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On-farm evaluation of paddy drum seeder (8 row) in farmers fields

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ABSTRACT : On-farm demonstrations were conducted to popularize the drum seeder among the farmers, feasibility of paddy sowing by drum seeder was done under supervision of DAATT Centre (Extension unit of Acharya N.G. Ranga Agricultural University, Andhra Pradesh), Anantapuram for two years during *Kharif*, 2010-11 to 2011-12. The comparison was made between direct sowing of paddy using drum seeder and farmers practice with an objective to reduce the cost of production of paddy and subsequently improve the returns from unit in farmers' fields. Demonstrations revealed that there were more number of tillers (406) and panicles (381) per metre square in direct sowing by drum seeder compared to 379 tillers and 354 panicles per metre square in farmers practice. In direct sowing by drum seeder plant height, number of tillers per metre square, panicles per metre square, panicle length and number of grains per panicle were increased by 4.8, 7.1, 7.6, 23.4 and 20.9 per cent, respectively over farmers practice. Direct sowing of paddy with drum seeder has recorded higher grain yield (5684 kg ha^{-1}) which was 12.7 per cent higher over farmers practice (5041 kg ha^{-1}). A saving of Rs. 4850/- (Rupees four thousand eight hundred and fifty only) on cost of cultivation per hectare was realized in direct sowing of paddy with drum seeder besides increasing paddy yield. Gross returns (Rs. 62867/-) and net returns (Rs. 42867/-) per hectare were with drum seeder method compared to farmers practice (Rs. 56777/- gross returns and Rs. 31927/- net returns). In drum seeder method cost of cultivation was reduced by 19.5 per cent whereas, gross returns and net returns were improved by 10.7 and 34.3 per cent, respectively over farmers practice. Seed rate can be reduced to 30 kg ha^{-1} against 68.7 kg ha^{-1} in farmers practice. Direct sowing with drum seeder helps in reducing the cost on nursery raising and transplanting besides increasing yield by 12.7 per cent, reduces the crop duration and cost of cultivation. The cost of cultivation was reduced by 19.5 per cent and net returns increased by 34.3 per cent.

KEY **W**ORDS : Paddy drum seeder, Yield attributes, Grain yield, Economics

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Rice (*Oryza sativa* L.) is the most important staple food crop in Anantapuram district of Andhra Pradesh cultivating in 30,898 ha area during *Kharif* and 17993ha during *Rabi* with an average productivity of 3850 kg/ha. The major rice area is under canals and well sand success of crop depends on rainfall received. Present management recommendations for rice in Andhra Pradesh include planting 20 to 25 day-old seedlings @ 2 per hill at 20 x 15 cm spacing with hand weeding and continuous flooding (Vyavasaya Panchangam, 2013). Majority of farmers use over aged seedlings due to delayed monsoon.Rice is being cultivated by raising nursery for about 30 days. Later seedlings are pulled and transplanted manually in zigzag manner without

adopting proper spacing in the main field after puddling. Ttransplanting is not profitable due to high labour wages and problem of non-availability of labour during peak period of operation (Singh *et al.*,2005). Due to non- availability of labour, hike in input cost and water shortage has lead to uneconomic rice cultivation. In the last five years the cost of production on different operations is increased by 33 per cent on seed, 45 per cent on chemical fertilizers, 100 per cent on labour cost, 35-40 per cent on tillage operations.Transplanting alone costs about 15 per cent of total rice production cost and delayed transplanting due to labour shortage causes sustainable loss in yield (Ponnuswamy *et al.*,1999).

Because of uncertainty in rainfall and increase in cost of production the cultivation of rice has become unprofitable in Anantapuram and same is the case in other growing regions of Andhra Pradesh.Therefore, there is need of alternative methods to replace transplanting to tackle the problems of high cost of production and labour scarcity. Direct sowing of sprouted seed in puddled fields using drum seeder reduces the input costs *i.e.*, cost of seed, nursery raising, transplanting and it is a good method under late onset of monsoon (Visalakshi and Sireesha, 2013).The transplanting of rice seedlings which is a highly labour-intensive and expensive operation can be replaced by direct seeding that can reduce labour needs by more than 20 per cent in terms of working hours required (Santhi *et al.*,1998). The cost of operation of drum seeder is Rs. 32.73 per hour and Rs. 297 per hectare (Chavan and Palkar, 2010). So, direct seeding is much helpful as it requires less labour and time by skipping the nursery raising and transplanting to the field manually.

Considering the above points, on-farm demonstrations were conducted to popularize the drum seeder among the farmers, feasibility of paddy sowing by drum seeder was done under supervision of District Agricultural Advisory Transfer Technology Centre (Extension unit of Acharya N.G. Ranga Agricultural University, A.P.), Anantapuram for two years during *Kharif*, 2010-11 to 2011-12. The comparison was made between direct sowing of paddy using drum seeder and farmers practice with an objective to reduce the cost of production of paddy and subsequently improve the returns from unit in farmers' fields.

RESEARCH PROCEDURE

The DAATT Centre, Anantapuram has introduced 8 row paddy drum seeder supplied by AGROS during *Kharif*, 2008. Specifications of drum seeder are given in Table A. A total of 9 demonstrations were conducted (five in 2010-11 and four in 2011-12) during *Kharif* season in farmers' fields under puddle conditions. Demonstration details are given in Table B. Test variety was Samba Masuri (BPT 5204) of 180 days duration in all the locations. The demonstrations comprised of two treatments *viz*., T_1 –Direct sowing with drumseeder and T_2-Farmers practice (traditional method of transplanting). Plot size for each treatment of on-farm demonstration was 4000 m^2.

Table A : Specifications of drum seeder

Power source	Hand operated
Row to row spacing	20 cm
Shape of the seed drum	Hyperboloid
Number of rows	8 rows
Diameter of the drum	20 cm
Diameter of the seed metering hole	9 mm
Number of seed metering hole	9 Nos.
Weight of the unit	10 kg.
Type of ground wheel	Lugged wheel
Diameter of the ground wheel	600 mm
Operating speed	1 kmph / Walking speed
Level of filling the seed drum	Half volume
Weight of seed drum	600 g
Seed requirements	12 kg per acre

Table B : Details of on farm demonstrations

Sr. No.	Year	No. of villages	No. of locations	Area (ha)
1.	2010-11	5	5	2.0
2.	2011-12	4	4	1.6
	Total	9	9	3.6

Direct sowing of paddy with drum seeder :

Direct sowing with drum seeder, the paddy seeds were soaked in water for 24 hours followed by incubation in gunny bags for 24-48 hours. The field was well puddled and leveled after draining the standing water before sowing to avoid damage of sprouted seed and to enable water to spread uniformly over the field. After puddling, the field was left for 1-2 days for settling of the puddle soil. Care was taken to maintain thin film of water in the field at the time of sowing. Seed rate required for direct sowing of sprouted seed in puddled fields was quantified and pre germinated seeds were filled in all drums upto 2/3rd of its capacity at a time. The ground wheels make

Table C : Growth and yield of paddy as influenced by direct sowing with drum seeder (Mean of 3 years)

Particulars	Direct sowing with drum seeder	Traditional method of transplanting (Farmers practice)	% increase or decrease over transplanting
Seed rate (kg/ha)	30	68.7	-56.3
Days to transplant	0	30 - 40	-
Cost of raising nursery (Rs./ha)	0	3750	-
Labour required for transplanting (for one hectare)	2	15-20	-
Spacing (cm)	20 x 5-8	Zigzag method	-
No. hills m^{-2}	26	30-35	-
Plant height (cm)	67.3	64.2	4.8
No. of tillers m^{-2}	406	379	7.1
No. panicles m^{-2}	381	354	7.6
Panicle length (cm)	17.4	14.1	23.4
No. of grains / panicle	179	148	20.9
Crop duration (days)	142	153	-
Grain yield (kg ha^{-1}))	5684	5041	12.7
Cost of cultivation (Rs. ha^{-1})	20000	24850	-19.5
Gross returns (Rs. ha^{-1})	62867	56777	10.7
Net returns (Rs. ha^{-1})	42867	31927	34.3
B:C ratio	1:3.1	1:2.3	-

the impression to serve as a marker for next row and helps for good movement of drumseeder due to lugs provided on the periphery of the wheels. After turning the drum seeder for second row, care should taken that the first wheel should go through the same line of previous row in order to maintain the inter row distance of 20 cm, care should be taken to watch for any blocks of the drum. Refill the drums with seed when it reaches to the 1/4th of its capacity and continue the operation. Minimum two labour were required for completing the sowing operation *i.e.* one labour is for pulling the seeder and the other is for checking the drop of seeds from holes and filling the pre-germinated seeds in the drum.The field was kept moist without standing water in the field upto 20 days after sowing.

Uniform dose of FYM @ 5.0 t ha^{-1} and 96-32- 32 kg ha^{-1} NPK were applied through urea, SSP, MOP. Entire P and K and 1/3 N was applied as basal, remaining N was applied in two equal splits at active tillering and panicle initiation stage. Weed growth was controlled by using oxadiargyl @ 35 g/acre by mixing in 500 ml of water with 25 kg of sand was applied at 7 days after sowing and post emergence application of bispyribac sodium @ 80 ml/acre.

Traditional method of nursery raising and transplanting :

In farmer's practice of traditional rice cultivation (Table C) seedlings of 30-40 days old were pulled out manually from the nursery and transplanted in the main field at random @ 30-35 hills m^{-2} using 4-6 seedlings per hill, maintaining 2 cm depth of water up to panicle initiation and 5-7 cm depth of water thereafter up to one week before harvest. The field was drained before application of fertilizers and one week before harvest. Manual weeding was done twice at tillering and panicle initiation to control weeds. Uniform dose of FYM @ 5.0 t ha^{-1} and 96-32- 32 kg ha^{-1} NPK were applied through urea, SSP, MOP. Entire P and K and 1/3 N was applied as basal, remaining N was applied in two equal splits at active tillering and panicle initiation stage. Both the treatments were received uniform plant protection and cultural management practices throughout the period of crop growth. Growth and yield attributes on 10 randomly selected hills were noted in each treatment plot. At harvest, grain yields from the net plots (5 m x 5 m) were recorded. Labour charges, cost of inputs were worked out to compute the cost of cultivation. Gross returns were calculated based on local market prices of paddy and straw. Benefit cost ratio was computed by dividing gross returns with cost of cultivation.

RESEARCH ANALYSIS AND REASONING

The findings of the present study as well as relevant discussion have been presented under following heads :

Yield parameters :

Higher plant height of 67.3 cm was recorded with direct sowing by drum seeder compared to farmers practice (64.2cm) (Table C). There were more number of tillers (406) and panicles (381) per metre square in direct sowing by drum seeder compared to 379 tillers and 354 panicles per metre square in farmers practice which can be attributed to sowing of sprouted seeds at wider row spacing (20cm). Early establishment of seedlings in direct sown sprouted seed might be the reason for higher tillers per m^2 than conventional transplanting. These results are in accordance with Visalakshi and Sireesha (2013). Higher number of grains panicle^{-1}(179) and more panicle length (17.4 cm)were recorded in direct sowing by drum seeder compared to farmers practice (14.1 cm panicle length and 148 grains per panicle). Tiller to panicle conversion ratio was higher in direct sowing by drum seeder which might be due to favourable growth and better translocation of assimilates to the sink as it was revealed by more number of grains panicle^{-1}. Similar findings were reported by Halder and Patra (2007). In direct sowing by drum seeder plant height, number of tillers per metre square, panicles per metre square, panicle length and number of grains per panicle were increased by 4.8, 7.1, 7.6, 23.4 and 20.9 per cent, respectively over farmers practice. Where as in farmers practice planting more seedlings per hill probably led to poor tillering which was also reflected in yield attributes such as number of panicles per metre square, panicle length and number of grain panicle^{-1}.Similar findings were observed by Shekhar *et al.* (2009). The direct seeded rice matured in 11 days earlier than transplanted rice. Wang and Sun (1990) noticed that duration can be shortened by 7-15 days in direct seeded rice compared to transplanted rice.

Grain yield :

Grain yield was influenced by sowing methods. Direct sowing of paddy with drum seeder has recorded higher grain yield (5684 kg ha^{-1}) which was 12.7 per cent higher over farmers practice (5041 kg ha^{-1}). Higher number of grains panicle^{-1} and panicle length (cm) might be the reason behind the yield increase in direct sowing method. Shekhar and Singh (1991)stated that direct sowing of sprouted seeds under puddled condition results in significant improvement in yield attributes like number of effective tillers and grain yield. Seeding of sprouted seeds with 8-row seeder after puddling increased grain yield (21.5%) over farmer's practice of transplanting (Halder and Patra, 2007). Lower paddy yields under farmers' practice might be due to planting 4 to 6 older seedlings (30 - 40 days old) with irregular spacing may lead to poor growth, poor tillering, lesser number of panicles per metre square and yield. Earlier reports indicated that grain yield reduction is due to planting of older seedlings (Menete *et al.,* 2008) at a higher density (San-oh *et al.,* 2004).

Economics :

A saving of Rs. 4850/- (Rupees four thousand eight hundred and fifty only) on cost of cultivation per hectare was realized indirect sowing of paddy with drum seeder besides increasing paddy yield. Gross returns (Rs. 62867/-) and net returns (Rs. 42867/-) per hectare was realised with drum seeder method compared to farmers practice (Rs. 56777/- gross returns and Rs. 31927/-net returns). This might be due to reduction in cost of cultivation and higher grain yield with drum seeder method. Higher gross returns of Rs. 6090/- per hectare was obtained with drum seeder method due to lesser cost of cultivation and higher grain yield compared to farmers practice. The cost of cultivation was comparatively lesser in drum seeder method which resulted in an additional net profit of Rs.10940/- per hectare as compared to conventional method of rice cultivation. Similar findings were reported by Halder and Patra (2007). Simultaneously benefit cost ratio was higher with drum seeder method (1:3.2) compared to farmers practice (1:2.2) because of lower cost of cultivation and increased yield with drum seeder method. Higher net returns and B:C ratio were recorded with drum seeder method due to no nursery raising and transplanting, less seed cost, reduced labour for weeding denoting lower cost of cultivation in drum seeder method resulted in increased profitability compared to farmers' practice. In drum seeder method cost of cultivation was reduced by 19.5 per cent whereas, gross returns and net returns were improved by 10.7 and 34.3 per cent, respectively over farmers practice.

Conclusion :

These demonstrations clearly established an advantage of direct sowing of paddy using drum seeder in puddled condition over conventional method of transplanting. Seed rate can be reduced to 30 kg ha^{-1}as against 68.7 kg ha^{-1} in farmers practice. Direct sowing with drum seeder helps in reducing the cost on nursery raising and transplanting besides increasing yield by12.7

per cent, reduces the crop duration and cost of cultivation. The cost of cultivation was reduced by 19.5 per cent and net returns increased by 34.3 per cent.

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