

ON FARM EVALUATION OF IRRI MULTI-CROP UPLAND SEEDER

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[Date Received : 10.11.1996]

Key words : Seeder, Performance, Field capacity and efficiency, Maize, Sunflower

ABSTRACT

Field performance of IRRI multi-crop upland seeder was done at Regional Agricultural Research Station (RARS), BARI, Ishurdi with maize and sunflower seeds. The field performance of the planter was highly encouraging. The field capacity of the seeder were 0.144 ha/hr and 0.162 ha/hr for sunflower and maize respectively. The field efficiency for sunflower and maize were 63.43% and 61.30% respectively at 3.2 km/hr forward speed. Seeding by this machine was about 3 times cheaper than hand seeding. At the present wage level of Tk. 60 per day the seeder has a break even area of 3 hectare per year.

INTRODUCTION

Broadcasting seeds over the loose soil and subsequent thinning of plants are the common practices in Bangladesh. Grain drill tends to give higher yield than broadcast seeder because of greater uniformity of seed distribution and uniform seeding depth (Barger *et al.*, (1972). Brammer (1977) showed similar results from his study in Bangladesh. Kemp (1966) developed a 9-row combined seed and fertilizer drill capable of sowing 493 kg/ha wheat and 137 kg/ha to 818 kg/ha fertilizer. Ali (1977) developed a multi-row seed drill for rice and wheat which gave a poor performance associated with crushing of seeds and non-uniform seed delivery. Saif and Alam (1983) developed a multi-row seed drill suitable for rice and wheat; but various modifications are needed in metering cell shape, power transmission, seed rate selector, and pull beam mechanisms. Kumar *et al.* (1986) developed a 5-row seeding attachment for wheat and barley. The overall performance of the machine was satisfactory. The maximum seed breakage obtained was 2.7% and field capacity was 0.228 ha/hr. Bangladesh Rice Research Institute (BRRI)

has developed similar animal drawn seed drill for rice. The seeding rate of BRRI upland seeder was 30-37 kg/ha, the field capacity was 0.08 ha/hr and the draft of the machine was 50-55 kg. The damage caused by the metering system was found 1-3% which is negligible (BRRI, 1986). Awadhal (1987) reported testing of a 4-row planter; its field capacity was 0.25 ha/hr.

Like all other farm machines, seeders should also be technically and economically suited to local needs and contribute to increased food production through increased yield. Experiences in some countries of the region have proved that proper sowing can only be carried out by seeding equipment of sound performance.

This study was aimed at testing and evaluation of a seeder for a number of crops and soil conditions. It was a collaborative work of BARI-IRRI farming system programme with the following objectives :

1. To test the performance of the IRRI designed multi-crop upland seeder in farmers' field condition,
2. To modify the machine as needed.

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MATERIALS AND METHODS

A five row multi-crop upland seeder (Fig. 1) obtained from IRRI through the IRRI-BARI Farming System programme, was tested in both laboratory and field condition with maize and sunflower. The planter has the following specifications (Table 1).

In the laboratory test, the equipment was calibrated for the test crop for standardization of metering mechanism, i.e. seed delivery rate, seed distribution pattern, and seed breakage. In the field, experiments were conducted at RARS, BARI, Ishurdi during the winter season of 1992-93. Two tests T_1 (seeding by machine) and T_2 (hand line sowing) were replicated thrice. The crop was fertilized with N, P_2O_5 and K_2O as per requirement of respective crops.

Table 1 Specifications of IRRI upland seeder

No. of Rows (maximum)	5 at 20 cm spacing
Row spacing	20 - 90 cm
Spacing within row	20, 25 and 50 cm
Length	158 cm
Width	108 cm
Height	73 cm
Weight (hopper empty)	105 kg
Hopper capacity (per row):	
seed section	2.5 kg rice seed
fertilizer section	3.3 kg fertilizer
Crops	Rice, sorghum, corn, mung bean
Power	2 men alternating

Data on missing hills, seed dropped per hill, hill and row spacing, depth of seeding, power requirement at working speed of the planter, field capacity, and field efficiency were recorded for each crop at the time of seeding. The field capacity and field efficiency of the machine were measured by time taken to plant a given area of land. Time required to plant 30 m × 20 m plot was noted and total loss or idle time in seed filling, turning, head land planting, and adjustment

were also noted separately. Comparative statement of cost in machine and hand sowing were made by measuring the working accuracy and labor requirements as per RNAM Test Code. For cost analysis following assumptions are made (Table 2).

Table 2 Assumptions for cost analysis

Machine cost	\$ 295 (Tk. 11,800)
Machine life ²	8 years
Salvage value ²	10% of purchase price
Annual interest ³	8%
Taxes, Insurance & Shelter ³	3 % of purchase price
Repair maintenance ³	8% of purchase price per 100 hrs
Labour wage	\$ 1.50 (TK. 60) per 8 hrs

¹ Bockhop (1988), ² RNAM (1983), ³ Hunt (1977)

RESULTS AND DISCUSSION

Data pertaining to the machine performance in the laboratory test with respect to different parameters are presented in Table 3. The metering mechanism was found suitable in the laboratory test at 3 km/hr. The seed breakage was about 3.5% for maize and 2.80 % for sunflower which is acceptable (Kumar et al, 1986).

The field test data of different parameters in machine and hand planting are presented in Table 4. The machine was pulled by a power tiller though it was designed for a single animal. The draft requirement ranged from 65 – 80 kg which was beyond the capacity of an average pair of bullocks of Bangladesh.

Furrow opener and closer functioned well as land preparation was good. The machine slip was 9.1% during the field test. The average calculated field capacity and field efficiency were 0.162 (ha/hr) and 63.43 % for maize and 0.144 ha/hr and 61.32% for

sunflower respectively. The field capacity was low due to unskilled operators.

Table 3 Laboratory test data on metering device for maize (Barnali) and sunflower (DS-1)

Parameters	Maize	Sunflower
Machine speed, km/hr	3	3
Theoretical seed rate, kg/ha	9.98 ^a	7.8 ^c
Actual seed rate, kg/ha	11.04 (\pm 0.378) ^b	7.98 (\pm 0.31) ^b
Crushed seed rate, kg/ha	0.398 (\pm 0.12) ^b	0.22 (\pm 0.13) ^b

^a considering 2 seeds per hill; ^b means of 5 passes;

^c considering 3 seeds per hill

For sunflower, machine planting produced 4.2% missing hills. Missing hills were observed in machine planting due to mechanical handling of seed (seed breakage or inadequate cell fill) which is acceptable. Seed per hill was also significantly different in each method. The machine produced an average of 4 seed per hill compared to 5.3 for hand planting with sunflower. For maize, machine produced an average of 2.4 seed per hill compared to 4.2 for hand planting. Perhaps this was due to lack of skill of the laborers.

Hill spacing was slightly higher (33 cm) in case of machine planting. This might be due to the skidding of the ground wheel of the planter. Established hill percentage after 15 days of planting were also significantly different in each method. Machine planting gave an average of 95.8% established hills in comparison to 99.3% in hand planting of sunflower. For maize, machine planting produced lower row spacing. This was perhaps due to the

limitation of the metering mechanism of the seeder as mentioned in specification (Table 1). The yield in hand and machine were different. Though the difference in yield in magnitude seems to be small but they were statistically different. This was perhaps due to the differences of hills established in the beginning.

Considering the fixed and variable cost for machine operation, machine planting was found about 3 times cheaper than that of hand planting. Machine planting incurred a planting cost of Tk. 497 for sunflower and Tk. 444 for maize. Hand seeding cost was Tk. 1480 for sunflower and Tk. 1416 for maize. The relationship between the total cost/ha and the annual area to be cultivated is shown in the Fig. 2 for sunflower. At the present wage level of Tk. 60 per day, the machine has a break even level at 3 ha per year. The calculated cost effective area was 3.15 ha/yr which showed a good agreement with graphical value.

CONCLUSION

The overall performance of the machine was satisfactory. The average working capacity of the machine was 0.144 ha/hr for sunflower and 0.162 ha/hr for maize and required 16 man-hr/ha. The machine is quite heavy as it weighs 105 kg. It needs a power tiller for pulling. The cost of seeding seems to be high; this may due to high initial price of the machine.

RECOMMENDATION

1. The machine should be tested with other seeds like soybean, mung bean, rice, wheat, etc.
2. The machine could be made with light materials for weight reduction and for easy pulling by draft animals.

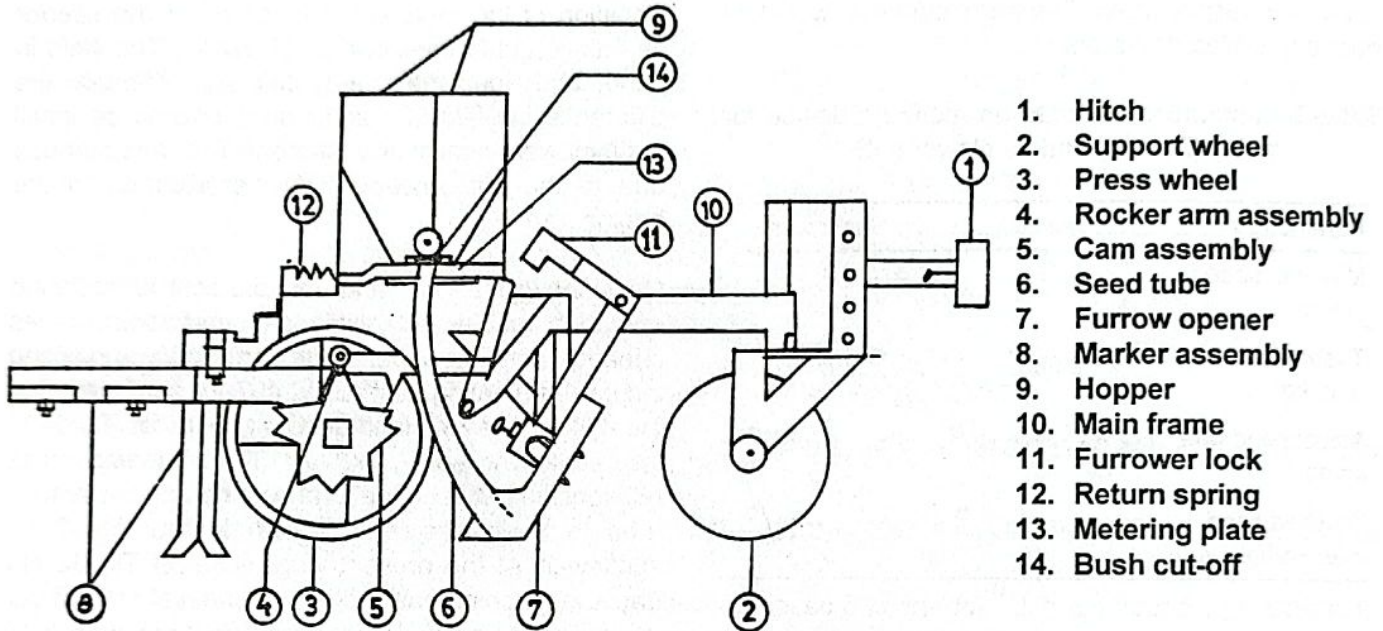


Fig. 1 Schematic diagram of IRRI upland seeder

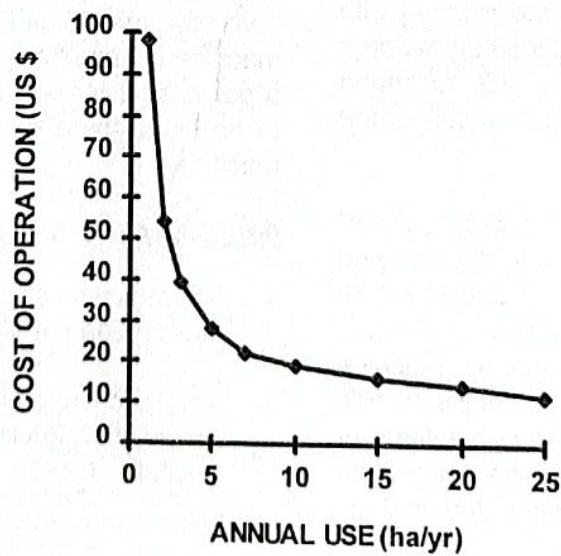


Fig. 2 Curve showing cost of operation as affected by the annual use of the seeder

Table 4 Comparison of some important parameters for machine and hand seeding
[Average performance : Sunflower 0.144 ha/hr; Maize 0.162 ha/hr]

Parameters	Planting Technique			
	Sunflower		Maize	
	Machine	Hand	Machine	Hand
Missing hill, % **	4.20	0.00	4.80	0.00
Seed per hill, no.	4.00	5.30	2.40	4.20
Hill spacing, cm **	33.00	30.00	22.50	25.00
Row spacing, cm	45.00	50.00	76.00	75.00
Established hill, % *	95.80	99.30	96.20	99.50
Seeding rate, kg/ha	7.98	11.60	10.10	16.04
Depth of planting, cm *	2.90	3.40	3.20	3.60
Wheel slip %	9.10	----	9.10	----
Yield, t/ha	1.30	1.21	3.61	3.72
Seeding cost (Tk./ha) **	443.60	1408.00	496.80	1416.00

* significant at 5 % level ** significant at 1% level

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