriate and precision farm machinery in every stage of rice cultivation practices. They keen interested about Rice transplanter and Mini type combine harvester for reducing pre and post harvest losses. They also needed Mini type drier to overcome the drying problem in wet season. They demanded a good marketing system for ensuring reasonable price of their product. All the farmers of two villages wanted to get sustainable modern varieties, good quality seed, fertilizers and all the other inputs in incentive cost and timely.

Conclusions

Bangladesh needs substantial increase in crop especially in rice production to provide her teeming millions of people with food and other basic needs of life by using its limited land resources. Bangladesh is a country of chronic food grain deficiency has recently attained self sufficiency due to green revolution but this is not a stable condition. About 92% farmers grow rice and have no scope for horizontal expansion. So the vertical expansion is the only way to increase rice production. To increase rice production vertically the farmers should be easy access to agricultural inputs timely, to change their traditional cultivation practices into modern cultivation practices, use of high yielding varieties, quality seeds, healthy seedlings, use of balance fertilizers, proper water management and farm mechanization from pre-harvest to post harvest operations. The government should give more emphasis and providing more training to build up awareness of the farmers about modern rice cultivation practices.

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