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Impact Study on Evaluation of Machine Transplanting in Paddy through Frontline Demonstration in Khammam District of Telangana, India

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ABSTRACT

Theon-farm demonstration was conducted in farmers' field of Khammam District, Professor Jayashankar Telangana State Agricultural University, Telangana state during kharif season of 2018, 2019, and 2020. Theon-farm demonstration results revealed that the significant improvement on both growth and yield attributes continuously in three (2018-2020) years and pooled respectively. The maximum growth and yield in terms of plant height (94.4, 97.6, 93.6 and 95.2 cm), no of effective tillers plant^{-1} (16.6, 17.4, 15.7 and 16.5), no of hills m^{-2} (25.0, 26.0, 25.0 and 25.3), no of panicles m^{-2}(346, 387, 321 and 351.3), no of filled grains (188, 193, 179 and 186.6), test weight (14.8, 15.7, 14.8 and 15.1), grain yield (6836, 7416, 6161 and 6804 kgha^{-1}), straw yield (8874, 9120, 8537 and 8844 kgha^{-1}), harvest index (43.5, 44.8. 41.9 and 43.4) and economics were higher with machine transplanting method than farmers' practice. Continuously in three years. The lowest plant height (86.7, 88.4, 85.3 and 86.4 cm), no of hills m^{-2} (21,22,22 and 21.6) no of panicles m^{-2} (258, 265, 245 and 256), no of filled grains (169, 176, 172 and 172), test weight (14.7, 14.9, 14.8 and 14.8), grain yield (6577, 6648, 5317 and 6180 kg ha^{-1}), straw yield (8612, 8732, 8456 and 8600 kg ha^{-1}), were recorded in farmers'practice under delayed transplanting condition with considerable limitations of aged nursery.

Key words*: C: B Ratio, Grain yield, Harvest Index, Rice, Straw yield, Test weight*

Introduction

Rice is the main staple food in Asia and particularly in Indian subcontinent. India ranks first in area (42.4 mill ha) and second in rice production with share of 21 percent (104 mt) of world rice production. Moreover, rice is major agriculture commodity of India for earning foreign currency and contributes about 338090 million rupees in agricultural exports (20%) in 2012- 2013 (Anonymous, 2013). Further in provides employment to millions of people in rice cultivation and rice-based industry. This indicates the importance of rice crop in national food security and economy of India. However, in wave of shrinking of resources like arable land, irrigation water and energy there is shifting of rice crop by more remunerative crops like soybean and oil farm which require less labor and water. Short fall in rice production leads to economic, social and nutritional insecurity in India and this has been witnessed in recent past and will be acute in future. Moreover, uncertainties of rain fall, limitation for increasing irrigation facilities towards traditional rice cultivation method, fertilizer and pesticide availability are major challenges

for attaining desired rice production at state and national level. In recent years labor scarcity is major challenge in rice cultivation areas across India. Yields of rice were reduced drastically year by year with delayed transplanting's in Khammam District of Telangana. The farmers have been faced serious problem of labour shortage during peak time of transplanting period, pertaining to NSP left canal command area of the Khammam District resulted in yield lossis more due to transplanting of more than 45 days aged seedlings by delayed conditions. Since last decade decreasing trend (up to 15%) was observed in the rice production and productivity in Khammam District under late transplanting due to labour shortage.Therefore, the present study was undertaken to demonstrate the machine transplanting in paddy cultivation in Khammam District of Telangana to overcome the problem as well as compare with farmer's regular practice.

Materials and Methods

The field trial investigation entitled "Impact study on evaluation of machine transplanting in paddy cultivation in Khammam District of Telangana" was conducted three years (2018 to 2020) during kharif season in five locations. The soils of the trial conducted locations was sandy clay loam texture with an average pH 7.4-7.8, organic carbon 0.57-0.60, available Nitrogen 225-234 kg/ha, available Phosphorus 43.8-46.4 kg/ha, and available Potassium 220.4-228.6 kg/ha. The experiment was laid out in five randomized locations with Demo and Check treatments. The total an average rainfall received for three years cropping season was 1048 mm. The seeds of long duration rice variety like BPT-5204, and M.T.U.-1061were sown on July first week in three years. The seed rate adopted for machine transplanting of rice was 35-40 Kgs/ha, and the nursery was raised in portable trays as well as in modified mat nursery method. 16-18 days aged seedlings were transplanted in the main field with six rows Honda machine transplanter. The crop was fertilized with 100:48:50 kg NPK/ha. Full dose of P, half dose of Kapplied at the time of transplanting remaining half at the time of panicle initiation stage and one third dose of N applied at the time of transplanting, one third dose of N were applied at tillering stage and last one third dose of N applied at panicle initiation stage. Herbicides and pesticides were applied with the help of knapsack sprayer fitted with flat fan nozzle at spray volume 300 l/ha. The observations on growth attributes were taken at different intervals and yield attributing characters like no of panicles m^{-2}, panicle length, grain yield, harvest index and test weight were recorded at harvest. The cost of cultivation was worked out includes expenditure on seeds, fertilizers, irrigation, plant protection chemicals, hiring charges of transplanter, fuel cost and labour charges prevailed in market during 2018-2020. Field observation data were compiled using Microsoft excel software. The collecting data of each sample was analyzed separately using standard technique to evaluate the variance of treatment effects.

The **student's t-test** was employed to test the significance of difference between demo and check. The observed data on the crop were statistically analyzed with the help of 'MS-excel' software. The experimental data was interpreted by using the standard technique of analysis of variance (ANOVA) by (Gomez and Gomez, 1984) standard procedures. The significance of treatment means was compared at 5% probability level with using t-calculated value and t-table value.

Results and Discussion

Growth attributes of rice

The data on progressive of growth and development of rice was significantly influenced with the machine transplanting method during kharif season continuously in three years. The data were recorded at periodical intervals in crop season. The plant height was increased continuously up to maturity. The increase in plant height was rapid during 30 to 90 days after transplanting and there after it was slow down naturally.

Significantly maximum plant height (94.4, 97.6, 93.6 and 95.2 cm), no of hillsm^{-2} (25.0, 26.0, 25.0 and 25.3) and more no of effective tillers (16.6, 17.4, 15.7 and 16.5) plant^{-1}was recorded (Table 1) continuously in three years and pooled respectively with machine transplanting than farmers' practice. Main reason behind these results might be optimum plant stand as well as transplanting of healthy and early aged seedlings (16-18 days) produce a greater number of effective tillers by vigorous root growth and high density per unit area in machine transplanting method thereby increase the plant height due to availability and utilization of natural resources and

nutrients. Similarresults were reported by Negaluri *et al.* (2016) and Maiti, Bhattacharya (2011.). The lowest growth and yield attributes plant height (86.7, 88.4,85.3 and 86.8 cm), no of hillsm^{-2} (21, 22, 22 and 21.6) and no of effective tillers plant^{-1} (12.5, 13.3, 11.7 and 12.5) were observed in Farmers practice due to aged nursery could not able to produce a greater number of effective tillers under delayed transplanting practice thereby decrease plant height with less utilization of natural resources as well as poor plant stand also should not enhance the maximum number of tillers per unit area, similar results were reported by Tripathi *et al*. (2004).

Yield attributes and yield

The data on yield attributes and yield were significantly influenced by machine transplanting over check. Significantly higher number of panicles per m^{-2}(346, 387, 321 and 351.3), No of filled grainspanicle^{-1}(188, 193, 179 and 186.6) and test weight (14.8, 15.7, 14.8 and 15.1) also higher with machine transplanting continuously (Table 2 and 3) during three years and pooled respectively over farmers' practice. This might be due to timely transplanting of healthy and early nursery was enhances the greater number of panicles per unit area as well as no of filled grainspanicle^{-1}and test weight of grains. Significantly higher grain yield, (6836, 7416, 6161 and 6804 kgha^{-1}) straw yield (8874, 9120, 8537 and 8844 kgha^{-1}) and harvest Index (43.5, 44.8. 41.9 and 43.4) were recorded with machine transplanting method over check due to accumulation of higher dry matter content by timely planting with early aged nursery has maintained optimum plant stand, similar results were reported by Kim *et al*. (1999) and Behera (2000). Lowest number of panicles per m^2 (258, 265, 245 and 256), No of filled grain spanicle^{-1} (169, 176, 172 and 172.3) and test weight (14.7, 14.9, 14.8 and 14.8) were obtained with manual planting under delayed conditions continuously during three years and pooled respectively than demo due to late transplanting of aged nursery have less tillering capacity, its leads to produce a smaller number of panicles per unit area and filled grains with lowest dry matter accumulations. Similar reports were revealed by Naidu *et al*. (2013). Significantly lowest straw yield (8612, 8732, 8456 and 8600 kg ha^{-1}) and harvest Index (43.3, 43.2. 38.5 and 41.8) were re-

Table 1. Effect of Machine transplanting on Growth attributes of Rice.

Treatments	Plant Height (cm)			Pooled	No of Hills m^{-2}			Pooled	No of effective Tillers plant^{-1}			Pooled
	2018	2019	2020		2018	2019	2020		2018	2019	2020	
T_1-Machine transplanting	94.4	97.6	93.6	95.2	25	26	25	25.3	16.6	17.4	15.7	16.5
T_2-Farmers Practice	86.7	88.4	85.3	86.8	21	22	22	21.6	12.5	13.3	11.7	12.5
t-Test	S	S	S	S	S	S	S	S	S	S	S	S
t– cal value	0.38	0.26	0.41	0.35	0.13	0.12	0.10	0.11	0.14	0.13	0.24	0.17

T_1– Demo field,
T_2 – Check (Manual transplanting under delayed condition),
Statistically different at (P=0.05) level of significance
S- Significant

Table 2. Influence of Machine transplanting on Yield attributes of Rice.

Treatments	No of panicles m^{-2}			Pooled	No of filled grains panicle^{-1}			Pooled	Test weight (g)			Pooled
	2018	2019	2020		2018	2019	2020		2018	2019	2020	
T_1-Machine transplanting	346	387	321	351.3	188	193	179	186.6	14.8	15.7	14.8	15.1
T_2-Farmers Practice	258	265	245	256.0	169	176	172	172.3	14.7	14.9	14.8	14.8
t-Test	S	S	S	S	S	S	S	S	NS	NS	NS	S
t– cal value	0.38	0.41	0.53	0.44	0.46	0.13	0.15	0.24	0.13	0.09	0.21	0.14

T_1– Demo field,
T_2 – Check (Manual transplanting under delayed condition),
Statistically different at (P=0.05) level of significance

corded under manual planting in delayed conditions with aged nursery due to accumulation of less dry matter content in yield attributes than demo. Significantly lowest grain yield (6577, 6648, 5317 and 6180kgha^{-1}) was obtained under late planting conditions similar findings were reported by Naidu *et al*., (2013) and Bozorgi *et al.* (2011).

Economics

The data on economics of rice (Table.4) was significantly influenced by machine transplanting. Higher gross returns (Rs.1,22,478/-) and cost- benefit ratio (1:1.72) was recorded by machine transplanting in rice over check it might be 16-18 days healthy nursery was transplanted timely through machine gave higher yield with least amount as well as high productive hours than manual transplanting under delayed condition similar findings were reported by Rasool *et al.* (2013). Lowest gross returns (Rs.1,11,252/-) and cost benefit ratio (1:1.38) were observed with the farmers practice than demo due to late planting of aged nursery with manual labor could show poor performance on growth and yield attributes in rice there by drastically affected the

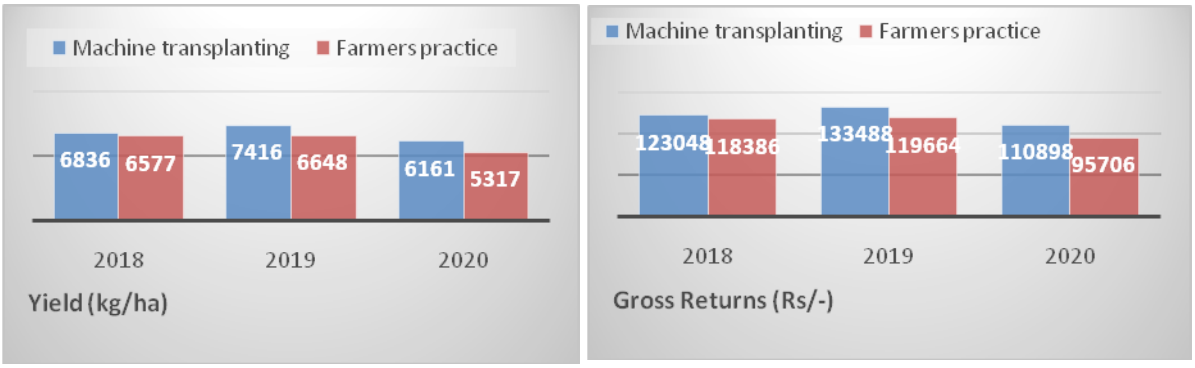

Fig. 1. Graphically representation of yield and gross returns influenced by machine transplanting in rice

Table 3. Effect of Machine transplanting on Yield and yield attributes of Rice.

Treatments	Grain yield (kgha^{-1})			Pooled	Straw yield (kgha^{-1})			Pooled	Harvest Index (%)			Pooled
	2018	2019	2020		2018	2019	2020		2018	2019	2020	
T_1-Machine transplanting	6836	7416	6161	6804	8874	9120	8537	8844	43.5	44.8	41.9	43.4
T_2-Farmers Practice	6577	6648	5317	6180	8612	8732	8456	8600	43.3	43.2	38.5	41.8
t-Test	S	S	S	S	S	S	S	S	S	S	S	S
t– cal value	0.54	0.39	0.67	0.53	0.34	0.52	0.21	0.35	0.10	0.08	0.17	0.11

T_1– Demo field,
T_2 – Check (Manual transplanting under delayed condition),
Statistically different at (P=0.05) level of significance

Table 4 Effect of Machine transplanting on Economics and C: B Ratio in Rice

Treatments	Cost of cultivation (Rs)			Pooled	Gross Returns (Rs)			Pooled	C: B Ratio			Pooled
	2018	2019	2020		2018	2019	2020		2018	2019	2020	
T_1-Machine transplanting	67608	73345	72011	70988	123048	133488	110898	122478	1:1.82	1:1.82	1:1.54	1:1.72
T_2-Farmers Practice	73078	88381	85452	82304	118386	119664	95706	111252	1:1.62	1:1.32	1:1.20	1:1.38
t-Test	S	S	S	S	S	S	S	S	S	S	S	S
t– cal value	0.61	0.58	0.45	0.54	0.43	0.39	0.47	0.34	0.23	0.18	0.32	0.24

MSP: Rs 1800/-per quintal
Cost of expenditure for machine transplanting 4000/- per acre
Cost of expenditure for manual transplanting, 5780/- per acre

monitory benefit returns. Similar results were reported by Manes *et al*. (2013), Bozorgi *et al.* (2011) and Duraisamy *et al.* (2011).

Conclusion

Machine transplanting method in rice was best option to the farming community, to avoid the delayed transplanting as well as labor shortage due to realization of significantly higher grain yield, (6836, 7416, 6161 and 6804 kgha^{-1}) straw yield (8874, 9120, 8537 and 8844 kgha^{-1}) and harvest Index (43.5, 44.8. 41.9 and 43.4) were recorded with machine transplanting method over check along with considerable gross returns in Khammam district, Telangana state of India.

References

Anonymous, 2013. Book on agricultural statistics, 2013, Govt of India, Ministry of agriculture, Dept. of agriculture and co-operation; *Directorate of Economics and Statistics,* New Delhi. 1-73.

Aswini, G.K., Swain, S. and Debaraj, B. 2009. Effect of seedling age on performance of rice transplanter. *Agricultural Mechanization in Asia, Africa and Latin America.* 40: 41–46.

Behera, B.K. 2000. *Investigation on puddle soil characteristics in relation to performance of self-propelled rice transplanter.* Un-published Ph.D. Thesis G.B. Pant University of Ag. and Tech. Pantnagar, UP.

Bozorgi, H.R., Amin, Faji, Khasravi, Danesh, Abdolkarim, K., Ebrahim, A. and Freshieh, T. 2011. Effect of plant density on yield and yield component of rice. *World Applied Science Journal.* 12: 2053–2057.

Duraisamy, V.M., Senthilkumar, T. and Subbulakhsmi, S. 2011. Studies on standardization of spacing and transplanting depth for a self-propelled rice transplanter. *Agricultural Mechanization in Asia, Africa and Latin America.* 42(1): 42–44.

Gomez, KA. and Gomez, AA. 1984. *Statistical Procedures for Agricultural Research*. 2nd Edition. John Wiley and Sons, New York: 680.

Kim, S.S., Kim, B.K., Choi, M.G., Back, M.H., Choi W.Y. and Lee, SY. 1999. Effect of seedling age on growth and yield of machine transplanted rice in southern plain region. *Korean Journal of Crop Science.* 44: 122–128.

Maiti, P.K. and Bhattacharya, B. 2011. Effect of seedling rate and number of seedlings hill-1 on the growth and yield of hybrid rice (*Oryza sativa L.*) grown in dry (boro) season. *Crop Research.* 42: 18–22.

Manes, G.S., Dixit, A., Singh, A., Mahal, J. and Mahajan, G. 2013. Feasibility of mechanical transplanter for paddy transplanting in Punjab, Agricultural Mechanization. *International Journal of Bio-resource and Stress Management*. 7(5): 984-989.

Negalur, R.B., Halepyati, A.S. and Channabasavanna, A.S. 2016. Productivity and Economics of Machine Transplanted Rice (*Oryza sativa L.*) as Influenced by Puddling Methods and Spacing. *International Journal of Bio-resource and Stress Management.* 7(5): 984-989.

Negalur, R.B., Halepyati, A.S. and Narayana Rao, K. 2016. Influence of Age and Number of Seedlings on Yield and Nutrient Uptake by Machine Transplanted Rice (*Oryza sativa* L.). *International Journal of Bio-Resource and Stress Management* . 7(3): 393-397.

Naidu, G.J., Rao, K.T., Rao, AU. and Reddy, D.S. 2013. Age of seedling and planting pattern on grain yield, protein content, NPK uptake and post-harvest nutrient status of rice under SRI. *Journal of Academia and Industrial Research.* 2: 334–337.

Rasool, F., Habib, R. and Bhat, M.I. 2013. Agronomic evaluation of rice (*Oryza sativa L.*) for plant spacing and seedlings per hill under temperate conditions. *Pakistan Journal of Agricultural Sciences.* 9: 169–172.

Tripathi, S.K., Jena, H.K. and Panda, PK. 2004. Self-propelled rice transplanter for economizing labour. *DARE/ICAR Annual Report.* 23-25.