

Mechanical transplanting

for enhancing productivity and profitability in rice

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Farm mechanization in rice is increasingly looked at for not only reducing labour inputs, human drudgery but also at improving farm productivity. This becomes more important as labour is not only scarce but their high costs are eroding profitability in rice cultivation; hence farm mechanization (especially transplanters) is increasingly advocated. Mechanical transplanting of rice increased productivity as well as energy use efficiency and reduced the cost of cultivation. Farmers can adopt this technology on a larger scale, saving water and boosting output.

Keywords: Energy use efficiency, Farmers' practice, System of rice intensification

IN India, food demand is rising due to ever-increasing population growth coupled with stagnant crop productivity, poor water productivity, low input use efficiency, reduced availability of labour, and environmental degradation. Traditional planting is the most conventional and common method of rice establishment under irrigated lowland ecosystems in India. Irrigated lowland rice not only consumes more water but also causes wastage of water. To address this problem, many methods of rice cultivation have been developed; System of Rice Intensification (SRI) is one among them and it reduces the amount of water use without compromising the rice yield. Farm mechanization in rice is increasingly looked at for not only reducing labour inputs, human drudgery but also at improving farm productivity. This becomes more important as labour is not only scarce but their high costs are eroding profitability in rice cultivation; hence farm mechanization (especially transplanters) is increasingly advocated. The Government is encouraging farmers to use appropriate mechanization of agricultural operations, recognizing

the need for peak season demand for labour and to reduce the costs. With paddy transplanting a labour intensive operation simultaneously done in many areas, there is a general shortage of labour during peak agricultural season. Different designs of mechanical transplanters for mat nursery are commercially available from reputed manufacturers. Fully automatic riding type, walk behind type and manual types of transplanters with 4, 6 and 8 row

capability and direct rice seeders are available in the country.

Two studies were conducted to address these constraints. One study was conducted under All India Coordinated Rice Improvement Project (AICRIP) during *kharif* season of 2012 (9 locations), 2013 (10 locations), 2014 (10 locations), 2015 (6 locations), 2016 (5 locations) and 2017 (4 locations). Three treatments viz. T₁ (Mechanical transplanting by transplanter



Mechanical transplanter

Table 1. Comparative performance of mechanical transplanting with manual transplanting and farmers practice

Year	Grain yield (t/ha)			% higher yield obtained under mechanical transplanting over that of manual	% higher yield obtained under mechanical transplanting over that of farmers' practice
	Mechanical transplanting	Manual transplanting	Farmers' practice		
2012	6.16	5.92	5.14	4.1	19.8
2013	6.33	6.64	4.89	-4.7	29.4
2014	5.33	5.02	4.36	6.2	22.2
2015	5.49	5.26	5.01	4.4	9.60
2016	5.58	5.52	3.81	1.1	46.5
2017	7.00	6.74	5.12	3.9	36.7

Table 2. Cost of cultivation under mechanical transplanting, manual transplanting and farmers practice

Year	Cost of cultivation (₹/ha)			Money (₹/ha) saved through reduction in cost of cultivation under mechanical transplanting compared to manual transplanting	Money (₹/ha) saved through reduction in cost of cultivation under mechanical transplanting compared to farmers' practice
	Mechanical transplanting	Manual transplanting	Farmers' practice		
2012	32148	38587	37828	6439	5680
2013	36403	38428	37946	2025	1543
2014	39577	42878	44865	3301	5288

Table 3. Gross and net returns, B:C ratio, and water productivity (kg/ha mm) as influenced by establishment methods

Method	Gross return (₹/ha)	Net returns (₹/ha)	B:C ratio	Total water productivity (kg/ha mm)
SRI	83,280	42,860	1.067	5.02
MSRI	80,926	41,686	1.069	4.91

followed by best management practices), T₂ (Manual transplanting in lines followed by crop management for puddled transplanted rice (Flooded rice system)) and T₃ (Farmers' practice of the location (random transplanting or direct broadcast seeding)) were evaluated. Another study was conducted in 2016 and 2017 on a clay loam soil at ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad, Telangana comparing between system of rice intensification (SRI) and mechanized system of rice intensification (MSRI). Particular attention was paid to energy requirements and efficiency as this factor is often not evaluated in agronomic assessments.

Selective mechanization treatments markedly influenced the performance of rice crop at all the

locations across the years. The highest rice grain yield was achieved with mechanical transplanting (yield varied from 5.33 t/ha to 7.00 t/ha across the years) at all the locations across the six years except 2013. Similarly, yield under manual transplanting varied from 5.02 t/ha to 6.74 t/ha across the years while farmers practice gave the lowest grain yield in all the seasons (range 3.81 to 5.14 t/ha). Hence, percentage gain in rice yield under mechanical transplanting were as high as 9.6% to 46.5% compared to farmers practice and 4.7% to 6.2% (in case of manual transplanting). Substantial savings could be achieved with mechanical transplanting compared to manual transplanting and farmers practice owing to reduction in cost of cultivation. Mechanical transplanting was the most energy efficient method (4.55) compared to other treatments

(manual transplanting, 4.16; farmers practice, 2.84), which adds another feather to its cap. Although gross returns and net returns were marginally higher with SRI compared to MSRI, mechanical transplanting is still preferable as the B:C ratio was similar and higher water productivity as water is a very critical input in agriculture.

SUMMARY

Mechanical transplanting helps realize higher productivity, energy use efficiency and reduces the cost of cultivation. Although, the usual manual method of SRI transplanting gives comparable yields and economic returns, mechanized transplanting of SRI due to a lower labour requirement can facilitate timely planting with reduced labour costs. Farmers should adopt this technology on a larger scale, saving water and boosting output. India's rice production can become more profitable and promising despite the shortage of irrigation water.

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