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Performance of Rice in Different Methods of Crop Establishment in Vizianagaram District of Andhra Pradesh

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ABSTRACT: In Vizianagaram district of Andhra Pradesh manual transplanting is the popular method of crop establishment in rice growing areas, the method more laborious leads to increase in the cost of cultivation and also delays planting due to scarcity of labour. Machine transplanting of young seedlings or direct seeding of sprouted seeds with the help of eight row drum seeder reduces labor, fastens planting operation, and avoids late planting. DAATT Centre Vizianagaram, conducted ten front line demonstrations on machine planting and direct seeding of sprouted paddy using eight row drum seeder and direct seeding of sprouted paddy by broadcasting consecutively for three years during rabi 2012-13, 2013-14 and 2014-15. The results revealed that the increase in rice grain yield of machine planting and direct seeding drum seeder method were 12.3, 3.9 percent, respectively, however direct seeding by broadcasting method yielded 3.1% lesser yield compared to transplanted rice. The benefit cost ratio were 1.67, 2.03, 1.99 and 1.88 in manual transplanting, machine transplanting planting and direct seeding of sprouted paddy seed by drum seeder method and direct seeding sprouted paddy seed by broadcasting, respectively.

Keywords: Machine planting, Drum seeder, Benefit cost ratio, Front line demonstrations, Grain yield.

1. Introduction

Rice (Oryza sativa L.) is considered as the "global grain". It is the major staple food for more than half of the global population. In rice production, India ranks second as it is grown in almost all the states of the country. In India rice is grown in an area of 43.86 million ha with a production of 104.80 million tones and with an average productivity of 2390 Kg ha^{-1} (Anonymous, 2015). In Andhra Pradesh, it is grown in an area of 18.29 lakh ha with a production of 69.08 lakh tonnes and an average productivity of 3777 Kg ha^{-1} (Anonymous, 2013). The transplanted rice crop was grown in an area of 1.25 lakh ha with a production of 5.5 lakh tonnes and an average yield of 4417 Kg ha^{-1} in Vizianagaram district (Hand Book of Statistics, Vizianagaram).

Manual transplanting is the most common practice of rice cultivation in Vizianagaram district. Though transplanting is the effective means of rice cultivation, it involves nursery bed preparation, raising of nursery up to one month, pulling of seedlings, transportation to main field and then transplanting. All these operations are laborious involving drudgery and timely availability of

labour. Hence, the cost of cultivation of transplanted rice has become high. Nursery pulling and transplanting takes about 250-300 man hours ha^{-1} which is roughly 25 per cent of the total labour requirement of the crop (Ved Prakash and Varshney, 2003). In such situation, alternate methods of rice establishment are the only option to deal with labour scarsity. Machine planting and Direct seeded rice offers low cost of cultivation due to skipping of nursery raising, pulling of seedlings and transplanting, and crop matured earlier by 7-12 days. (Subbaiah *et al.*, 2002, Gill, 2008). The productivity of direct seeded rice with drum seeder was comparable with manually transplanted rice (Gangawar *et al.*, 2008).

DAATT Centre, Vizianagaram introduced direct seeding rice with drum seeder method and machine transplanting method in Vizianagaram district during 2009, 2011 respectively assessed their performances for two seasons. After confirming these technologies gave encouraging results, front line demonstrations were conducted during rabi season from 2012-13 to 2014-15.

2. Material and Methods

The performance of Machine transplanting, direct seeding by drum seeder and direct seeding of sprouted seeds by broadcasting was evaluated in 10 front line demonstrations for three consecutive years during *rabi* 2012-13, 2013-14 and 214-15. The demonstrations were conducted in 6 mandals of Vizianagaram district by using popular variety MTU 1001 (Vijetha), a blast resistant and coarse grain rice variety. The soil texture of the demonstrations area was sandy clay loam with a pH ranging from 7.1 to 7.9, electrical conductivity ranging from 0.26 to 1.02 dSm^{-1} estimated with the as outlined by Jackson (1973), low in available nitrogen (92 to 212 Kg ha^{-1}) estimated by adopting alkaline permanganate method of Subbaiah and Asija (1956), medium to high in available phosphorus (9 to 32 Kg ha^{-1}) estimated by Olsen's metod (Olsen et al., 1954) and medium to high in available potassium (148 to 298 Kg ha^{-1}) estimated by adopting procedure laid out by Jackson (1973).

In manual planting method a wet nursery was raised, seedlings of 30 days old were transplanted using women labour in puddle field. Machine transplanting of 18 days old seedlings of 3-4 leaved was done by a self propelled VST eight row transplanter model 2ZT 238-8 at a spacing of 24 x 12 cm. Direct seeding of sprouted seed by eight row drum seeder consisting of four rotating drums with circular holes around the two edges of each drum. These drums are connected to horizontal iron rod of 1.8m length and then it was mounted on two plastic moulded wheels at both the ends. In direct seeding method, 25 kg ha^{-1} of seed was soaked in water for 24 hours and incubated for another 24 hours to obtain just sprouted seed. The sprouted seeds were filled in the drums and drum seeder was manually dragged on the field after draining the water to saturation. On pulling the drum seeder, the sprouted seeds are placed on the puddled soil surface in eight rows at a distance of 20 cm between rows and at about 8 cm within the row. In direct seeding of sprouted seeds by broad casting method, 25 Kg seeds incubated for sprouting and just sprouted seeds were broadcasted uniformly in one hectare field. The field was kept moist followed by alternate wetting and drying of soil from the second day after sowing to panicle initiation stage and 5cm depth of water was maintained ten days before crop maturity.

Weed management by application Butachlor, 1.0 Kg a.i. ha^{-1} was uniformly at 5th day after sowing by mixing with 50 Kg of sand ha^{-1} by maintaining thin film of water followed by mechanical weeding with cono- weeder twice at 20 and 40 days after sowing for effective control of weeds. In the case of manual method of transplanting existing package of practices were being adopted by the farmers with the same variety MTU 1001. The data were statistically analyzed using analysis of variance (ANOVA) procedure of SAS (SAS, 2000) and the significance of the treatment effect was determined using on F-Test and significance between the means of the treatments differentiated based on least significant difference (LSD) at 5% probability level.

3. Results and Discussion

Yield attributes

The results revealed that machine planting method of rice cultivation recorded significantly more number of productive tillers m^{-2} (292.33) and number of grains $panicle^{-1}$ (137) than manual transplanting i.e. 267.67 and 126, respectively (Table.1). The direct sowing of sprouted seeds with drumseeder and direct sowing of sprouted seeds by broadcasting methods although recorded higher number of productive tillers but did not vary significantly with manual transplanting method. This might be due to wider spacing and early seedling vigour resulted in more number of tillers. Further mechanical weeding with cono weeder between the inter rows leads to loosening of the soil, better aeration at root zone depth and reduction of weed competition which in turn recorded more number of tillers and panicles per unit area in machine transplanting and drumseeder methods. Higher number of tillers and number of panicles $hill^{-1}$ obtained by machine planting, and drum seeder methods than manual transplanting was also reported by Manjunatha *et al.* (2009) and Veeresh *et al*. (2011). The number of productive tillers per m^{-2} increased about 8.9, 7.1 and 7.8 percent in machine planting, direct seeding by drumseeder and direct seeding by broadcasting , respectively than manual transplanting.

Number of grains per panicle was highest (137) in machine planting which is 8.7 percent increase over manual planting method, however similar number of grains per panicle were recorded in direct seeding by drumseeder and broadcasting methods compared to manual transplanting method.

Grain yield

The results indicated that machine planting method recorded significantly higher grain yield over manual transplanting in all the three consecutive years (Table.1). The mean grain yield in machine transplanting method was 6.10 tonnes ha^{-1} as compared to 5.64 tonnes ha^{-1} in case of direct seeding

drumseer method, 5.43 tonnes ha^{-1} in case of manual transplanting and lowest grain yield of 5.16 tonnes ha^{-1} in case of in case of directing seeding by broadcasting method. Machine planting method is significantly superior in grain yield compared to other three method of rice cultivation. Drumseeder method was significantly superior to broadcasting method but statistically similar to manual transplanting method. The higher grain yield in machine palnting and drumseeder methods might be due to more number of productive tillers per unit area and higher stature of filled grains per panicle owing to better translocation of photosynthates from source to sink. Higher grain yields obtained in machine planting and drum seeder methods than transplanting was also reported by Manjunatha *et al*. (2009). The grain yield of machine transplanted and drumseeder methods were increased by 12.3 and 3.9 percent respectively compared to transplanted rice. However, direct seeding by broadcasting method showed about five percent decreased yield compared to manual transplanting.

Economics

The present study revealed that the cost of cultivation was low in direct seeded rice by broad casting method (Rs. 29,233 ha^{-1}), followed by direct seeding by drumseeder method (Rs.30,163), machine transplanting method (Rs.32,098) and highest in manual transplanting method (Rs. 34,589) An amount of Rs.5,356 ha^{-1} can be saved by adopting direct seeding by broadcasting, Rs.4,426 ha-1 can be saved by adopting direct seeding by drumseeder method and Rs.2,491 can be save by adopting machine transplanting method. The saving is mainly due to ease in operation without raising of nursery, pulling and transport of seedlings to main field for manual labour. Similar findings were also reported by Senthilkumar and Kasthuri Thilagam (2012).

Gross and net returns were significantly more in machine transplanting and drumseeder methods compared to manual transplanting. However similar returns were recorded with manual transplanting and direct seeding by broadcasting method. The data from three consecutive seasons shows that the average benefit cost ratio was more in machine transplanting method (2.03), followed by direct seeded rice with drum seeder (1.99), direct seeding by broadcasting (1.88) than manual transplanting (1.67). This might be due to increased grain yield and relatively low cost of cultivation in machine transplanting and drumseeder methods than manual transplanting. These results are in

conformity with those of Manjunatha *et al.* (2009) and Gangawar *et al.* (2008). Labour intensive and costly method of manual transplanting in rice could be substituted by machines without sacrifice in productivity(John Kutty *et al*, 2002).

4. Conclusion

The results of front line demonstrations revealed that by adopting machine transplanting higher yields and high BC ratio and overcoming labour scarsity problem is possible. By adopting direct seeding of sprouted paddy seed either with drumseeder or by broadcasting in puddle field although the grain yields are relatively similar, achieving higher BC ratio and overcoming labour scarcity problem is possible in sandy clay loam soils of Vizianagaram district.

References

[1]. Anonymous, 2015 Agricultural statistics at Glance, Directorate of Economics and Statistics, Government of AP, http://des.ap.gov.in/jsp/social/agriculture%20at%20a%20glance2014-15.pdf
[2]. Gangawar, K. .S, Tomar O K and Pandey,D. K. 2008 Productivity and economics of transplanted and direct seeded rice (Oryza sativa) – based cropping systems in Indo- Gangetic plains. *Indian Journal of Agricultural Sciences*, 78: 655-658.
[3]. Gill, M. S. 2008 Productivity of direct seeded rice (Oryza sativa) under varying seed rates, weed control and irrigation levels. *Indian Journal Agricultural Sciences*, 78: 766- 770.
[4]. Anonymous, 2013Hand book of Statistics Vizianagarm Dist district – 2013, pp. 66
[5]. Jackson M L 1973 Soil Chemical Analysis, (Ed.). Prentice-Hall of India, Pvt. Ltd., New Delhi, pp. 121-125.
[6]. John kutty, I., Gracey mathew and Jose mathew 2002 Comparison between transplanting and direct seeding methods for crop establishing in rice. *Journal of Tropical Agriculture*, 40: 65-66.
[7]. Manjunatha, M. V., Masthana Reddy, B. G and Joshi V. R. 2009 Performance of rice (Oryza sativa) under different methods of establishment in Tungabhadra canal command, Karnataka. *Karnataka Journal of Agricultural Sciences*, 22 (5): 1151- 1152.
[8]. Olsen, S.R, Cole, C.L, Watanabe, F.S and Deaw, D.A. 1954 Estimation of available phosphorous in soils by extraction with sodium bicarbonate. United States Departments of Agriculture circular, pp.939.
[9]. SAS, Statistical Analysis Software 2000, https://www.sas.com/en_us/software/stat.html
[10]. Senthilkumar, T and Kasthuri thilagam, V. 2012 Comparative study on improved TNAU drum seeder with SRI and conventional methods of transplanting. *Madras Agricultural Journal*, 99 (7-9): 629-630.
[11]. Subbaiah, S. V., Krishnaiah, K and Balasubramanian V. 2002 Evaluation of drum seeder in puddle rice. *Agricultural Mechanization in Asia, Africa, Latin America*, 33: 23-26.
[12]. Ved Prakash chaudhary and Varshney B. P. 2003 Performance evaluation of self-propelled rice transplanter under different puddle field conditions and sedimentation periods. *Agricultural Mechanization in Asia, Africa, Latin America*, 34: 23-33.
[13]. Veeresh desai, B. K., Vishwanatha S., Anilkumar S. N, Satyanarayana rao and Halepyati, A. S, 2011 Growth and yield of Rice (Oryza sativa L.) varieties as influenced by different methods of planting under aerobic method of cultivation. *Research Journal of Agricultural Sciences*, 2(2): 298-300.

Table 1. Yield attributes, grain yield, gross returns and net returns as influenced by the rice crop establishment methods.

Year	Particulars	Number of productive tillers per sq meter	Number of grains per panicle	Yield t ha^{-1}	Cost of cultivation Rs. ha^{-1}	Gross returns Rs. ha^{-1}	Net returns Rs. ha^{-1}	Benefit Cost Ratio
2012	Manual transplanting	273	128	5.36	33055	50920	17865	1.54
	Machine planting	288	145	6.15	31120	58425	27305	1.88
	Direct sowing of sprouted seed by Drumseeder method	292	130	5.63	28590	53485	24895	1.87
	Direct seeding of sprouted seeds by broadcasting	302	125	5.18	27850	49210	21360	1.77
	LSD (0.05)	20.9	9.06	0.39	1865.92	708.67	2558.2	0.146
2013	Manual transplanting	259	122	5.05	34800	55550	20750	1.60
	Machine planting	277	130	5.71	31925	62810	30885	1.97
	Direct sowing of sprouted seed by Drumseeder method	265	126	5.26	30500	57860	27360	1.90
	Direct seeding of sprouted seeds by broadcasting	271	120	4.93	29350	54230	24880	1.85
	LSD (0.05)	NS	NS	0.33	2483.79	1781.34	3767.47	0.188
2014	Manual transplanting	271	128	5.87	35912	67505	31593	1.88
	Machine planting	312	136	6.45	33250	74175	40925	2.23
	Direct sowing of sprouted seed by Drumseeder method	305	125	6.03	31400	69345	37945	2.21
	Direct seeding of sprouted seeds by broadcasting	293	125	5.37	30500	61755	31255	2.02
	LSD (0.05)	31.6	3.661	0.374	2256	1735	3697	0.163
Mean	Manual transplanting	268	126	5.43	34589	57992	23403	1.67
	Machine planting	292	137	6.10	32098	65137	33038	2.03
	Direct sowing of sprouted seed by Drumseeder method	287	127	5.64	30163	60230	30067	1.99
	Direct seeding of sprouted seeds by broadcasting	289	123	5.16	29233	55065	25832	1.88
	LSD (0.05)	0.408	4.196	0.313	2187	3408	4341	0.165

Price of 100 Kg grain: Rs. 950/-, Rs. 1100/- and Rs.1150/- in 2012, 2013, and 2014 respectively.

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