

Success Stories ...2016



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Promotion of Self Propelled Riding Type Rice Transplanters in Odisha

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Introduction

Odisha has more than 4 million ha area under rice cultivation. The area under transplanted paddy is 1.66 million hectare as compared to 2.24 million hectare under broadcasted paddy (2012-13). Before transplanting, seedlings of improved varieties are nurtured for 20-25 days in the nursery. Rice seedlings are transplanted randomly without maintaining row to row and plant to plant spacing. Manual transplanting requires less seed but much more labour and the crop takes longer to mature. Improved method of raising mat type nursery can not only ensure less quantity of seeds but also less labour and area as compared to traditional practice. Planting in straight rows also facilitates mechanization of weeding and fertilizer application. Considering these benefits and to increase the work output, front line demonstrations on 8 row self-propelled riding type rice transplanters were conducted by OUAT, Bhubaneswar. The objective of this study was to evaluate the performance of rice transplanters at the farmer's fields and to get feedback on the performance of the transplanters for necessary modification and mass adoption.

The promotion of cost effective and energy efficient eight row riding type self-propelled rice transplanter was successful. It ensured timeliness in transplanting and facilitated mechanical weeding using cono weeder which ultimately reduced the cost of cultivation over traditional practice of transplanting. The mechanized transplanting helped the farmers to increase the profitability as well as productivity in the region.

Traditional Practice of Transplanting

Transplanting of rice in Odisha is usually done manually by hired female labourers. Transplanting of uprooted seedlings by female labourers is the most arduous operation in rice cultivation due to their half bending body posture. A person puts 2-3 seedlings per hill in the puddled soil at a depth of 30-50 mm. The person moves in backward direction in bending posture in puddled soil. On an average, a worker can transplant only 0.016 ha/day. A worker inserts his/her fingers 3,50,000 times in puddled field in order to transplant one hectare of land. This operation is highly labour intensive and results in low plant density leading to lower yield. Timely transplanting is affected by scarcity of labour during peak season. Delay in transplanting results in decrease in rice yield. Manual transplanting of paddy requires 300-350 man-h/ha, which is roughly 25% of total labour requirement of rice production. Mechanical weeding by weeders is also not possible due to random placement of seedlings during manual transplanting.

Salient Features of the Machine

It is a single wheel, 8-row riding type machine (Yanzi Shakti make, model 2ZT) fitted with a 2.94 kW single cylinder, air cooled diesel engine which powers the front wheel (Fig. 1). The drive wheel receives power through V-belt, cone clutch and gear box. A propeller shaft from the gear box provides power to the transplanting mechanism mounted over the float. The float facilitates the transplanter to slide over the puddled surface. The tray for keeping mat type nursery in 8 rows is moved sideways by a scroll shaft mechanism, which converts rotary motion received from the engine through belt-pulley, gear and universal joint shaft into linear motion of a rod connected to the seedling tray. It is having auto-reversing mechanism to reverse the direction of movement of tray after it reaches the extreme position at one end. Fixed fork with knock out lever type planting fingers are moved by a four bar linkage to give the designed locus to the tip of the planting finger. The planting mechanism is operated by a separate crank shaft and connecting rod system with seedling pusher. It transplants seedlings from mat type nursery in eight rows in a single pass. The effective field capacity of machine is 0.14-0.20 ha/h. The detailed specifications of the transplanter are given in Table 1.



Fig. 1. Stationery view of self-propelled rice transplanter

Table 1. Specifications of self-propelled 8-row riding type rice transplanter

1	Overall dimensions (l x b x h), mm	2410 x 2297 x 1200
2	Power source	2.94 kW single cylinder air cooled diesel engine
3	Weight, kg	305
4	Rated width, mm	1888
5	Number of rows	8
6	Row spacing, mm	238
7	Distance between hills in a row,mm	120-170
8	Power transmission system	Separate crank shaft and connecting rod system with seedling pusher

Evaluation of Self-propelled Rice Transplanter

Mat type seedlings were raised in the field on polythene sheets using a pre-fabricated frame of required tray size (Figs. 2 and 3). The germinated seeds were uniformly spread on the prepared soil mats and a thin layer of soil was spread over the sprouted seeds. Seed rate of 40 kg/ha was taken for preparation of mat type seedlings as compared to 70-80 kg/ha in case of manual transplanting. The growth of seedlings was monitored in the nursery

for next 20-22 days till they become suitable for mechanical transplanting. Seedling height at the time of transplanting was more in case of manual transplanting because the seedlings were raised directly in the field.



Fig. 2 Preparation of mat type nursery of rice



Fig. 3 Ten days old mat type rice seedlings

The performance of the self-propelled compared with traditional method of manual transplanting of root wash seedlings (Fig. 4). The standing water at the time of transplanting was less than 20 mm. The field capacity of the transplanter was 0.16 ha/h with a field efficiency of 62%. The cost of operation of the transplanter was Rs 3800/- per ha as compared to Rs 9000 per ha in manual transplanting. The saving in seed requirement was 30-40 kg/ha. The performance results of the machine are given in Table 2.

eight rows rice transplanter was



Fig. 4. Evaluation of rice transplanter at farmer's fields.

Table 2. Performance of self-propelled 8 row rice transplanter in field

S. No.	Parameters	Farmer's practice	Transplanter
1.	Type of soil	Clay loam	Sandy loam
2.	Actual area covered, ha	5	36
3.	Method of nursery raising	Root wash	Mat nursery
4.	Effective working width, mm	-	1888
5.	Labour requirement, man-h/ha	-	36
6.	Working depth, mm	20-30	20-25
7.	Height of standing water, mm	5	2 – 5
8.	Planting speed, m/s	-	0.44-0.54
9.	Number of seedlings/hill	3 - 6	2-4
10.	Missing hills, %	-	0.5
11.	Effective field capacity, ha/h	0.002	0.14-0.20
12.	Field efficiency, %	-	62.2
13.	Fuel consumption, l/h	-	0.7

14.	Cost of operation, Rs/h (Rs./ha)	- (9000)	602 (3770)
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Economics of Self-propelled Rice Transplanter

It was observed that the adoption of machine resulted in net saving in cost of transplanting of Rs. 5200/ha to machine owning farmers and about Rs. 4610/ha to farmers who got the work done on custom hiring basis (Table 3). The average payback period of the machine was worked out as 208 h. Thus, machine owners got back their investment in one year after use of 200 h annually. There was a net return of Rs. 38,150/ha to farmers in machine transplanted field as compared to Rs.23,625/ha in manual transplanted field. The higher return of Rs.14,525/ha was due to the increase in yield and savings in total labour and seed requirement.

Table 3. Economics of rice production with the use of self-propelled rice transplanter

S. No.	Parameters	Manual transplanting	Self-propelled transplanter
1.	Seed requirement, Rs./ha (kg/ha)	1125.00 (75)	600.00 (40)
2.	Cost of field preparation of main field, Rs./ha	3000.00	3000.00
3.	Cost of nursery raising and management, Rs./ha	750.00	1350.00
4.	Cost of transplanting, Rs./ha	9000.00	3800.00
5.	Cost of fertilizer application, Rs./ha	6000.00	6000.00
6.	Cost of insecticides, Rs./ha	600.00	600.00
7.	Cost of harvesting, Rs./ha	2500.00	2500.00
8.	Total cost of cultivation, Rs./ha	22975.00	17850.00
9.	Yield, q/ha	46.60	56.00
10.	Gross return, Rs./ha(@ Rs.1000/q)	46,600.00	56,000.00
11.	Net return, Rs./ha	23,625.00	38,150.00
12.	Benefit cost ratio	2.03	3.27

Table 4. Impact of adoption of self-propelled rice transplanter

S. No.	Parameters	Value
1.	Saving in cost of operation over traditional method, Rs./ha	5,125/-
2.	Enhanced yield due to uniform spacing and better plant population, Rs./ha	9,400/-
3.	Total saving, Rs/ha	14,525/-
4.	Total area covered by one machine in one year	32 ha
5.	Additional income/benefit over conventional system with one machine in one year (Rs.)	4,64,800/-
6.	No. of units with farmers	1000
7.	Total benefit, Rs./year	465 million

Enhanced income due to increase in yield because of uniform spacing and better plant population was Rs. 9,400/ha and monetary benefit over

conventional system with one machine in one year will be Rs. 4, 64,800/ha (Table 4)

Farmers Feedback

During the demonstration of self-propelled rice transplanters, the farmers appreciated riding type seat arrangement, maintenance free operation, ease in adjustments, high effective field capacity, savings in labour, seedlings and cost of operation (Fig. 5). The improved nursery preparation technique was also appreciated by women due to less requirement of nursery area and seeds quantity. The farmers were also getting accustomed to the technique of raising mat type seedlings. The machine is getting popular in coastal districts of Odisha where there is an acute shortage of labour during rice transplanting. Farmers reported an increase in yield of 10-12% with the use of self-propelled rice transplanter due to uniform plant population and healthy crop environment in line planted crop. No specific problem was reported by farmers in operation of the machine after initial training on its operation in participatory mode. Farmers reported that the planting fingers need replacement every year.



Fig. 5. Frontline demonstration of rice transplanter

Status of Technology

The large scale frontline demonstrations of 8 row self-propelled rice transplanters were carried out at farmer's fields in a total area of 96 ha during 2004-2013 in different villages of Khurda, Puri, Balasore, Cuttack, Bhadrak and Sonapur districts of Odisha state. The machine was demonstrated at Hirakud command area during 2008-12 and an area of 68 ha was covered. The machine was widely accepted by the farmers of Odisha state as more than 609 transplanters were sold during 2013-14. Presently, about one thousand self-propelled rice transplanters are in use in Odisha state. The state govt. is giving subsidy up to 75% on purchase price of transplanter to the farmers.

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