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Field capacity and economical study of self-propelled rice transplanting machine

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Abstract
Manual method of seed planting, results in low seed placement, spacing efficiencies and serious back ache for the farmer which limits the size of field that can be planted. The cost price of imported planters has gone beyond the purchasing power of most of our farmers. Peasant farmers can do much to increase food production especially grains, if drudgery can be reduced or totally removed from their planting operations. To achieve the best performance from a seed planter, the above limits are to be optimized by proper design and selection of the components required on the machine to suit the needs of crops. Need of rice transplanter machine is growing now a days because it unique features seeding in well sequence and in well manner. Seeding by rice trans-planter saves too much efforts of human being. Class of people who uses this kind of machines is farmers and they are having poor economic background. This paper provides case study self-propelled rice transplanting machine in rice growing area of Madhya Pradesh. Rice is very labour intensive crop. Input cost is increasing day by day due to increase in cost of labour, fertilizer, seed, insecticide and other critical inputs. The study was carried out with more than 25 farmers adopting rice transplanter machine. Farmers of the rice growing area selling their produce to government cooperative society at Minimum Support Price. Benefit cost ratio in traditional rice transplanting is about 1.88 to 1.8 but mechanical method it increases up to 2.22:1.

Keywords: Self-propelled rice transplanter, rice, economy, B:C Ratio, farmer

Introduction
Rice is the major crop grown in the Balaghat district in kharif and rabi season. Earlier days there are limited availability rice transplanters in the study area. Farmers transplanting rice seedling by labour which cause high input cost and time consuming. But last few years back mechanization involved in rice transplanting. Farmers easily purchase rice transplanters machine in attractive subsidy form government. Rice is the staple food for 65% of the total population. Farm mechanisation has been helpful to bring about a significant improvement in agricultural productivity. Thus, there is strong need for mechanisation of agricultural operations. The factors that justify the strengthening of farm mechanisation in the country can be numerous. The timeliness of operations has assumed greater significant in obtaining optimal yields from different crops, which has been possible by way of mechanisation. Higher productivity of land and labour is another factor, which clearly justifies farm mechanisation. The various operations such as land levelling, irrigation, sowing and planting, use of fertilisers, plant protection, harvesting and threshing need a high degree of precision to increase the efficiency of the inputs and reduce the losses reported Chaturvedi, *et al.* (2006) [1].
It is quite inevitable to use such mechanical equipments which have higher output capacity and cut down the number of operations to be performed so as to ensure timeliness of various operations. This has helped in increasing area under cultivation and increase in cropping intensity. Due to scientific and research advancements, many agricultural machineries especially for paddy have been invented in recent years. Farmers are also well aware of this fact and started to use those machineries in their paddy field to do their farm operations. Scarcity of labour is the crucial factor which forces the farmers to adopt mechanisation in agricultural activities. Most of the farmers do not own the farm machineries as the cost is higher and they use it on hired basis. Due to heavy hire charges, non-availability of machineries at right time and labour availability some farmers still hesitate to mechanise their paddy farms.

Transplanting, weeding and harvesting operations consume most of the labour requirements in paddy cultivation and hence thrust should be given for mechanising these operations in order to reduce the labour requirement in paddy cultivation. High labour demand during peak periods adversely affects timeliness of operation, thereby reducing the crop yield. The steady drift of agricultural labour to industrial sector is adding more to the woes of the paddy farmer. To offset these problems stress on mechanisation is the need of the hour.

Traditional way of rice transplanting is labour intensive and involves drudgery reported Satyanarayana, *et al.* (2006) [9]. Mechanical rice transplanter is cost effective and operation friendly. It helps in maintaining soil physical properties and is considered to be better from crop management and productivity point of view. In spite of having an edge over the traditional transplanting, adoption rate of mechanical transplanters is low due to high initial investment and lack of knowledge in growing mat type nursery. Imparting technical knowledge, ensuring timely availability and encouraging custom hiring may be some of the practical solutions for increasing the rice area under mechanical transplanting. This review summarizes the problems associated with rice transplanting, technological gaps in adoption of mechanical transplanter and future research to make transplanter more users friendly.

In recent years, the improved implements and machinery have played significant role in accelerating the pace of agriculture mechanization in the country. These machines have been instrumental in not only increasing the cropping intensity in rice gaining areas but also in reducing the cost of rice production. This paper mainly discuss on implements and machinery being used for rice cultivation at different phase of operations such as puddling, levelling, mulching, transplanting, weeding, harvesting, threshing, winnowing, cleaning, straw management in different part of the state by the farmers for conventional rice cultivation and specially for paddy wheat cultivation reported Deshmukh (2012) [3]. Therefore a study was taken up with the objective to analyse the economics of transplanting machine involved in rice cultivation for rice transplanting in Balaghat, District of Madhya Pradesh, Deshmukh *et al*. (2013) [4].

Materials and Methods

Selection of Area of research Farmers are not aware of the advantages associated with transplanting of paddy over the broadcasting. But they are unable to practice it for high scarcity of labour. Still the transplanting machines available for the country are imported. Engine driven transplanters are high in cost and the inter-raw, intra-raw spacing are fixed which are not suitable for the Indian condition. Existing manually operated transplanters are inefficient. The main reason for the poor acceptance was the law capacity of the machine. A simple engine operated transplanter or manually operated transplanter having an average capacity of one hectare per day would be a better solution. Here are two methods practices in establishment of paddy in India. Those are direct sowing / seeding and Transplanting. 1 Direct sowing/ seeding there are two types- Wet seeding & dry\ seeding. Wet seeding Pre germinated seeds are used to broad-casted into puddled as well as levelled fields which are free from standing water. At same time of puddling basal fertilizer must be added in it. Spraying should be done when seedlings will come up to 10 inches long. The stand establishment by this method varies with the quality of land preparation, weed competition, water management & rain water during the first period after sowing. Rate of seed varies with the conditions & the type of physical damages & impurities of the seeds. Rate of seed varies from 145 Kg ha^{-1} to 290 Kg ha^{-1} depending on the level of weed infestation in dry seeded rice. Well development of plant, No transplanting shock to the plant, Suitable method for short duration varieties

A field level experiment was conducted for Assessment of Rice Transplanting Machine in Balaghat District of Madhya Pradesh (India during kharif season 2017, 2018 and 2019. The experiments consists field level survey of 25 farmers of different locations, using rice transplanting machine for seedling transplantation on their own field. The details of materials used, methods and experimental techniques adopted during the course of experimentation are described in this chapter.

Experimental site

The proposed study was conducted at different blocks of Balaghat District of MP. Field experimental surveys were conducted to study the assessment of rice transplanting machine in rice transplantation of rice seedlings at farmers filed. Field capacity and crop yield data were collected and analyzed.

Climatic condition

An area comes under the Chhattisgarh-Plains agro-climatic Zone. Average rainfall was 1301.90 mm. Maximum rainfall was received in the month of July. During Rabi season, rain was received in the 1st week of January, February and March. The maximum temp of 43.40 °C was observed in the month of May. Whereas, minimum temp of 2 °C was observed in the month of December. The study area (Balaghat district) is spread between latitude - 21º34'56" N to 22º11'00" N and longitude-79º47'31" E to 80º32'34" E.

Soil type

The soils of the Balaghat district were reported as mixed red and black soil. Thus, the deficiency of Micronutrients and sulphur were observed as Zn: 46.5%, Fe: 2.0% Mn & Cu: 0.5% and S: 9.0% as the major disorders in mixed red and black soils of Balaghat district of Madhya Pradesh, India.

Table 1: Major Soils of Balaghat

Major Soils	Area ('000 ha)	Percent (%) of total
Deep black soils	577.6	62.6
Medium sandy clay loam soils	166.0	18.05
Shallow sandy soils	177.0	19.2

***Source*:** NBSS & LUP, Nagpur

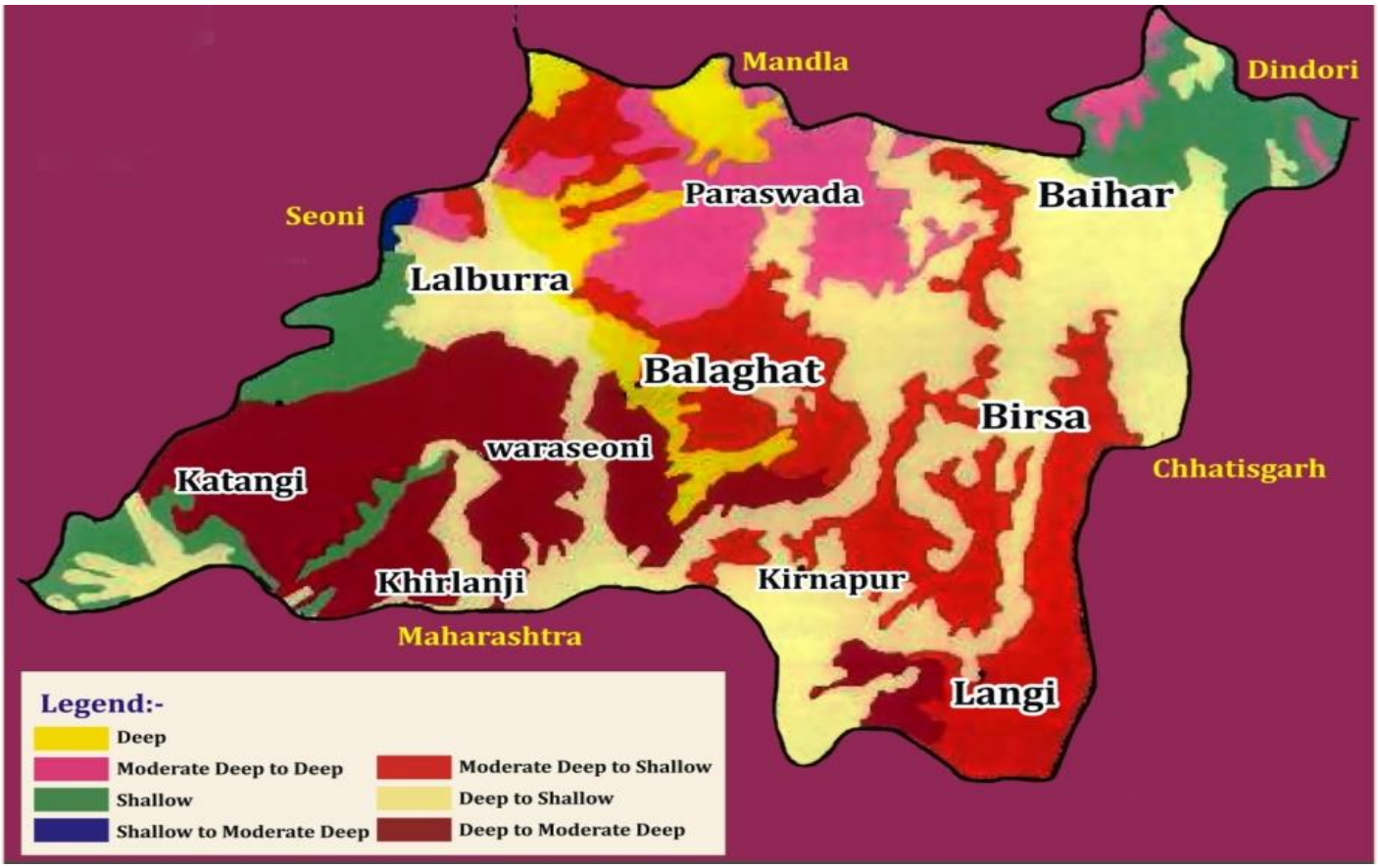

Fig 1: Soil Map of Balaghat

Rice transplanting machine

In Balaghat district more than 2.70 lakhs area under rice cultivation. Planting of Rice at right time is the major problem for farmers due unavailability of labour and high labour cost. Most of the farmers transplanted nursery up to 40 to 45 days after sowing, which causes low yield and poor productivity. Last few years use of self-propelled rice transplanters are increasing among farmers in the District. Government is providing attractive subsidy to farmers for purchase of rice transplanter through department of agriculture and agricultural engineering. It has been observed that number machines purchased by farmers are increasing every year. There are number of national and international manufactures involved in supplying rice transplanting machine.

It is a self-propelled machine driven by diesel engine. The machine transplants at a row spacing of 23 cm with a provision to vary the plant to plant distance of 10-12 cm and vary the depth of planting and number of plants per hill. It requires mat type nursery. The machine helps in a net saving in labour of about 40 percent. The machine is more suitable for light textured soils. Further at present, the mechanical transplanters can plant 2 seedlings per hill at a spacing of 24 cm (row to row) and 12- 24 cm (plant to plant) for adoption of other SRI principles. This will be a very good development in promoting SRI in large scale reported by Deshmukh and Tiwari (2011) [2].

Fig 2: Self Propelled Rice Transplanter

Observation of experimental data

In this research we will select 25 farmers using rice transplanter for the study of different part (villages) of the district. We will arrange individual meeting and interactions with farmers and collecting data and analyzed. There will be different formats for collecting the data. The procedures followed for recording observations are given in Table 1. The field capacity of rice transplanting machine was calculated as:

Field Capacity = Area covered in Ha/Time required in Hr = ha hr^{-1}

Results and Discussion

Self-propelled Rice transplanter machine was evaluated in the field, and it worked. There were some points to be redesigned. In the study more than 25 farmers were selected for field level survey. In the year 2017, 2018 and 2019 kharif pooled data were collected and averages of that were used for study. Similarly few farmers were selected those using traditional transplanting and direct rice seeding. Field level data traditional transplanting and direct rice seeding were also collected and analyzed for the study are given in Table 2. It has been noted that the average field capacity of self-propelled rice transplanter is 0.26 ha hr^{-1} as compare to manual transplanting and direct seeded rice. Yield of transplanted rice was 4.24 $t.ha^{-1}$ as compare to manual transplanted (4.05 $t.ha^{-1}$) and direct seeded rice (2.25 $t.ha^{-1}$). Average input cost in case of rice transplanted rice is 0.38 lakh ha^{-1} as compare to manual transplanted (0.43 lakh ha^{-1}) and direct seeded rice (0.25 lakh ha^{-1}). Gross income in rice transplanted rice was 0.85 lakh ha^{-1} as compare to manual transplanted (0.81 lakh ha^{-1}) and direct seeded rice (0.45 lakh ha^{-1}). Benefit cost ratio is 2.22 in case of transplanter and 1.88 to 1.8 in manual transplanted and direct seeded rice respectively.

Table 2: Performance of rice transplanter machine and traditional system

S. N.	Farmer	FC t. hr^{-1}	Yield t ha^{-1}	Input Cost Lakh ha^{-1}	Gross Income Lakh ha^{-1}	Profit Lakh ha^{-1}	B:C
1	F1	0.25	4.25	0.38	0.85	0.47	2.24
2	F2	0.24	4.26	0.37	0.85	0.48	2.30
3	F3	0.27	4.15	0.39	0.83	0.44	2.13
4	F4	0.25	4.18	0.38	0.84	0.46	2.20
5	F5	0.27	4.19	0.38	0.84	0.46	2.21
6	F6	0.25	4.2	0.38	0.84	0.46	2.21
7	F7	0.28	4.22	0.39	0.84	0.46	2.19
8	F8	0.25	4.23	0.38	0.85	0.47	2.23
9	F9	0.29	4.26	0.39	0.85	0.47	2.21
10	F10	0.25	4.23	0.38	0.85	0.47	2.23
11	F11	0.25	4.24	0.38	0.85	0.47	2.23
12	F12	0.25	4.26	0.38	0.85	0.47	2.24
13	F13	0.25	4.27	0.38	0.85	0.47	2.25
14	F14	0.25	4.24	0.39	0.85	0.46	2.19
15	F15	0.25	4.26	0.38	0.85	0.47	2.24
16	F16	0.25	4.3	0.39	0.86	0.47	2.23
17	F17	0.25	4.31	0.38	0.86	0.48	2.27
18	F 18	0.26	4.21	0.40	0.84	0.44	2.11
19	F19	0.25	4.22	0.38	0.84	0.46	2.22
20	F20	0.25	4.27	0.38	0.85	0.47	2.22
21	F21	0.28	4.31	0.38	0.86	0.48	2.27
22	F22	0.26	4.32	0.39	0.86	0.48	2.24
23	F23	0.27	4.26	0.38	0.85	0.47	2.24
24	F24	0.25	4.27	0.38	0.85	0.47	2.24
25	F25	0.27	4.15	0.39	0.83	0.45	2.16
Manual T		0.02	4.05	0.43	0.81	0.38	1.88
D.S.R.		1.00	2.25	0.25	0.45	0.20	1.8
A.M.		0.26	4.24	0.38	0.85	0.47	2.22
S. D.		0.01	0.05	0.01	0.01	0.01	0.04
Min.		0.24	4.15	0.37	0.83	0.44	2.11
Max.		0.29	4.32	0.40	0.86	0.48	2.30
C.V.		4.92	1.08	1.39	1.08	2.47	1.87

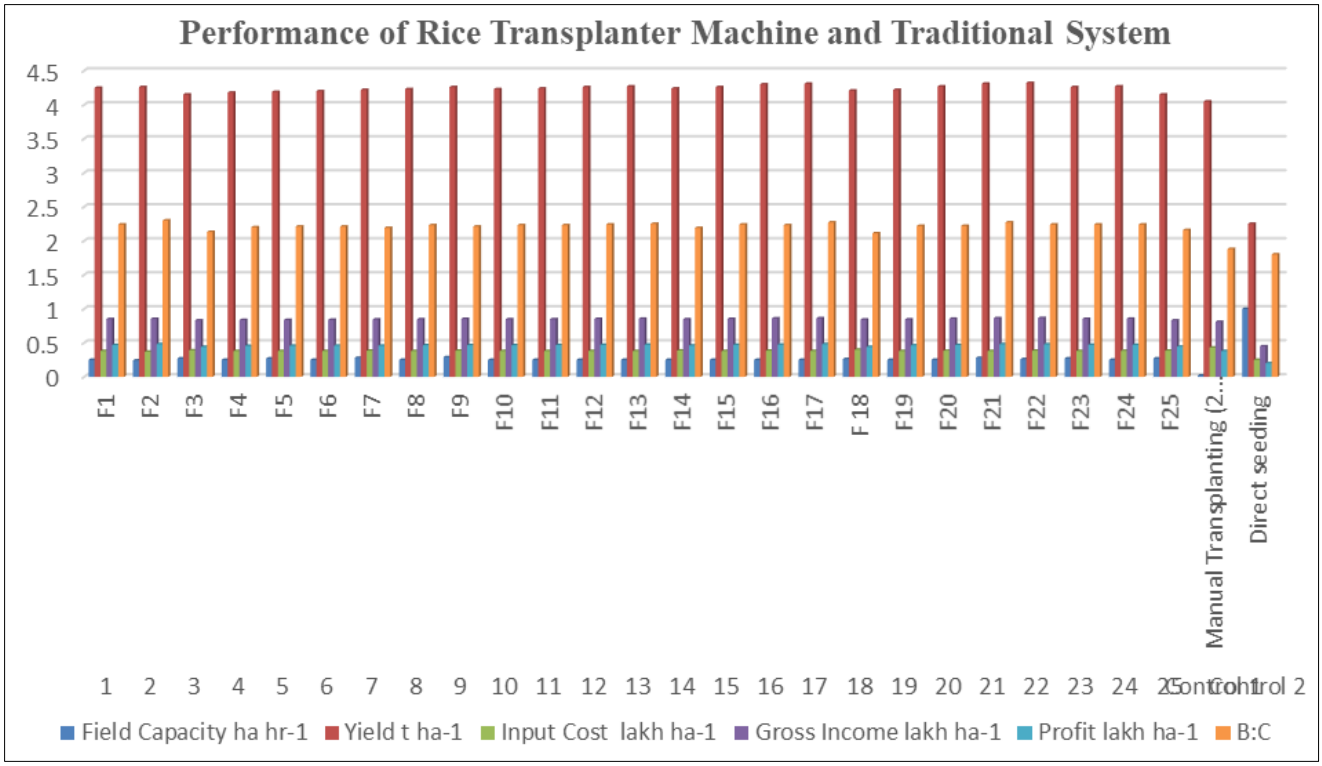

Fig 3: Performance of field capacity and yield attributes of rice crop

Yield of rice varies from farmers to farmer and it depends upon agronomical practise apply by farmer and fertility level of soil. There are other different factors which affect the yield of crop. In this study we have selected that farmer who is sowing same duration variety of Approx same yield potential. It was medium to short duration varieties and good response in the district. It has been observed that machine transplanted seedling having average yield between 4.32 t ha^{-1} to 4.15 t ha^{-1} as compared to manual transplanting 4.05 t ha^{-1} to 2.25 t ha^{-1} shown in table 2. Economics in rice cultivation play a very important role.

Summary and Conclusions

Farm mechanization plays an important role in rice production as well as saving time and cost of cultivation. There are number of farm implements being used in rice field from field preparation to its harvesting and processing. It has been observed that timely rice transplanting of seedling has play an important role in rice production and productivity. Rice transplanting by transplanter machine gives significant changes in rice cultivation. Rice yield varies from farmers to farmer and it depends upon agronomical practise applied by farmer and fertility level of soil. There are other different factors which affect the yield of crop. In this study we have selected that farmer those are sowing same short duration varieties. Selected varieties are medium to short duration variety and good response in the district.

Self-propelled Rice transplanter machine is highly recommended in the district and it need to be educated regarding its proper use since mechanized transplanter requires mat – type nursery reported by Shinde *et al* 2018 [11]. In self-propelled rice transplanting machine tray mechanism worked but the design should be altered or improved. The tray move to both left and right directions while the tray on a grove. That resulted high friction. Therefore it is better to have nylon bushes and iron or aluminium rods to reduce the friction. Tray moving mechanism made using nylon sprocket wheel. The transplanter machine can be easily coupled to a weed remover mechanism which could further help farmers in the weeding process of paddy plantation. In future days the self-propelled rice transplanter machine will be best option for transplanting young rice seedling with minimizing input cost.

References

1. Chaturvedi, *et al*. Peoples Science Institute, Dehradoon, SRI Report doc; c2006. p. 25-27.
2. Deshmukh G, Tiwari RK. Impact of Weeders for weed management in system of rice intensification (SRI). Indian Journal of weed Science. 2011;43(3&4):243-244.
3. Deshmukh G. Rotary weeder for drudgery reduction of women during weeding in paddy field. Indian Journal of weed Science. 2012;44(2):134-135.
4. Deshmukh G, Tiwari RK, Dwivedi BS. Impact of paddy drum seeder under puddle soil for rice cultivation. JNKVV Res J. 2013;47(2):224-227.
5. Guru PK, Chhuneja NK, Dixit A, Tiwari P, Kumar A. Mechanical transplanting of rice in India: status, technological gaps and future thrust. ORYZA-An International Journal on Rice. 2018;55(1):100-106.
6. Murumkar RP, Dongarwar UR, Phad DS, Borkar BY, Pisalkar PS. Performance testing of four row selfpropelled paddy transplanter. International Journal of Science, Environment, and Technology. 2014;3(6):2015-2019.
7. Manikyam N, Guru PK, Naik RK, Diwan P. Performance evaluation of self-propelled rice transplanter. Journal of Pharmacognosy and Phytochemistry. 2020;9(1):980-983
8. Pateriya RN, Datta RK. Design Modifications of Mat type Rice transplanter, International Journal of Advanced Technology and Engineering Research; c2012.
9. Satyanarayana, *et al*. Case study 1, unbelievable tillering capacity Taking Roots, ANGARU Hyderabad; c2006. p. 7-42 (on line).
10. Shahare PU, Bhat MR. Performance evaluation of semiautomatic two row rice transplanter. International Journal of Agricultural Engineering. 2011;4(1):103-105.

11. Shinde Jitendra G, Pandit Shamuvel V, Kadam Sunil J. Review paper on development of Rice Transplanter Iconic research and engineering journals. 2018;2(4):63-65.
12. Kumar U, Thomas EV. Determination of force acting on the rice transplanter finger, CIGR International Commission of Agriculture and Bio-system Engineering; c2015.