Farmer Participatory studies on machine transplanting of rice: An approach to climate change impacts

Abstract

Front line demonstration on machine transplanting of rice were organised in Telangana state. A total of 20 Front Line demonstrations were organized in20 ha. Best management practices for machine transplanted Rice production were demonstrated for getting higher net returns. The demonstrations got yield of 6874 kg/ha. The manual transplanting recorded an average of 6530 kg/ha. Average cost of cultivation, gross returns, net returns and benefit cost ratio of machine transplanted rice was recorded as Rs. 49474/ha, 13090/ha, 81435/ha and 2.7 respectively over the manual transplanting Rs.54138/ha, Rs.124528/ha, Rs.70391 and 2.3. Machine transplanting of rice is the successful technology for reaping higher returns toovercome labour shortage and for timely transplanting.

Key words: Frontline demonstrations, machine transplanting, Rice

Introduction

Climate change impact is one of the major challenges facing farmers in tropical and sub-tropical countries due to its negative impact on agricultural activities. A decrease in agricultural production has been caused by an increase in air temperature, changes in rain patterns, and extreme climates (Salman et al., 2022). Rice is an important food crop grown annually in an area of 41.69 lakh ha in Telangana State with production of 2,18,51,471 metric tons. It is, relatively, a labour-intensive crop which involves enormous drudgery and human stress since all the field operationsi.e starting from land preparation to harvestingare carried out in wet soil. At the same time, mechanization is successful in some field operations viz., land preparation and harvesting and to some extent for weeding in rice.

In the present days, agriculture is facing a serious threat of climate change and several production and management constraints including acute labour shortage resulting in enhanced production costs and reduced returns. As the time passes, number of people depending directly on farming are dwindling in rural areas. Adaptation to the effects of climate change is required in order to reduce the vulnerability of their livelihood systems. Farmers implemented a wide range of adaptation measures in response to climate change conditions, such as non-farm activities, improved seed varietyand crop diversification (Dendir and Simane, 2021). As a result, agricultural operations are being affected in spite of paying higher wages, resulting in poor crop yields. This situation warrantspromotion of mechanization in all the major operations (Pramanik, K., & Bera, A. K. 2013).

To achieve complete mechanization in rice crop, one of thelabour intensive operation *i.e.*, transplanting needs to be carried out by using ricetransplanters to relieve women labour from drudgery and ensure timely planting (Sreenivasulu *et al* 2014). Despite the availability of transplanting machines the technology has not advanced forward due to myths abouts working of transplanters. In view of this Rice Research Centre took up the Front-line demonstration on the Machine transplanting of Rice in farmers fields during 2018 and 2019.

Materials and methods

Front line demonstrations were taken up in the villages of Sanga Reddy and Mahabubnagar district *i.e*Choutkur, Nandiwaddeman, Nallavalli and Kotha thanda in Telangana state. Soils in the selected villages was red and black soils. Treatments include farmers practice of manual transplanting of rice and demonstration consisting of machine transplanting.Yield of both demonstrations and check involving farmers practices were recorded.Using the yield parameters extension gap wasyield gapwas calculated as procedure suggested by Samui *et al*. (2000).Extension gap (q/ha) = Demonstration yield – Yield under existing farmers practice, Yield gap (%) = Extension gap/ Yield under farmer practice x100. Economics of the demos and check were recorded. Based on economics additional cost, effective gain, additional returns, incremental B: C ratio were calculated. Additional cost (Rs.) = Demonstration Cost (Rs.) - Farmers' Practice Cost (Rs.) Additional returns (Rs.) = Demonstration returns (Rs.) - Farmers' Practice returns (Rs.), Effective gain (Rs.) =

Additional Returns (Rs.)-Additional cost (Rs.), Incremental B:C ratio = Additional Returns/ Additional Cost. For the machine transplanting field was ploughed before wet tillage, followed by tilling twice (criss - cross) and puddling with rotovator by maintaining 5-10 cm water level. After puddling, field was levelled perfectly and allowed for settlement of soil particles for a day, prior to transplanting. Cage wheels was not be used for land preparation as deep ploughing results in sinking of the machine while transplanting. At the time of transplanting a thin film of water (1-2 cm) was maintained in main field for smooth running of the machine/ rolling of wheels and for effective transplanting through better scouring of fingers after dibbling.

RESULTS AND DISCUSSION

Yield results were reported in Table 1. In the demonstration performance of 6 row ride on type transplanter using mat type nursery raised on polythene sheet was compared with that of conventional manual transplanting (CT). Since row to row spacing is fixed (30.0 cm) for the machine, with an adjustment of 14 cm between hills within the row, the transplanter achieved a plant density of 24 hills m^{-2} compared to that of manual random transplanting (hills 25 m^{-2}). Machine transplanted crop (MT) produced gave an additional yield of 400 kg ha $^{-1}$ over that of farmer's manual transplanting practice(Ali, R *et al,* 2012).

The results clearly showed the superiority of machine transplanting over conventional manual transplanting of rice by recording an yield advantage of 5.3 %Pramanik and Bera (2013). The grain yield levels of rice with machine planting varied from 6.7 to 6.9 t ha^{-1} compared to that of conventional manual transplanting (6.5t $ha^{-1)}$. In addition to a saving of around Rs 4600 per hectare in cost of cultivation of rice (8.6%), machine transplanting ensures timely planting in the season and relieve women labor from drudgery with an additional net returnof Rs 11000/ha (15.7%). These results are in accordance with (Shukla*et al*., 2014.) (Vijayalaxmi et al 2016).

Table 1.

Year	Grain Yield (kg/ha)		Extension gap	Yield gap (%)	Cost of cultivation (Rs/ha)		% Decrease in cost of cultivation
	MT	CT			MT	CT	
2018	6972	6559	413	6.3	49736	54100	8.1
2019	6775	6500	275	4.2	49213	54175	9.2
Mean	6874	6530	344	5.3	49474	54138	8.6
	165.8	227					
CD	NS	NS					

	Gross returns (Rs/ha)		% Increase in gross returns	Net returns (Rs/ha)		% Increase in net returns	B:C ratio	
	MT	CT		MT	CT		MT	CT
2018	123691	116321	6.3	73954	62221	18.9	2.5	2.2
2019	138128	132735	4.1	88915	78560	13.2	2.8	2.5
Mean	130909	124528	5.1	81435	70391	15.7	2.7	2.3

FARMERS FEEDBACK

As per the feedback of farmers the following advantages over farmers practice of manual random transplanting were recorded.

Advantages:

- Ensures timely and cost-effective planting under labour scarce situations.
- This practice relieves drudgery to farm women.
- Uniform plant stand could be established with 7-10 days saving in crop duration and a yield advantage of 0.55 t ha^{-1}.

Constraints:

- Lack of proper awareness and skill in nursery raising
- The technology is not suitable in problematic soils, as young seedlings are planted with machine.

- Maintaining perfect levelling is difficult under farmers conditions.

Conclusion

The machine transplanting technology needs to be upscaled in large areas in view of farmers needs and increasing rice area.

- The government should give policy incentives to encourage machine transplanting either by custom hiring centres or by farmer himself.
- As better land preparation and levelling is required for machine transplanting laser guider levellers and rotovators may be promoted.
- In view of sensitivity of these machines, service centres may be opened in rural areas for any kind of repairs for the success of machine transplanting.

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