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Transplanting of paddy by self-propelled paddy transplanter over manual transplanting

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Abstract
Paddy Transplanting by self propelled transplanter ensures timely operation, saving in cost and human drudgery. A detailed economics of both manual and machine transplanting was worked out based on the study done at K.V.K. (S.V.P.U.A. & T. Meerut), Pilibhit farm in 2013-14.The self propelled paddy transplanter gave net profit of Rs 1146 and Rs 1319 per hectare when annual use of machine was 300 h (one Season) and 500 h (two) season, respectively, in one year over manual transplanting of 115 hectare respectively. The field capacity, field efficiency and fuel consumption of the machine was 0.16 ha/ h, 60.02% and 2.87 l/ha respectively. Payback period for investment on the transplanted was 6.25years and one year when area covered was 20 and 115ha. The area of coverage by transplanted should be more than 20 ha per year to make the machine transplanting profitable in comparison to the manual transplanting.

Keywords: Self propelled, transplanting, field capacity, field efficiency, payback period, fuel efficiency

Introduction
Rice is largely grown by transplanting of seedlings under puddle field condition. Transplanting healthy and vigorous seedlings gives a more uniform crop stand with higher yield than direct seeded rice (Khan and Gunkel, 1989) [2]. Transplanting in India is mostly done manually, which is tough and involves enormous drudgery and human stress in sweltering weather. It consumes about 250- 300 person-h per hectare, which is approximately 25% of the total labour requirement for rice cultivation (Singh and Hussain,1983) [5]. Non availability of labour has compounded the situation and paddy transplanting has emerged as the problem in the major growing region. This results in delay of transplanting and decrease in yield. Optimum plant density and timeliness of operation in paddy is considered essential for optimizing paddy yield which may be possible if dependence on hired labour is minimized. Since long mechanical transplanting using self propelled transplanter has been considered as most promising option because it saves labour to the tune of 90% of that required in manual transplanting minimizes stress and drudgery, ensures timely transplanting and attains optimum plant density contributing to higher productivity (Behera, 2000) [1].
These factors have encouraged the rice growing countries to investigate the economics and the performance of self propelled transplanter as compared to manual transplanting in order to know whether or not the mechanical transplanting are efficiently utilized by farmers and also find out its economic viability.

Material and Methods
The required data were collected from K.V.K. Pilibhit farm during Kharif 2013.The field performance of the transplanter in terms of field capacity, field efficiency, machine index, breakeven point, payback period, fuel consumption and analysis were evaluated (Renoll,1970) [4] in plot size of 400 square meter by using the standard methods and compared with manual transplanting. The field was first ploughed by harrow and cultivators twice to get it free from weeds. Thereafter, puddling was done by cultivators with two passes after flooding to about 10-15 cm dept of water for left for settling for 36 hours. The rice transplanting was done with self propelleled transplanter after 36 hours of sedimentation period. A Chinese make self propelled 8- row rice transplanter (Model- 2ZT-238-8), marked by M/s V.S.T. Agro Inputs Bangalore, (Specification given in table 1) was used in the trial (Fig1 and 2).

In order to determine fuel consumption of the transplanter a 4000m^2 plot was used for transplanting. The quantity of diesel filled and time of transplanting were recorded to determine the fuel consumption per hour and in liter per hectare. Detailed economics of both the methods were worked out considering the cost of operation, breakeven point and payback period of transplanter based on the trial observations.

Table 1: Technical specification of self propelled rice transplanter

Sl. No.	Item	Specifications
1.	Model	2ZT-238-8
2.	Dimension (lxwxh)cm	241x213.1x130
3.	Engine power Kw	2.4
4.	Fuel	Diesel
5.	Cooling System	Air-cooled
6.	Weight Kg	320
7.	Bulky Mechanism	Single wheel driven
8.	Type plot	Fiber glasses
9.	Working mechanism	Separate crank connecting rod transplanting mechanism
10.	No. of Rows	8
11.	Row spacing cm	23.8
12.	Wheel spacing cm	10,12
13.	Frequency of transplanting strokes /minute	238
14.	Depth of transplanting	2,12 cm adjustable with row rod
15.	**Traction wheel**	
	(a) diameter cm	70
	(b) No of Lugs	15
	(c) Lugs angle degree	22upward
16.	Frequency of strokes of fingers in maximum displacement of tray no.	14
17.	Maximum depth of finger in tearing the mate cm	1.7

Cost of operation of transplanter was calculated assuming its life as annual use of 300 hours in one season and 500 hours in two seasons. The total cost of transplanting including fixed and variable cost was determined by standard method. The total cost of transplanting was calculated on hourly basis and subsequently converted into cost per hectare taking into account the field capacity of transplanter, the cost of manual transplanting was determine by taking cost of nursery raising and its management. Nursery uprooting and transplanting per hectare, breakeven point of the transplanter was expressed as the minimum area that should be transplanted by the machine annually so that the cost of transplanting per hectare equals to that of manual transplanting. Breakeven point was calculated by determining the total cost of transplanting on unit hectare basis by increasing the area of coverage from 20 hectare at an increment of one hectare, Payback period was been expressed as the time required to recover the total money invested on the purchase of the machine and its annual coverage.

Results and Discussions

The field capacity of self propelled rice transplanter was found to be 0.16 ha/h with field efficiency of 60.02% as an average operating speeds of 1.40 Km/h (Table 2). The turning time loss was estimated as 9.38% with machine index of 87.50%. Nursery feeding and there time to time placement consumes 18.75% of total time of operation, when three person (2loaders and 1 feeders) were employed during field operation of rice transplanter.

Table 2: Field evaluation of self propelled rice transplanter.

S.No.	Particulars	Value
1.	Average operating speed km/hr	1.40
2.	Average turning time min/ha	34.97
3.	Width of operation, cm	190.40
4.	Field capacity, ha/h	0.16
5.	Field efficiency,%	60.02
6.	Percent distribution of operating time	
	(a) Transplanting time	65.63
	(b) Total time losses during operation	34.38
	(i)Turning loss time	9.38
	(ii) Mat feeding and adjustment	18.75
	(iii) Others (Cleaning of clogged fingers, engine shut down, etc)	6.25
7.	Machine index, %	87.50
8.	Fuel consumption, l/ha	0.46

A few times clogging of transplanting fingers with seedlings was also observed because bulky of mat at the base of tray. The fuel consumption of rice transplanter was measured at 0.46lit/h and

Fig 1: Mat type nursery

2.87 l/ha (Behra, 2000). The economic analysis showed that the cost of operation of the transplanter was Rs 227.47 per h and Rs 261.98 per h by considering 300 and 500 hours of annual use, respectively while using in one and two seasons (Table 3). Taking into account the average field capacity of the machine the cost of transplanting of one hectare area was calculated as Rs 2100.60 and Rs 2000.36 respectively for the above maintained annual use.

Fig 2: Machine Transplanting Paddy Crop

The above estimated cost of transplanting included the cost of nursery raising, its management, uprooting, transportation and feeding etc. The cost of manual transplanting was estimated as Rs 3300.00 per hectare. Thus a net profit of Rs 1199.40 and Rs 1299.64 per hectare at 300 and 500 hours of annual use of machine respectively would be realized over the manual transplanting (Table -3).

The transplanter requiring heavy entitled investment had a high annual fixed cost but the total transplanting cost per hectare gradually reduced when the area of coverage per year increased. So the cost analysis of two transplanting methods indicating that when an area of 20 hectare per year is covered by transplanter, the cost of transplanting per hectare equals the cost of manual transplanting.

Table 3: Cost of operation of self propelled rice transplanter and manual transplanting.

S. No.	Activity	Person-hour/ha	Cost Rs. /ha
1.	**Cost of operation of self propelled rice transplanter**		
	(i) Fixed cost	-	375.60
	(a) One season (300) hour/annum	-	225.36
	(b) Two season (500 hour/annum)	-	142.00
	(ii) Variable cost		
	(iii) The cost of operation	-	200.00
	(a) Cost of polythene	24	600.00
	(b) Nursery raising (nursery bed preparation and management etc.)		
	(c) Nursery mat cutting, transport and tray loading	24	600.00
	(d) Operator cost		
	Total cost of transplanting	6	240.00
	(a) One season (300 hour/annum)	-	2100.60
	(b) Two season (500 hour /annum)	-	2000.36
2.	**Cost of manual transplanting Nursery**		
	(i) raising and its management	16	300.00
	(ii)Nursery uprooting	26	500.00
	(iii) Transplanting	135	2500.00
	Total cost of manual transplanting	-	3300.00

Hence the minimum area of coverage per year by the transplanter should be more than 20 hectare per year to make the machine transplanting profitable in comparison to manual transplanting. The above economics analysis to that under Indian conditions, where average size of land holding is usually less than 5 hectare, owning and operating of self Propelled rice transplanter would not be economical unless owner utilize the machine on custom hiring or on co-operative basis, so that more than 20 hectare area per year is covered. The payback period, which depends upon the annual coverage of area by the transplanter (Mufti and Khan1995) [3] would be 6.25 year when the annual use of the transplanter for 20 ha. It has been estimated that at the most transplanter could be used for 500hours per year of rice transplanting is done. In two seasons, for this condition, and considering the average field capacity of the machine as 0.16 ha/h. the total area covered by the transplanter would be about 115 ha/year. The payback period would be only one year. It may, therefore, be inferred that the area of coverage should be as high as possible to make the transplanter economically viable. The productivity of the paddy was observed at no change as compared to manual transplanting, whereas the operation in the crop (intercultural and broadcasting) was easier as compared to manual transplanting.

Table 4: Particulars percent distribution

S. No.	Particulars	Value
1.	Average operating speed km/hr	1.40
2.	Average turning time min/ha	34.97
3.	Width of operation, cm	190.40
4.	Field capacity, ha/h	0.16
5.	Field efficiency,%	60.02
6.	**Percent distribution of operating time**	
	(c) Transplanting time	65.63
	(d) Total time losses during operation	34.38
	(i)Turning loss time	9.38
	(ii) Mat feeding and adjustment	18.75
	(iii) Others (Cleaning of clogged fingers, engine shut down, etc.)	6.25
7.	Machine index, %	87.50
8.	Fuel consumption, l/ha	0.46

Conclusions

The net monetary profit of Rs.1318.50 and Rs1318.50 per ha at 300 and 500 hours of annual use of transplanter, respectively, over the manual transplanting was estimated. The economic analysis shows that under Indian conditions where average land holding is usually less than 5 ha. Owning and operating of self propelled rice transplanter will not be economical unless the owner uses the machine on custom hiring or co-operative basis, so that more than 20 ha area per year is covered by the self propelled rice transplanter. The area of coverage should be as high as possible to make the transplanter economically viable.

References

1. Behera BK. Investigation on puddled soil characteristics in relation to performance of self-propelled rice transplanter. Ph. D. Thesis G.B.Pant University of Agriculture and Tech., Pantnager, 2000, 197.
2. Khan AS, WW Gunkel. Puddled soil and rice seedlings characteristics affecting rice seedlings withdrawal force, Trans, ASAE. 1989; 32(1):41-49
3. Mufti AI, AS Khan. Performance evaluation of Yanmar paddy transplanter in Pakistan, AMA. 1995; 26(1):31-36 &40.
4. Renoll ES. A method for predicting field machinery efficiency and capacity, Trans.ASAE, 1970, 448-449.
5. Singh G, UK Hussain. Modification and testing of a manual rice transplanter, AMA. 1983; 4(2):25-30.
6. Chaudhary VP, Varsheny BP, Kalra MS. Self-propelled rice transplanter- A better alternative than manual transplanting, Agricultural Engineering Today. 2005; 29(5-6):32-37.