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Direct seeding rice with drum seeder is made easy to rice cultivation in North Coastal Andhra Pradesh

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Abstract
Paddy is major predominant crop during *Kharif* in Visakhapatnam district of Andhra Pradesh, cultivated in an area of 1,17,608 ha, out of total cropped area of 1,92,638 ha with productivity of 2664 kg/ha. Farmers grow crop by adopting traditional method of paddy cultivation, use more seed rate, and close spacing, late transplanting with over aged seedlings common phenomenon due to erotic rainfall climate change. Scarcity of labour and escalation in labor wages, reduction in labor efficiency are leading to low net returns. Introduction of Drum Seeder technology which is very easy and less labour involved. Drum seeder technology is boon to farmers to save money and time and crop comes to harvest 7-10 days earlier than normal transplanted paddy. Executed On-Farm Demonstrations (OFDs) in farmer fields during two consecutive seasons of *Kharif*, 2018 and *Kharif*, 2019. Drum seeder technology in paddy recorded 12.49% yield over normal transplanting method of paddy cultivation. The results from the study showed that the farmers realized the 58.19% increase in net income due to increased grain yield by 12.49% with reduction of cost of cultivation by 9.35%, it could be attributed to reduction in manual labour of 12 man labour and 25 women labour per ha and also increase in yield attributes and yield.

Keywords: Paddy drum seeder, Cono Weeder, OFT, Yield and yield attributes, B:C Ratio

1. Introduction
Rice area has been decreasing in state like Andhra Pradesh, although overall productivity is increasing, there is a decrease in compound growth rate in rice productivity at national level [1]. There is no scope for expansion of area for rice cultivation. Rice yields are plateau in the irrigated ecosystem and the rainfed system with low productivity of 2.5 to 3.5t ha^{-1}, it has become imperative to increase rice production per unit area per unit time to feed the teaming millions in the new millennium. India has to produce 135-145 million tons by 2020 A.D. to feed the additional 350million people. To do so, the productivity should be raised to 3.2t ha^{-1} a by 2020AD from the present level of 2.05t ha^{-1} [2]. Visakhapatnam district is the one of the rice growing districts in Andhra Pradesh. Farmers grow rice in 1.17 lakh ha during *Kharif* and 2000 ha during *Rabi*. Cost of cultivation is rising year by year due many reasons i.e., social reasons, situational factors and input cost. At present cost of cultivation per hectare is between Rs.34250/- to Rs 38500/-. This is mainly due escalation of labour wages and scarcity of labour in villages during agricultural season, labour requirement is very intense at the time of transplanting season and increase in price of fertilizers. To overcome this, Wet paddy seeding with drum seeder can reduce the labour requirement during transplanting season, technology is very simple and can be adopted by the farmers easily, cost of cultivation can be reduced and receive quality crop harvest at 7-10 days earlier than normal transplanted field. Paddy drum seeder technology holds special significance in the present day production system with regard to saving labour component by 30-50% and increase the productivity by 20-30% [3]. Paddy drum seeder technology, a new way of cultivation is gaining more attention of the farmers in Visakhapatnam District. But the paddy drum seeder technology has its own implications to adopt such as right choice of field, irrigation facilities, varieties, land preparation, weed management and machinery available. Objectives includes to test the feasibility of paddy drum seeder technology in the Visakhapatnam District through On Farm Trials (OFTs), Method demonstrations to record the yield in paddy drum seeder technology in comparison with normal method to convince the farmer and to analyze the economics of paddy cultivation in Visakhapatnam District.

2. Material and Methods
Introduced paddy drum seeder technology with comparing normal method of cultivation through organizing On-Farm Trials (OFTs) during *Kharif*, 2018 and *Kharif 20*19 in 10 locations.

2.1 Flow Chart of Handed Over of Paddy Drum Seeder Technology to the Farmers

Wide publicity through Press & Media

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Selection farmers

↓

Training

↓

Method Demonstrations & On Farm Trials

↓

Monitoring & Supervision

↓

Data recording & Analysis & Evaluation

Direct Paddy Drum Seeder (Fig.1) is small equipment for sowing germinated paddy seed directly in wetland field is fabricated and it is used for demonstration. There is no need for transplantation. It is a manually pulled implement. It covers 8 rows of 20cm row-to-row spacing at a time. It is made up of plastic materials. Cono weeder (Fig.2) is used for intercultivaton to incorporate weed in inbetween rows apart of 20cm.

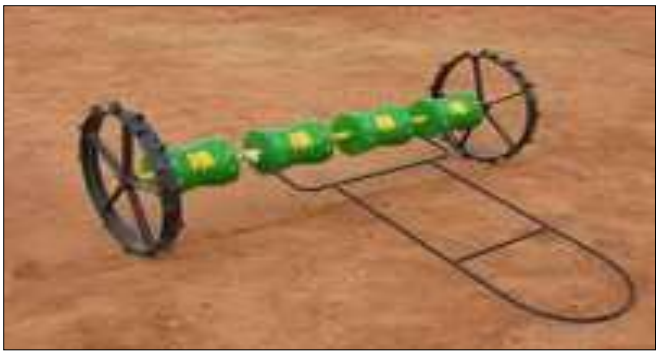

Fig 1: Drum seeder

Fig 2: Cono weeder

Salient Features includes labour cost is reduced drastically Cost of cultivation is reduced because, cost on nursery raising, nursery pulling and transplanting can be saved, uniformity in seed sowing and Plant population, continuous drilling of seeds is eliminated, reduction in seed rate and thinning cost. Crop matures 7-10 days earlier than the transplanted paddy Light in weight and easy to handle, an area of 1 hectare per day can be shown and saving in seed requirements: 12-18 kg per acre is sufficient depending on variety. Farmer fields are selected to conduct On Farm demonstrations (OFDs) with proper drainage facility and regulation of water. The varieties cultivated in paddy drum seeder technology were in *Kharif* with RGL-2537, in Rabi with MTU-1010.Since planting of crop in both Drum seeder technology and Normal transplanting method data pertaining to crop stand with number of tillers per hill, number of tillers per square meter, incidence of pests and diseases if any at regular intervals followed by yield contributing parameters like effective tillers, panicles per hill & square meter, length and texture of panicle, number of grains per panicle and 1000 grain weight are recorded. Yield per 5x5m^2 was collected and calculated per hectare area. Means of yield attributes, yield and cost of cultivation were arrived for yield in both drum seeder technology and normal transplanting methods. Percentage yield increase over normal method was calculated and comparative analysis of cost benefit ratio per hectare was arrived and presented in the tables.

3. Results and Discussion

On-Farm Demonstrations with Drum seeder technology is conducted for two seasons both in *Kharif*, 2018 and *Kharif*, 2019 at innovative farmer fields and yield attributes, yield are depicted in following tables.

Table 1: Mean data on Yield and Yield attributes of On-Farm Demonstrations on paddy drum seeder technology conducted during *Kharif*-2018 and *Kharif*- 2019

Season	No. of Locations	Duration		No. of Productive tillers/Sq.mt		No. of grains/panicle		Yield Kg/ha		Percentage Increase over Check
		Demo	Check	Demo	Check	Demo	Check	Demo	Check	
Kharif- 2018	3	124	134	227	190	213	198	6580	5680	15.85
Kharif- 2019	5	113	121	230	212	171	153	5910	5528	6.92
Average		119	128	229	201	192	176	6245	5604	11.39

The duration of the crop (Table.1) is recorded. It was observed that there is reduction of duration to reach the harvesting of rice crop was observed. The reduction of crop duration 9 days was observed when compared to normal transplantation method of rice cultivation. The results are corroborates with the [4]. All yield attributes, during all the years were recorded better in Drum seeder technology than normal method (Table.1). During all the seasons of three years of demonstrations and in all the locations with different varieties recorded the number of productive tillers per/Sq.mt, and number of grains per panicle are 229 and 192 are more than normal practice 201 and 176 [5] respectively. Grain yield (Table.1) increase was achieved to a tune of 11.39% in drum seeder method (6245 $kgha^{-1}$) over normal method of cultivation (5604 $kgha^{-1}$). The use of drum seeder is superior to broad casting method of raising the rice crop. Higher yield in drum seeder technology is contributed by more number of productive tillers by supported by profuse root system resulted in more number of panicles.

Table 2: Mean of comparative analysis of Cost of Cultivation including labour per hectare of paddy recorded during *Kharif*-2018 and *Kharif*-2019

S. No	Practice	Paddy drum seeder technology					Conventional transplantation method				
		Labour cost		Input cost		Total Cost in Rs/ha	Labour cost		Input cost		Total Cost in Rs/ha
		No	Cost	Input	Cost Rs		No. of labour	Cost Rs/ha	Input	Cost Rs	
1.	Nursery management	0	0	0	0	0	2 M preparation	600	FYM	500	1100
2	Seed quantity and cost	0	0	40kg/ha@Rs 30	1200	1200	0	0	75kg/ha@R30	2250	2250
3	Land preparation of main field	10 M Puddling	6600	0	0	6600	8M & Puddling	5600	0	0	5600
4	Nursery Pulling and spreading	0	0	0	0	0	15M 3 W	4950	0	0	4950
5	Transplanting/ sowing	5M 3W	2000	0	0	2000	25W	3750	0		3750
6	Manures & Fertilizers management /ha	8M	2400	DAP-125Kg Urea 150kg Mop :85 kg	8000	10400	8M	2400	DAP-125Kg Urea 150kg Mop :85 kg	8000	10400
7	Weeding & Herbicide Inter-cultivation	3M 20W	4000	Herbicides	2500	6500	1M 20W	3300	Herbicide	1000	4300
8	Plant protection	2M 2W	1000	PP Chemicals	3500	4500	4M 4W	1800	Pp Chemicals	4500	6300
9	Irrigation management	8 M	2400	0	0	2400	10M	3000	0	0	3000
10	Harvesting	27 W	5400	0	0	5400	25 W	5000	0	0	5000
11	Threshing, Winnowing and bagging	16M 16W	8000	0	0	8000	16M 16W	8000	0	0	8000
	Total	52 M 68 W	31800		15200	47000	64M 93W	38400		13500	51850

M-Male F-Female

There is reduction in labour utilization (Table 2) is observed in drum seeder technology i.e., 12 man labour and 25 women labour when compared to normal method of transplanting method.

Table 3: Economics of the Paddy Drum seeder technology Vs Normal transplantation method recorded during *Kharif*-2018 and *Kharif*- 2019

S. No	Particulars	Paddy drum seeder technology Method	Transplantation method	Difference
1	Grain Yield Kg/ha	6580	5680	900
2	Straw Yield Kg/ha	7370	6362	1008
3	Grain Value (Rs.14/kg)	92120	79520	12600
4	Straw Value (Rs.0.5/kg)	3685	3180	504
5	Gross income Rs./ha	95805	82700	13104
6	Total cost of cultivation Rs./ha	47000	51850	-4850
7	Net income Rs./ha	48805	30851	17954
8	C:B ratio	2.03	1.59	0.44

Additional grain yield and straw yield (Table.3) of 900$Kgha^{-1}$ and 1008 $Kgha^{-1}$ recorded in drum seed technology compared with normal practice of transplantation, this could be due to uniform plant population, good tillering capacity. Additional net income of Rs.15404 ha^{-1} received in drum seeder technology with reduction of cost of cultivation of Rs.2300 ha^{-1}realized over normal transplanting. The net income increased by Rs 17954 per hectare in drum seeder technology. It was mainly due to the reduction in cost of sowing operation and transplanting operations. It was observed that the cost-benefit ration was higher in direct sowing (2.03) which is significantly higher than in conventional method (1.59).

4. Conclusion

Results from the study indicated that the farmers realized towards 58.19% higher net income due to increased grain yield by 12.49% with reduction of cost of cultivation by 9.35%, it could be attributed to reduction in manual labour of 15 man labour and 27 women labour and also increase in yield attributes and yield.

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