



Evaluation of Bullock Drawn Drum Seeder with other Rice Establishment Methods under Wet Land Conditions

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ABSTRACT

A bullock drawn 8 row drum seeder has been developed by incorporating suitable modifications in the manual 8 row drum seeder to improve plant population stand under wet land rice cultivation system. The performance of the developed bullock drawn drum seeder was compared with the existing manual drum seeder and four other methods of rice establishment i.e. manual three row mechanical transplanter, line transplanting using rope and guide; often considered as Researcher's method, SRI method and manual random transplanting as control. The performance of bullock drawn drum seeder was found superior to other methods of paddy establishment with respect to labour requirement, cost of operation, plant growth and yield parameters. The highest B: C ratio of 2.26 was found out in case of bullock drawn drum seeder with cost of operation being Rs 1275/- per ha. Among the six methods of paddy establishment under wet land condition, highest grain and straw yield of 51.8 q/ha and 67.3q/ha, respectively were recorded in case of the developed bullock drawn drum seeder. The small and marginal farmers of the state would be substantially benefited by using the bullock drawn drum seeder considering the lower cost of cultivation, labour and drudgery involvement; yet obtaining higher grain and straw yield.

Key Words: Drum seeder, Cost of operation, transplanting, labour requirement.

INTRODUCTION

Paddy is the major cereal crop of Odisha and is grown under wet land condition primarily during *kharif* season and under irrigated conditions in rabi season where conventional manual random transplanting is followed. The high yielding rice varieties have been growing in transplanted condition since their introduction, with a belief that transplanted rice usually produces 10-15 per cent more yield than direct seeded rice.

Transplanting method involves seedbed preparation, nursery growing, care of seedlings in nursery, uprooting of seedlings, hauling and transplanting operations. The preparation of seedbed and sowing are done 30 days before planting. The rice farmers practicing transplanting are facing

problems like shortage of labour during peak time, hike in labour charges, small and fragmented land holdings etc. Use of mechanical transplanter is slowly increasing; but raising mat type seedling has been a major concern for the farmers. The socio-economic conditions of the farmers of Odisha hardly permit them to own mechanical transplanters for line transplanting. In comparison, the drum seeder seems to be an alternative to transplanting under wet land rice cultivation without sacrificing the yield. The farmers are preferring line sowing of pre-germinated paddy seeds by using a 8 row manual drawn drum seeder to line transplanting by conventional hand transplanting method. The major reasons for this are reduction in labour and time requirement and cost involvement and reduction

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in drudgery. The wet seeding of rice is generally followed in irrigated areas. For wet drum seeding the paddy seeds are soaked in water for 24 hr and incubated for 24-48 hr. These sprouted seeds are sown in puddled field 1-2 d after puddling using perforated drum seeder.

Subbaiah and Balasubramanian (2000) cited the advantages of direct wet seeding of rice in comparison to transplanting as faster and easier crop establishment, reduced labour use, lesser drudgery, earlier crop maturity (8-10 d), more efficient water use due to reduced crop duration and increased benefit-crop ratio. They further opined that direct wet seeding has every potential to occupy the place of transplanted rice in command areas of Karnataka, Andhra Pradesh, Tamil Nadu and Uttar Pradesh especially under rainfed low land rice ecosystem. Chavan *et al* (2012) evaluated 8 row manual operated drum seeder in the Konkan region for seeding in both *kharif* and *rabi* season with proper irrigation practices. During field test the theoretical field capacity was calculated as 0.2 ha/h, while effective field capacity was observed to be 0.11 ha/h. The field efficiency of the seeder was found to be 55 per cent. The cost of operation of drum seeder is Rs. 32.73/- per hour and Rs.297/- per hectare. Singh and Hensel (2012) reported that the cost of operation for sowing paddy using drum seeder was Rs.800/-ha as compared to Rs.30000/-ha in conventional method. The benefit cost (B:C) ratio of drum seeding was calculated as 4.59 as compared to 3.89 in case of transplanting method. They further emphasized that the dry seeder technology is preferred because of low draft requirement, labour saving, natural resource conservation, better output/profits and less occupational health hazards. Islam and Ahmad (2010) developed a BRRRI modified drum type row seeder incorporating few changes in IRRRI manual drum type seeder for line sowing of pre-germinated paddy seeds and conducted field experiments to compare its performance with hand broadcasted paddy system. It was reported that the BRRRI modified drum type row seeder, with a

seeding rate of 60 kg/ha, performed better for an optimum crop yield.

However, the use of drum seeder is also limited because of improper levelling of puddled field, which results in rotting of seeds. Hence, a bullock drawn ridge type drum seeder was developed by incorporating necessary modifications in manual drum seeder i.e. making a provision for a float to form ridges as it is pulled forward and allowing the pre-germinated paddy seeds to fall on the ridge to ensure the proper plant population apart from timely completion of sowing leading to higher production and productivity.

MATERIALS AND METHODS

The bullock drawn ridge type 8 row drum seeder has been developed incorporating necessary modifications in the existing manual 8 row drum seeder. This device has got a float on which there is a provision for operator to sit and control the operation. The manual drum seeder is attached at the rear end of the float while the beam is attached to the yoke at the front. The float is so designed that it gives alternate raised surface and furrow during its operation in puddle field. The operator has to press a pedal to lift the drum seeder during the turning and has to release the pedal to allow the rotation of the ground wheels of the drum seeder as it proceeds forward. The drums of the seeder is so arranged that the seeds drop only over the middle of the raised surfaces (ridges) formed by the float and stagnant water if any flow into the furrows.

A field experiment was conducted by using (RBD) 6 treatments with 4 replications to evaluate the performance of bullock drawn drum seeder along with other rice establishment methods during *kharif*, 2016 in Central Farm, Orissa University of Agriculture and Technology. The performance of the developed bullock drawn drum seeder was compared with the existing manual drum seeder and three other methods of rice establishment i.e. manual three row mechanical transplanter, line transplanting using rope and guide; often

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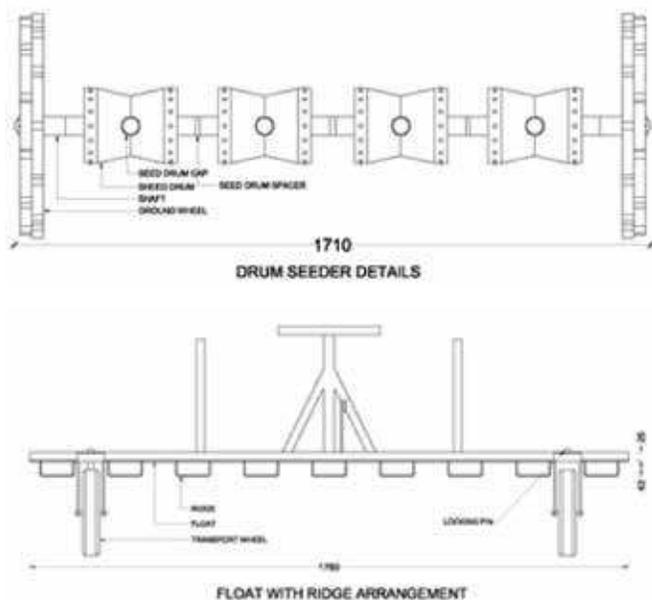


Fig 1. Drum seeder details and float with ridge arrangement

Treatments

- T1: Bullock drawn 8 row drum seeder
- T2: Manual 8 row drum seeder
- T3: Manual 3 row mechanical transplanter
- T4: SRI method
- T5: Line transplanting using rope & guide method
- T6: Control-Manual random transplanting

RESULTS AND DISCUSSIONS

The results on functional parameters, plant growth and yield parameters of different methods of paddy establishment have been presented in Table 1 and 2, respectively. The output of the bullock drawn drum seeder was found to be 0.157 ha/h as compared to 0.165 ha/h in case of the manual drum seeder. The output of the 3 row manual mechanical transplanter was observed to be 0.016 ha/h. The draft and power requirement of the bullock Cost of conventional transplanting: Rs 10900/- per ha [(30 workers/ha for transplanting + 20 workers for nursery uprooting + bullock with plough man 1 day with 2 workers for nursery bed preparation)

considered as Researcher's method and SRI method. Conventional manual random transplanting was included in the field experiment as control. A high yielding variety (HYV), *Rani* was selected for the experiment. Recommended package of practices with references to land preparation, fertilizer and plant protection measure were followed for the experiment. The functional parameters, plant growth parameters and yield parameters were recorded to compare the performance of different treatments under the study.

Table 1. Functional parameters of different methods of paddy establishment.

Treatment	Actual field capacity, ha/h h/ha	Speed of operation, kmph	Draft, kgf	Power, hp	Cost of operation, Rs/ha	Seed rate, kg/ha	Labour requirement, man days/ha	Field efficiency, percent
T1	0.165 6.06	1.602	8.1	0.048	975	30.67	5.02	64.35
T2	0.157 6.37	1.453	45.8	0.246	1275	31.25	5.12	67.54
T3	0.016 62.5	0.290	14.6	0.016	2874	35.12	10.42	61.21
T4	-	-	-	-	12548	5.24	60.24	-
T5	-	-	-	-	11456	40.32	54.78	-
T6	-	-	-	-	11004	40.16	52.52	-

Table 2. Plant growth and yield parameters under different methods of paddy establishment.

Treatment	No of tillers/ sqm at maxi- mum tillering	Plant height, cm	No of panicles /sq m	No of grains/ panicle	1000 grain weight, g	Grain yield, q/ ha	Straw yield, q/ ha	B:C ratio
T1	320	118.2	294	107	23.8	46.8	64.6	2.06
T2r	370	115.0	340	118	24.1	51.8	67.3	2.26
T3	321	107.6	291	105	23.7	46.0	64.4	1.93
T4	360	113.2	332	116	23.4	50.2	60.2	1.65
T5	356	112.8	327	111	23.0	49.5	59.4	1.67
T6	327	111.2	301	109	23.1	45.6	57.1	1.55
CD 0.05%	9.8	6.97	10.22	8.20	0.34	6.11	3.75	

Cost of planting by 8-row bullock drawn drum seeder: Rs 1275/- per ha [(operating cost of drum seeder is Rs 108/h)x 6.25 hrs/ha) + 1 worker for watching 3 days]

Cost of planting by 8-row drum seeder: Rs 975/- per ha [(operating cost of drum seeder is Rs 75/h) x 5 hrs/ha) + 1 worker for watching 3 days drawn drum seeder were found to be 45.8 kgf and 0.246 hp respectively. The average draft requirement for operating the transplanter was found to be 14.6 kgf and operating the manual drum seeder was within 5.3 to 8.1 kgf. Highest cost of operation among the treatments was recorded as Rs12548/- per ha for manual transplanting in SRI method while it was lowest as Rs 975/- per ha in case of manual drum seeder due to the fact that the highest and lowest labour requirement of 60.24 man days/ha and 5.02 man days/ha were observed in SRI method and manual drum seeder, respectively. The cost of operation in case of bullock drawn drum seeder was found to be Rs 1275/- ha.

Among the different paddy establishment methods, maximum and minimum number of plants per square meter at maximum tillering stage were observed to be 370 and 320 respectively, in case of bullock drawn drum seeder and manual drum seeder. The highest and lowest plant heights as 118.2 cm and 107.6 cm were found to be in case of manual drum seeder under puddled condition and

3 row manual mechanical trasplanter respectively. Considering the other plant growth parameters such as No of panicles/sq m, No of grains/ panicle and 1000 grain weight, the performance of the bullock drawn drum seeder was found to be superior to other treatments under the experiment. The highest No of panicles/sq m, No of grains/ panicle and 1000 grain weight in case of the said treatment were 340, 118 and 24.1 g respectively. Highest and lowest grain yield of 51.8 q/ha and 45.6 q/ha were recorded in case of bullock drawn drum seeder and manual random transplanting respectively. The grain yield in case of manual drum seeder, SRI method and manual line transplanting using rope and guide were at par. Similarly the straw yield was found to be highest as 67.3q/ha in case of bullock drawn drum seeder which was at par with manual drum seeder and manual mechanical transplanter. The highest and lowest B:C ratio of 2.26 and 1.55 were found out in case of bullock drawn drum seeder and manual random transplanting respectively. Among other treatments, the B:C ratio of manual drum seeder was observed to be 2.06, followed by 1.93 in case of manual mechanical transplanter. This may be due to the fact that the grain and straw yield were higher in case of bullock drawn drum seeder along with lower cost of operation while the cost of operation in case of manual random transplanting, manual line transplanting and SRI method were much higher in comparison to other methods.

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CONCLUSION

Considering B: C ratio and labour requirement, economic benefit to the farmer and labour involvement in different paddy establishment methods, bullock drawn drum seeder under puddled condition was found superior to other methods. This device can cater to the needs of small and marginal farmers of paddy growing areas of the state.

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Received on 11/04/2017

Accepted on 30/05/2017