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Front Line Demonstration of Paddy Drum Seeder (8 Row) under Well Irrigated Rice in Nalgonda District, Telangana

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Front line demonstration was conducted on drum seeding technology the farmers, assessment of drum seeder implement was done with the assistance of Krishi Vigyan Kendra, Kampasagar, Nalgonda under Professor Jayashankar Telangana State Agricultural University, Telangana for consequently three years during *Kharif,* from 2018-19 to 2020-21. The comparison was made between drum seeding technology and manual transplanting with an objective to reduction of cost of cultivation and subsequently increase farmer's net returns. Frontline Demonstrations revealed that, there were more number of tillers (395) and panicles (370)/m^2 in direct seeded technology with drum seeder compared to farmer's practice (365 and 346/ m^2). Drum seeder technology influence plant height (68.2cm), number of tillers/m^2 (395) and yield attributes viz., Number panicles m^{-2} (370), length of panicle (16.9 cm) and Number of grains / panicle (182). Direct seeded technology with drum seeder has recorded higher grain yield (6,512 kg ha^{-1}) which was 6.4 per cent over farmer's practice (6,094 kg ha^{-1}) with a net saving of Rs. 8,990/- on the cost of cultivation ha^{-1}. The Gross returns and net returns (Rs.1, 20,795and Rs. 69, 265/ha) by the drum seeder method were more compared to farmer's practice (Rs.1, 13,036/ha and Rs. 52, 516/ha).

Keywords: Rice; frontline demonstrations; drum seeder.

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1. INTRODUCTION

"Rice (Oryza sativa L.) is the most important staple food crop in the Nalgonda district of Telangana cultivated in 87642 ha area during *Kharif* and 63661 ha during Rabi with an average productivity of 3450 kg/ha. The major rice area is under NSP left canal irrigated red soils/ Red soils with wells, tanks, kuntas as irrigation sources. Present management recommendations for rice in Telangana include planting 20 to 25 day-old seedlings @ 2 per hill at 20 x 15 cm spacing with hand weeding and continuous flooding" [1]. The Majority of farmers use over aged seedlings due to delayed monsoon. Rice is cultivated by raising nursery for about 30 days. Later seedlings are pulled and transplanted manually in a zigzag manner without proper spacing in the main field after puddling. Due to a variety of variables, including social considerations, environmental considerations, and input costs, the cost of agriculture is rising yearly. The current cost of farming per hectare ranges from Rs. 51300 to Rs. 53000. This is mostly because to rising labor costs, a labor shortage in rural areas during the growing season, a high demand for labor during transplanting, and a rise in fertilizer costs. This can be resolved by using direct rice seeding using a drum seeder, which requires less labor during transplanting, is a fairly simple technology that farmers can quickly adopt, can lower cultivation costs, and yields high-quality crops 7–10 days earlier than with a typical transplanted field. Direct seeding of Rice with drum seeder holds special significance in the present day production system with regard to saving labour component by 30-50% and increasing productivity by 20-30%. "Transplanting is not profitable due to high labour wages and the problem of non-availability of labour during the peak periods of operation" [2]. Non- availability of labour, hike in inputs cost and water shortage have led 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 and 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" [3]. "Because of uncertainty in rainfall and increase in cost of production, the rice cultivation has become unprofitable in Nalgonda and the same is in the other growing regions of Telangana" [4]. "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" [5]. The cost of operation of a drum seeder is Rs. 40.50 per hour and Rs. 320 per hectare [6]. 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, Front line demonstrations were conducted to popularize the drum seeder among the farmers,the feasibility of paddy sowing by drum seeder was done under the supervision of Krishi Vigyan Kendra (Extension unit of Professor Jayashankar Telangana State Agricultural University, Telangana.), Nalgonda for three years during *Kharif*, 2018-19 to 2020-21. In order to lower the cost of producing paddy and subsequently increase the returns from unit in farmer's fields, a comparison between direct paddy sowing using a drum seeder and farmers' practice was made.

2. MATERIALS AND METHODS

The present investigation of Frontline demonstration was conducted on Direct seeded technology with drum seeder during *Kharif* seasons of 2018-21 by KVK, Kampasagar at Nalgonda district of Telangana State. In three consecutive years, ten villages of Tripuraram block and Madugulapally blocks were chosen for this project. Total 30 farmers were selected for the demonstration at farmer fields under puddle conditions. The demonstrations comprised of two treatments viz., $T_{1:}$ Direct sowing with drum seeder $T_{2:}$ Farmer practice (Traditional method of transplanting). The Plot size for each treatments of demonstration was 4000 m^2. Farmers were accomplished to follow the package of practices recommended by the Professor Jayashankar Telanagana State Agricultural University, Telangana and need based input material were provided to the farmers. All the participating farmers were trained on various aspects of Drum seeder production technologies. 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.. Refill the drums with seed when it reaches 1/4th of its capacity and continues the operation. A minimum of two workers were needed to complete the sowing procedure, one to draw the seeder and the other to inspect the drop of seeds from holes and fill the drum with pre-germinated seeds. The field was kept moist without standing water in the field up to 20 days after sowing. Uniform dose of FYM @ 5.0 t ha^{-1} and 120-60- 50 kg ha^{-1} NPK were

applied through urea, SSP and MOP. Entire P and K and 1/3 N was applied as basal, remaining N were applied in two equal splits at the active tillering and panicle initiation stage. Weed growth was controlled by using pre- emergence herbicide Pyrazosulfuron Ethyl 10% WP@ 80 gm/acre was applied at 1-3 days after sowing and post-emergence application of bis pyribac sodium @ 80 ml/acre or herbicide mixture Cyhalofop-Butyl 5.1% + Penoxsulam 1.02% @ 800- 1000 ml per acre was applied at 15-20 days after sowing.Data were subjected to suitable statistical methods.

Per cent increase in yield = {Demonstration yield − farmers practice yield Farmers practice yield} x 100.

Net return (Rs. ha^{-1}) = Gross return (Rs. ha^{-1}) - Total cost of cultivation (Rs. ha^{-1}).

Benefit: Cost ratio = Gross return (Rs. ha^{-1}) Cost of cultivation (Rs. ha^{-1}).

3. RESULTS AND DISCUSSION

3.1 Yield Attributes

Higher plant height of 68.2 cm was recorded with direct sowing by drum seeder compared to farmer's practice (65.3 cm) (Table 4). There were more of tillers (395) and panicles (370) per m^2 in direct sowing by drum seeder compared to 365 tillers and 346 panicles per m^2 in farmer's practice which can be attributed to the sowing of sprouted seeds at wider row spacing (20 cm). There may be more tillers per m2 from direct sowing sprouted seed than from standard transplanting due to the early establishment of seedlings in these conditions. These results are in accordance with Visalakshi and Sireesha [4]. A higher number of grains $panicle^{-1}$(182) and more panicle length (16.9 cm) were recorded in direct sowing by drum seeder compared to farmer's practice (14.5 cm panicle length and 156 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 [7]. Where as in farmer's 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. [8]. The direct- seeded rice matured in 10 days earlier than the transplanted rice. Wang and Sun [9] noticed that "duration can be shortened by 7-15 days in direct seeded rice compared to transplanted rice".

Table 1. 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 No
Weight of the unit	10 Kg
Type of ground wheel	
Diameter of the ground wheel	Lugged wheel
Operating speed	600 mm
Level of filling the seed drum	1 kmph / Walking speed
Weight of seed drum	Half volume
Weight of seed drum	600 g
Seed requirements	12 kg per acre

Table 2. Details of Front-Line demonstrations

Sr. No.	Year	No. of villages	No. of locations	Area (ha)
1	2018-19	5	10	4
2	2019-20	5	10	4
3	2020-21	5	10	4

3.2 Grain yield

Grain yield was influenced by sowing methods. Direct sowing of paddy with drum seeder has recorded higher grain yield (6512 kg ha-1) (Table 3) which was 6.4 per cent higher over farmer's practice (6094 kg ha^{-1}). The higher number of grains $panicle^{-1}$ and panicle length (cm) might be the reason behind the yield increase in the direct sowing method. Shekhar and Singh [10] 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 a 8-row seeder after puddling increased grain yield (21.5%) over farmer's practice of transplanting" [7]. Lower paddy yields under farmers' practice might be due to planting 4 to 6 older seedlings (25 - 30 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 the older seedlings [11] at a higher density [12].

3.3 Economics

A saving of Rs. 8990/- on the cost of cultivation per hectare was realized through indirect sowing of paddy with drum seeder besides increasing paddy yield. Gross returns (Rs. 1, 20,795/ ha) and net returns (Rs. 69, 265/ ha) (Table 3) was realised with drum seeder method compared to farmers practice (Rs. 1, 13,036 / ha gross returns and Rs. 52, 516/ ha net returns). This might be due to a reduction in cost of cultivation and higher grain yield with drum seeder method. Higher Net returns of Rs. 69, 265/ha were obtained with the drum seeder method due to lesser cost of cultivation and higher grain yield compared to farmer's practice. The cost of cultivation was comparatively lesser in drum seeder method which resulted in an additional net profit of Rs.16749/ha as compared to the conventional method of rice cultivation. Similar findings were reported by Halder and Patra [7]. Simultaneously benefit-cost ratio was higher with drum seeder method (2.3) compared to farmers practice (1.8) because of lower cost of cultivation and increased yield with the drum seeder method. Higher net returns and B:C ratio were recorded with the drum seeder method due to no nursery raising and transplanting, less seed cost, reduced labour for weeding denoting lower cost of cultivation in the drum seeder method resulted in increased profitability compared to farmer's practice. In comparison to farmers' practices, the drum seeder approach lowered cultivation costs by 14.8% while increasing gross and net returns by 6.4% and 24.2%, respectively.

Table 3. Yield improvement in rice by direct sowing with rice the drum seeder

Treatment	Average yield kg/ha	Gross returns (Rs. ha^{-1})	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs)	C:B ratio	% Increase in yield
Direct sowing with drum seeder	6,512	1, 20,795	51530	69, 265	**2.3**	**6.41**
Farmers practice (Conventional transplanting method)	6,094	1, 13,036	60520	52, 516	**1.86**	

Table 4. Growth parameters of paddy as influenced by direct sowing with the drum seeder (mean of 3 years)

Particulars	Direct sowing with drum seeder	Traditional method of transplanting (Farmers practice)
Seed rate (kg/ha)	30	68.7
Days to transplant	0	25-30
Cost of raising nursery (Rs./ha)	0	3950
Labour required for transplanting (for one hectare	2	15-20
Spacing (cm)	20*5-8	Zig zag method
No. hills m^{-2}	26	30-35
Plant height (cm)	68.2	65.3
Number of tillers m^{-2}	395	365
Number panicles m^{-2}	370	346

Particulars	Direct sowing with drum seeder	Traditional method of transplanting (Farmers practice)
Panicle length (cm)	16.9	14.5
Number of grains / panicles	182	156
Crop duration (days)	125	135

4. CONCLUSION

Frontline demonstrations on Direct seeded technology with drum seeder during 2018-19,2019-20 and 202 0-21 concluded that average highest yield of 65.12 q ha^{-1} obtained with demonstration followed by 60.92 q ha^{-1} with farmers practice. Similarly, monetary benefits were also recorded highest with demonstrations as compared to farmers practice. The demonstration of a 6.41% percent increase in paddy production as compared to the farmers' practice raised awareness and encouraged other farmers to follow the farmers' practice. These demonstrations built the relationship and confidence between farmers and KVK scientists. The FLD program is a useful instrument for boosting paddy yield and productivity as well as altering farmers' knowledge, attitudes, and abilities. This has helped the community achieve food and nutritional security in addition to socioeconomic stability.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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