Drum Seeder as a Promising Technology for Direct Wet-Seeding Rice Production in Bangladesh

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Abstract

The paper is based an a study undertaken at BARD to evaluate the realtive profitability of direct seeded rice production using drum seeder in and transplanted rice during Boro season. Results indicates that direct seeding using drum seeder decreases seed rate/ha 42.85 percent, lifecycle duration by 18 days, labour requirement by 16.66 percent, and also reduces the production cost by 14.78 percent. A significant yield difference was found between direct seeded rice and transplanted rice. The study showed that direct wet seeded rice using drum seeder had out-yielded the conventional transplanted rice by 17.4 percent, which was 36 percent more profitable. Most of the farmers' attitude in the study area is positive towards drum seeder. The study recommends for wider expansion of this new technology for ensuring food security in Bangladesh.

Introduction

In Bangladesh, rice is cultivated on around 10.5 million hectares of land. The country now produces about 25 million tons of clean rice to feed her 140 million people. However, the population of Bangladesh with its present growth rate of 1.48 percent will approach 160 million by 2020. For that increased population the country will need to produce about 27.26 million tons of rice. The additional rice production has to come vertically via application of superior technologies and intensive management practices. Rice production system is undergoing changes due to progressive advancement in technologies and socio-economic conditions

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throughout the rice growing areas of the world especially in Asia. With the advent of improved agricultural machinery coupled with shortage of farm labour, mechanization is becoming inevitable and as such we must strive to take these advantages. Modern rice cultivation in Bangladesh is mostly practiced in transplanting method, which involves raising uprooting, and transplanting of seedling. Drum seeder has opened a new dimension in rice cultivation, by which rice is grown through direct seeding (Husain, 2005). Direct wet seeding of rice can now also be done more efficiently with a plastic drum seeder that is being promoted by PhilRice (Philippine Rice Research Institute). It sows the seeds in straight line and reduces the amount and cost of seed to be sown. (Sosimo Ma. Pablico).

Plastic drum seeder was first introduced in Vietnam during the year 2000 and in Bangladesh it was introduced by Bangladesh Rice Research Institute, Gazipur during 2003 by the Adaptive Research Scientists (Husain, 2005). Drum seeder is a simple machine made of high density of plastic with six to eight drums (16 cm. dia) each having a pair of rows of holes (8-9 mm.dia) on each side of the drum. It is used for seedling well prepared puddle soil directly. Several experiments conducted at research farm have very clearly demonstrated that irrespective of rice varieties, direct wet-seeded rice using drum seeder has out-yielded the conventional transplanted rice by 15-20 percent both in Aman (July- November) and Boro (November-May) season. The average yield advantage between direct wet seed and transplanting is 0.5-1.0 ton/ha. The other advantage of using Drum seeder is to bring crops matured 10-20 days earlier than the transplanted rice, which save the crop from early flood and this technique is 10-20 percent more profitable than transplanting rice production (IFAD, 2006; Husain, 2005).

Rationale for the Study

The population of Bangladesh with its present growth rate of 1.48 percent will approach 182.31 million by 2025. For the increasing population the country will have to produce more than 30 million tons of rice. The additional rice production has to come virtually through application of appropriate and sustainable technologies (improved and adaptable variety, better cultural practices, etc). Drum seeder opened a new dimension in rice cultivation that increases yield, and reduces cost of production, by which rice cultivation becomes more profitable than the previous system.

Rice cultivation in Bangladesh is predominantly practiced in transplanting method, which involves raising, uprooting and transplanting of seedlings, needs

more labour cost for planting, preparation of seedbed, raising of seeding and transplanting, and is a labour and time intensive operation. Research shows that labour involvement in these operations accounts for nearly 30 percent of the total cost of production. On the other hand, direct-wet-seeding of rice through drum seeder establishment reduces labour and production costs. In fact, this method can reduce labour requirement as much as 70 percent giving 10-15 percent yield advantage over the conventional transplanting.

The Government of Bangladesh suggested to adopt this technology. Accordingly BRRI has developed plastic drum seeder and recommended it to replicate in different regions of Bangladesh. This study might be helpful to identify the problems faced by the farmers, and to encourage policy makers, scientists, planners and implementers for adopting appropriate measures so that farmers could contribute more in rice production.

Objectives

The study was undertaken to satisfy the following objectives:

i) To demonstrate the growth and yield performance of direct wet-seeding rice production using drum seeder versus traditional transplanting method for its wider extension;
ii) To determine the profitability of rice production using drum seeder;
iii) To analyse the farmers attitude towards drum seeder;
iv) To identify constraints and prospects of drum seeder as rice production technology.

Materials and Methods

Location of the Experimental Plot and Farmer Selection:

The study was conducted at the village Hatigara, Comilla, during the period from July 2005 to June 2006 by following method demonstration and result demonstration. For demonstration purpose, farmers were selected on the basis of landownership, educational background, leadership quality, integrity and irrigation facilities.

Cultural and Other Management Practices

About 40 decimal cultivable lands were selected for demonstration purpose. The study plot consists of two sub plots (each plot size 20 decimal) - one for direct wet seeding another for transplanting. 3.5 kg seeds were sown for seedling as well as

transplanting in selected plots. Before seeding of wet seed and transplanting of seedling, the lands were well prepared with a power tiller and were ploughed and cross ploughed several times to bring about a good tilth suitable for rice production. Laddering to loosen the soil and to level the soil surface followed each ploughing. Weeds and others stubbles of the previous crops were collected and removed from the selected areas before land preparation. 30 kg urea/bigha (33 decimal), 8.25 kg TSP/bigha, 14.84 kg MP/bigha and 9.9 kg Gypsum per bigha were applied in the demonstration plots. Except urea, TSP, MP and Gypsum were applied in final land preparation. Ureas were applied by using leaf color chart (LCC) for proper management. Well sprouted (4-6mm) seeds were sown in the selected plots. Weeding, watering, urea application, pest control, roughing and other cultural management practices were done.

Data Collection and Analysis

Data were collected on different yield contribution characters and yield during the course of the experiment. Four corners were selected for data collection except extreme 3 rows to avoid the border effect.

The cost of production was analyzed to find out the comparative profitability between drum seeder method and traditional transplanting method. All the material and non-material input costs were considered for computing the cost of production. The price of rice at harvest was considered to be Tk. 9000/ton. The benefit cost ratio (BCR) was calculated by the following formula:

$$\text{Benefit Cost Ratio} = \frac{\text{Gross Return (Tk/ha)}}{\text{Total Cost of Production (Tk/ha)}}$$

Results

Growth & Yield Performance of Rice

Lifecycle duration: Direct seeded rice using drum seeder reduces the lifecycle of rice. The study indicates that BRRI dhan 29 needs 132 days for its maturity by direct seeding; on the other hand transplanted rice needs 150 days for its maturity, which shows that 18 fewer days are required for maturity of direct seeded rice (Table-1). This 18 days early harvest can save the rice crop from damages caused by any climatic hazard. IFAD (2006) reports that the growth duration decreased by an average 11 days in BRRI dhan 29 through direct seeding using drum seeder.

Yield: Significant yield difference was found between direct seeded rice and transplanted rice cultivation. The study shows that direct wet-seeded rice using drum seeder has out-yielded the conventional transplanted rice by 17.4 percent in BRRI dhan 29. The absolute difference between direct wet seeded and transplanted rice yield was around 0.97 ton/ha (Table-1). IFAD (2006) reported that paddy yield from BRRI dhan 29 increased by an average of 12 to 30 percent

Table 1 : Comparative Performance of Growth and Yield Between Direct Seeding Through Drum Seeder and Traditional Transplanting in BRRI Dhan-29

Name of the cultivation system	Life cycle Duration (days)	Area of cultivation (Decimal)	Corp Cutting Area (sq m)	Yield in Corp Cutting Area (kg)	Yield/Plot (kg)	Yield ton/ha	Increase Yield/ha (%)
Direct Seeding	132	20	2	1.308	530	6.54	17.4
Transplanting	150	20	2	1.114	451	5.57	-

Source: Field survey

using this method. Jabber et al (2006) showed that direct seeding through drum seeder in rice cultivation is more profitable for its higher yield and lower production cost (BRRI Amon Survey, 2005)

Profitability of rice production: The profitability of rice production depends on the amount of seed rate, labour requirement, operational cost, fertilizer and irrigation cost etc.

Amount of seed rate: The study showed that direct seeded rice using drum seeder needeed 42.85 percent less seed rate than transplanted rice. The experiment showed that only 2kg BRRI dhan 29 seed was required for 20 decimal of land under the direct seeding method using drum seeder, whereas 3.5 kg seed was required for the same land (Table-2) in the traditional transplanting system. These results indicate that using drum seeder saved 18.5 kg seed per hectare, which can significantly reduce cost of production in rice cultivation.

Labour requirement: Rice cultivation in 20 decimal land through drum seeder needed total 20 labours from cultivation to harvesting, as against 24 labours under the transplanting system (Table-2). So the results show 16.66 percent lower labour requirement in direct seeding, which indicates that the drum seeder reduces labour

requirement as well as labour cost of production. Jabber et al (2006) and BRRI (2005) also reported simitar findings.

Cost of Production: Table-3 indicates that the cost of production in transplanted rice was 14.78 percent higher than direct seededing using drum seeder due to more labour in transplanting phase. The study showed cost of production through direct seeding is 35407.45 Taka/ha and through transplanting is 40643.85 Taka/ha (Table-3).

Table 2 : Seed and Labour Required in Demonstrated Plot

Sl. No.	Subject	Direct Seeding through Drum Seeder	Conventional Transplanting
(1)	Area of cultivated land	20 Decimal	20 Decimal
(2)	Seed requirement	2 kg	3.5 kg
(3)	Labour required		
(i)	Labour required for Seed bed Preparation	0	1
(ii)	Labour required for main land Preparation	1	1
(iii)	Labour required for transplanting	o	4
(iv)	Labour required for direct seeding	1	0
(v)	Labour required for weeding & Irrigation	9	9
(vi)	Labour required for fertilizer Application	1	1
(vii)	Labour required for harvesting, thrashing & storing	8	8
	Total labour	20	24

Source: Field survey

Profitability: Profitability analysis showed that direct seeded rice using drum seeder was 36 percent more profitable than transplanting rice due to less labour, less seed and increased yield. Results showed that the net return from direct seeded rice was 23452.55 Tk/ha, and from transplanting rice was 12271.15 Taka/ha (Table-4). Husain et al (2005) reported that a farmer can earn 4700 to 7000 taka more profit by direct seeding through drum seeder than from transplanting.

Farmers' Attitude Towards Drum Seeder: To know the farmers attitude towards drum seeder, the researchers used a well structured questionnaire, personal communication and focussed group discussion. Farmers' attitude towards drum seeder are presented below:

Table 3 : Cost of Production in Demonstrated Plot

Cost item	Cost of Production			
	Direct Seeding through Drum Seeder		Traditional Transplanting	
	Taka/ 20 decimal	Taka/ hectare	Taka/ 20 decimal	Taka/ hectare
(i) Seed (16 Tk/Kg)	32	395.2	56	691.6
(ii) Seed bed preparation & maintenance	-	-	100	1235
(iii) Main land preparation	100	1235	100	1235
(iv) Tractor & Ploughing Cost	100	1235	100	1235
(v) Transplanting Cost	-	-	400	4940
(vi) Direct Seeding Cost	100	1235	-	-
(vii) Weeding & fertilizer application Cost	900	11115	900	11115
(viii) Fertilizer	335	4137.25	335	4137.25
(ix) Irrigation	600	7410	600	7410
(x) Harvesting Cost	700	8645	700	8645
Total Cost	2867	35407.45	3291	40643.85

Table 4 : Cost and Return Between Direct Seeding and Transplanting

System of Cultivation	Cost & Return				
	Yield (ton/ha)	Price (Tk/ton)	Gross Return (Tk/ha)	Total Cost (Tk/ha)	Net Return (Tk/ha)
Direct Seeding through Drum Seeder	6.54	9000	58860	35407.45	23452.55
Transplanting	5.57	9000	52915	40643.85	12271.15

Source: Field survey

A. Positive Attitude

(i) Direct seeded rice production through drum seeder is suitable for Boro season and soil should be medium high to medium low land. This method decreases the life cycle duration of rice and finally increases the yield over the transplanting method.

Table 5 : Profitability Analysis Between Direct Seeding and Transplanting

Cost item	Direct seeding through Drum Seeder	Transplanting
Total cost (Tk/ha)	35407.45	40643.85
Total Return (Tk/ha)	58860	52915
Net Return (Tk/ha)	23452.55	12271.15
Cost Benefit Ratio (Total Return/Total Cost)	1,662	1.301

Source: As quoted from Table-3 and Table –4.

(ii) Rice cultivation through drum seeder is helpful for medium and large farmer, which decreases labour requirement so that this method decreases the rice production cost.

(iii) This is a new technology, which saves cost of seedbed preparation and can plant without seeding. Direct seeding also save the seed rate/bigha.

(iv) Now rice cultivation is less profitable than other business. Direct seeding through drum seeder makes rice cultivation more profitable than transplanting method.

B. Negative Attitude

(i) Direct Seeding through drum seeder has some problem in rice cultivation. This method is not suitable during Amon season because seeding may be washed away by sudden rain. Farmers should be trained up about sprouting and how to operate the drum seeder.

(ii) This method performs better in level land. During cultivation, land preparation and properly leveling for direct seeding is problematic to a normal farmer. There is the probability of more weed during Boro and Aus season.

(iii) Direct seeding through Drum seeder decreases labour requirement, which can create a problem in the rural economy. The labour who are migrated from Rangpur and Kurigram to Comilla as day labour, may face unemployment.

Constraints & Prospects of Drum Seeder

Constraints

There are some constraints in direct wet-seeding rice using drum seeder. Firstly, weed is the main constraint in direct wet seeding rice during Boro and Aus season. Secondly, water logging condition is another problem during direct seeding rice. Thirdly, drum seeder is not available in the market and the farmers of our country are not well aware about it.

Prospects

Although drum seeder has some constraints, its prospects are high. Direct wet-seeded rice reduces seed rate (42.85%), reduces labour cost (15%), and increases yield (17.4%). Rice cultivation through direct wet seeding using drum seeder is economically more profitable than conventional transplanting. Direct wet seeding of rice using drum seeder may bring a revolutionary change in rice cultivation in Bangladesh. So the farmers of our country can easily adopt this technology. Policy makers may extend support to facilitate its rapid dissemination.

Conclusions

To disseminate the new technology successfully, the following points should be considered. Farmers should be trained up about how to operate this drum seeder. Drum seeder should be available in the market. Properly sprouted seed preparation and timely seeding will be necesoary. Land should be well prepared to paddled and proper label condition. Proper weed management during land preparation will be inportant. Any standing water must be drained out before sowing by drum seeder.

Finally the study concludes that direct seeded rice cultivation through drum seeder would have a very good prospect for commercial production in Bangladesh and could play an important role in ensuring the future food security of the country.

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