

Research Paper :

Performance evaluation of semi automatic two row rice transplanter

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ABSTRACT

Rice (*Oryza sativa*), one of the three most important food crop in world, forms the staple diet of 2.7 billion people. In Konkan region, rice is an important crop. Transplanting is most labour consuming operation during paddy cultivation. The cost of puddling and transplanting shares 50 % of total production cost. Lots of efforts are made by Dr.B.S.K.K.V, Dapoli to popularize the commercially available eight row self propelled transplanter (Yanji Shakti). The machine works well in literatic soil of the Konkan region. The limitations of the machine are smaller plot size and undulating topography of land. Manually operated four row, six row transplanters could not get much popularity in the region as the operator has to pull the transplanter which involves lots of drudgery. In order to develop two row self propelled transplanter the performance of 2 row pulled type was studied. The transplanter was tested at the Agronomy field of Dr. B.S.K.K.V., Dapoli. Various parameters like plant to plant spacing, planting depth, field capacity, field efficiency, total time of operation, speed of operation were recorded during field evaluation. The field efficiency and field capacity of the transplanter was observed to be 84.5 % and 0.051 ha/hr respectively.

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Rice (*Oryza sativa*), one of the three most important food crop in world, forms the staple diet of 2.7 billion people. It is grown in all the continents except Antarctica, with total production of 661.3 million tonnes. The paddy production in Asia is 600.4 million tonnes (Anonymous, 2009). Its cultivation is of immense importance to food security of Asia, where more than 90% of the global rice is produced and consumed. Being the staple food for more than 62% of people, our national food security hinges on the growth and stability of its production.

Rice is generally grown by transplanting seedling in flooded field conditions or direct sowing depending upon the availability of water. In Konkan region, wet land cultivation system is followed. The land is ploughed thoroughly and puddle in 3-5 cm standing water. The puddling is largely done by bullock drawn country made plough and wooden planks in the region. In some of the pockets, the power tiller is used for puddling, but the extent is very low.

Transplanting is most labour consuming operation during paddy cultivation. The cost of puddling and transplanting shares 50 % of total production cost. The man days required for transplanting ranges from 50 to 60 man-days/ha. Now a days labour are very costly and scares. The delay in transplanting directly affects the

yield. Hence, the transplanting operation needs to mechanize. The efforts are made by Dr.B.S.K.K.V, Dapoli to popularize the commercially available eight row self propelled transplanter (Make : Yanji Shakti). The utility of the machine is limited due to smaller plot size and undulating topography of land. The field efficiency of the machine reduced due to small plot size. It is also difficult to turn the machine in smaller plot. Some imported small size transplanters are made available in the region. In order to develop 2 row self propelled transplanter the performance of 2 row pulled type was studied.

METHODOLOGY

Two row semi automatic pulled type paddy transplanter consists of 1.25 hp engine, float, two transplanting arms, rocker arm, power transmission unit, needle. Transplanting mechanism is operated by engine. Power from engine is transmitted to gear box with the help of belt and pulley arrangement and is then it is transmitted to transplanting arm. Sufficient speed reduction unit is fixed in between engine and transplanting mechanism. During operation, operator has to pull the machine in field. The specifications of the machine are shown in Table 1.

Table 1 : Specifications of the Korean transplanter

Sr. No.	Particulars	Specification
1.	Make and model	Semi automatic two rows, Korean
2.	Dimensions, mm	1500x700x900
3.	Weight, kg	50
4.	Adapted seedlings type	Mat type
5.	Row to row spacing, mm	300
6.	Engine	1.25 Hp, 3000 rpm, petrol operated, 4 stroke
7.	Float size, mm	700x700

Method of raising mat type nursery:

For raising mat type nursery, the raised bed 10x1 m was prepared on levelled field. The bed surface was levelled, compacted and smoothened. For the preparation of nursery, rice seeds of variety Palghar-1 was used. The 5 kg seeds were kept in solution of salt and water. The lighter material floating on the water surface was removed and kept in water for 24 hours. The seeds were kept in gunny bag for sprouting. Sprouted seeds were ready to use after 24-36 hours. The bed was covered with the polythene sheet (150-200 gauge) with perforations, was spread to serve as base. The frame size of 1 m x 1 m x 0.25 m was made with angle iron of 25 mm and 2 mm thick. Frame was kept over the sheet. It was filled with prepared mixture of soil compost and silt (70:20:10) to depth of 25 mm and levelled properly. The soil was moistened with water and sprouted seeds were spread evenly in frame with hand, taking care of uniform and even distribution of seeds. The bed was watered lightly and then covered with soil layer of 3-5 mm. The soil was covered with paddy straw to prevent moisture evaporation and to

protect the nursery from birds. Irrigation was applied daily to the nursery. After 20-22 days the seedlings came to height of 12-15 cm with 2-4 leaf and were ready to use.

The field testing of the transplanter was carried out in Agronomy field, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth Dapoli during year 2009. The size of the field was 10x10 m. The field was ploughed twice with the help of rotavator to a shallow depth of 12-15 cm. The puddling was carried out with the animal drawn Pankaj puddler (Make: DBSKKV, Dapoli). The field was levelled properly after puddling. Depth of water on field was kept as 3-4 cm. The field testing was carried out after 24 hours of settlement period. Various crop and field parameters like plant to plant distance, planting depth, missing of hill/m², no. of hill, draft, sinkage, no. of labour required, total time of operation, time loss in turning and nursery feeding, fuel consumption, field capacity, field efficiency were studied.

RESULTS AND DISCUSSION

The performance of the two row semiautomatic transplanter was studied in Agronomy field of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. The results obtained during field testing are presented in Table 2 and Fig. 1.

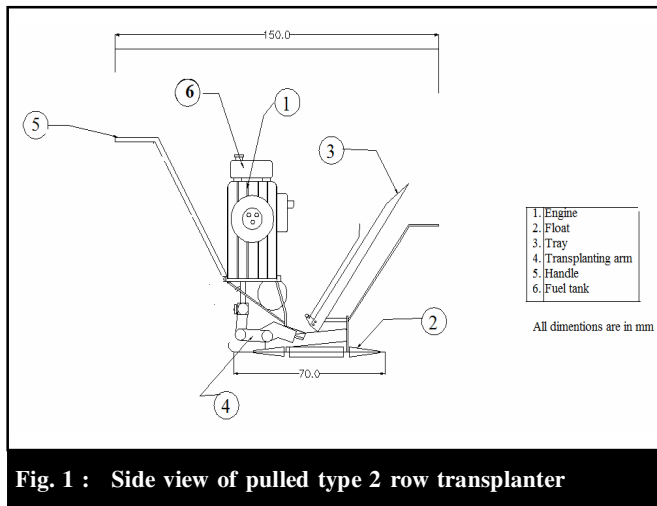
The results reveals that, average plant to plant spacing and planting depth during testing was 13.25 cm, 4.4 cm, respectively. The average seedlings per hill were 3.2. The average number of hills in one square meter area were found as 21 hills/m². The transplanting machine maintained the plant population of 67.2 /m². The plant population obtained from the machine was low against the required plant population of 100 seedlings per square meter area. The machines has resulted into row spacing of 30 cm,

Table 2 : Operating parameters of Korean transplanter

Sr. No.	Attribute	Transplanting			Average
		T ₁	T ₂	T ₃	
1.	Planting distance,(cm)	13.1	13.35	13.32	13.25
2.	Planting depth, (cm)	4.28	4.6	4.6	4.4
3.	No. of seedlings/ hill	3.1	3.2	3.2	3.2
4.	No. of hills/m ²	21	20	21	21
5.	Travel speed (km/hr)	0.96	0.97	0.96	0.96
6.	Missing hills/ m ²	6	5.5	6.1	5.8
7.	Draft (Kg-f)	30.1	30.24	30.5	30.28
8.	Sinkage (cm)	3.5	3.61	3.7	3.6
9.	Fuel consumption (l/h)	0.93	1.01	0.97	0.97
10.	Field efficiency,(%)	85.1	84.2	84.2	84.5
11.	No. of persons required for machine pulling	3	3	3	3
12.	No. of persons required for mat feeding	1	1	1	1

Table 3 : Time requirement of transplanter for transplanting, nursery feeding, repair and adjustment

Sr. No.	Operation	Time consumed (hr/ha)			Average
		T ₁	T ₂	T ₃	
1.	Planting	38.33	38	38.17	38.06
2.	Turning	7.5	7.9	7.6	7.6
3.	Feeding	4.1	4.32	4.2	4.21
4.	Adjustments/ repair	2.1	1.9	2.3	2.1
5.	Total time of operation	52.03	52.12	52.27	52.14
6.	Field capacity (ha/hr)	0.051	0.052	0.051	0.051

**Fig. 1 : Side view of pulled type 2 row transplanter**

which was responsible for low plant population. Hence, it is needed to modify the machine for required row spacing (23.5-25 cm). The Missing hills/m² was observed to be 5.8.

The average speed of operation of transplanter was 0.96 km/hr. The field efficiency was 84.5 %. Fuel consumption of the machine was 0.97 l/h. Draft requirement was observed to be 30.28 kg-f. The sinkage of the machine was observed to be 3.6 cm. Number of operators required for various operations were observed to be four. Details of time requirement of transplanter for transplanting, nursery feeding, repair and adjustments, are presented in Table 3. The time required for planting was observed to be 38.06 hr/ha. The time loss in turning and feeding was 7.6 hr/ha and 4.21 hr/ha, respectively. The time loss on repair and adjustment was 2.1 hr/ha. Total

time of operation of the transplanter was observed to be 52.14 hr/ha. The field capacity of the transplanting machine was found to be 0.051 ha/hr.

The machine is pulled type and it is required by three operator in the field. This increased the labour requirement. This is also drudgerious for two operators. It could not maintain the required plant populations per hill. This emphasise the need for modification of machine for required row spacing and making it self propelled.

Conclusion:

- The field capacity of the transplanter was 0.051 ha/hr.
- The transplanter works satisfactory in the field.
- The machine need to modify for required row spacing and also for self propelling.

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