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FABRICATION AND EVALUATION OF 4 ROW DRUM SEEDER WITH 25 AND 30 CM SPACING

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Abstract- The mechanization of direct sowing pre germinated paddy via drum seeders has been introduced by various institutes those have 20 cm row spacing which covers 8 rows at a time. In many forums farmers are requesting for drum seeder with either 25 or 30 cm for ease of inter cultivation. The present experiment was carried out for fabrication and evaluation of 4 row drum seeder with 25 and 30 cm spacing in the same implement during kharif 2013. The calibration of drum seeder was carried out in the laboratory and the seed rate of 37.99 and 33.33 kg/ha was achieved with the 25 and 30 cm row spacing's respectively. From the field evaluation the field capacity of 25 cm row spacing was observed that 0.07 kg/ha with the field efficiency of 77.41 per cent at the seed rate of 38 kg/ha whereas the field capacity of 30 cm row spacing was 0.08 ha/h with the field efficiency of 76.16 per cent at the seed rate of 33.85 kg/ha was observed. Maximum tillers of 561/ m2 and panicles of 509 / m2 were recorded with 30 cm spacing whereas the tillers of 491/ m2 and panicles of 440/ m2 were recorded for 25 cm row spacing. Rice sown with 30 cm drum seeder recorded grain yield of 5820 kg/ha, and 5588 kg/ha for 25 cm row spacing. The operating cost for 25 cm and 30 cm row spacing is Rs. 1820.79 per ha and 1598.26 per ha respectively. From the results 30 cm row spacing has got more yield and less operating cost which is more economical and suitable for farmers.

Key words- Drum seeder, spacing, fabrication, Evaluation, Calibration, 4 row, Field capacity and cost of operation.

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Introduction

Rice (*Oryza Sativa* L.) is the staple food for millions of people. It is one of the major cereal crops cultivated in more than 110 countries in the world with a total production of 527 million tones, of which 78% is contributed the major rice growing countries of Asia [1]. India is the largest grower of rice in the world and it occupies the largest cropped area of 44.2 M ha with a total production of 87.5 Mt and an average productivity of 1.9 t ha^{-1} [4]. However, it ranks second to China in terms of production. In Andhra Pradesh rice is the major food crop grown in an area of 28.03 lakh ha in kharif and 15.84 lakh ha in rabi. Rice is the principle food crop cultivated throughout the Andhra Pradesh state, providing food for the growing population, fodder to the cattle and employment to the rural masses [2].

The rice cultivation is done in different ways in the world. The most important cultivation ways are transplanting and direct seeding methods. Transplanting is done either by manually or mechanical transplanting methods. In manual transplanting the seedlings are first raised in the seed bed before they are planted in the main field. Though manual transplanting gives uniform crop stand it is quite expensive, and requires lots of labour besides involving lots of drudgery. Manual transplanting is a labour consuming operation which requires approximately 25% of the total labour requirement of the crop [8]. Mechanical transplanting requires a special method of raising nursery either in the tray or mat type seedlings. The mechanical transplanting of rice has been considered the most promising option, as it saves labour, ensures timely transplanting and attains optimum plant density that contributes to high productivity. Moreover, the price of the machine is very high and the majority of the farmers cannot afford to buy. As the usage of the machine in terms of the number of hectares per year decreases, the cost of operation per hectare increases. At 28 hectares of usage per year through mechanical transplanter, the cost of operation for mechanical and manual transplanting would be same. Hence, the mechanical transplanting would be economical if it is used to cover an area of 28 ha and above per year [7].

Direct seeding of rice refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting rice seedlings from the nursery. There are three principal methods of direct seeding of rice. Dry seeding (sowing dry seeds into dry soil), wet seeding (sowing pre-germinated seeds on wet puddle soils) and water seeding (seeds sown into standing water) [6]. In direct seeding, the seed is sown directly in the main field either by broadcast or row seeding in the wet or dry field. Direct seeding is a labour saving technology in the rice crop establishment and is being rapidly adopted by farmers. Direct seeding of rice is helpful to the farmers due to the lesser labour and time requirement, the low cost of cultivation due to the skipping of nursery raising and transplanting, the maintaining of the recommended plant population and also due to the earlier crop maturity by 7-12 days [5].

Broadcasting of pre-germinated paddy in a puddle field results non-uniformity in plant stand and difficulty in adopting the improved intercultural tools for weeding. Hence, it is vital to develop a mechanized direct sowing rice method that allows improved intercultural tools for weeding. The mechanization of direct sowing pre germinated paddy rice via drum seeders has been introduced by various institutes those have 20 cm row-to-row spacing which covers 8 rows at a time. In many forums farmers are requesting for drum seeder with either 25 or 30 cm for ease of inter cultivation.

Keeping all the points in view an attempt was made for the fabrication and evaluation of different spaced drum seeders with the following objectives.

1) To fabricate and evaluate 25 and 30 cm spacing drum seeder.
2) To compare the economics of operation in 25 and 30 cm spacing's.

MATERIAL AND METHODS

The study was conducted at Farm Implements and Machinery Scheme and Agricultural Research Institute Rajendranagar (17^0 19^1 N latitude, 78^0 23^1 E longitudes and an altitude of 542.3 m above mean sea level), Hyderabad, during kharif 2013. The soil of the experimental site was clay loam soil. The experiment consists of fabrication and evaluation of 25 and 30 cm drum seeder was developed for requirement of farmers choice by the small adjustment to save the labour, time and for ease of inter cultivation operation. The cost economics of those two spacing's were also carried out.

Methodology for fabrication of drum seeder

M.S. sheet of 18 gauge was used to fabricate the drum seeder. The design had two drums forming 4 rows. Drums were fixed to an axle, which was connected to two wheels having lugs facilitate rotating even in boggy fields. Two rows of orifices were provided on the circumference of each conical shaped drum in order to obtain the recommended spacing's of 25 and 30 cm between the rows. Drums fitted on the axle have provision to change the required spacing's (25 or 30 cm) by adjusting with cotter pins fixed on the axle. The fabricated drum seeder and adjustment of recommended spacing of drum seeder were shown in [Fig-1] and [Fig-2]. If we use one recommended spacing of either 25 or 30 cm the other spacing orifices were covered with Teflon tape. Wheels of 60 cm diameter were connected to the axle such that when the wheels rotate, drums rotate along with the shaft and wheels. The handle is connected to the axle by steel bushings. The views of drum seeder and cad design of drum seeder were shown in [Fig-3] and [Fig-4] and the specifications of fabricated drum seeder were shown in [Table-1].

Fig.-1 View of fabricated drum seeder for 25 and 30 cm spacing's.

Fig- 2- View of adjustment of spacing by cotter pins.

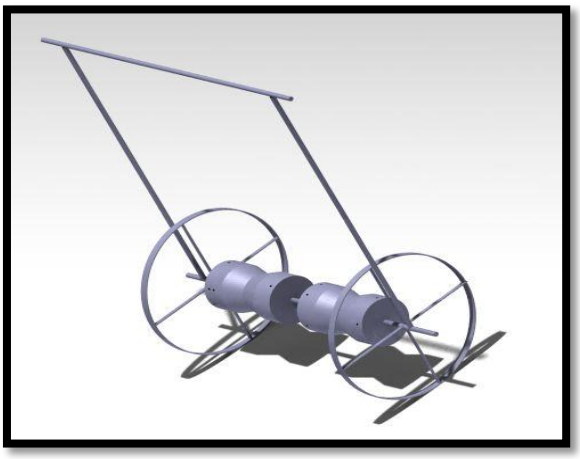
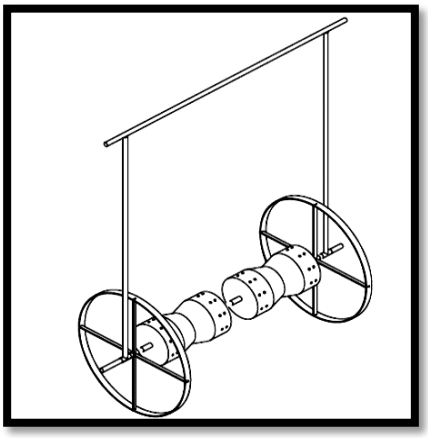


Fig- 3- Isometric view of drum seeder in cad design



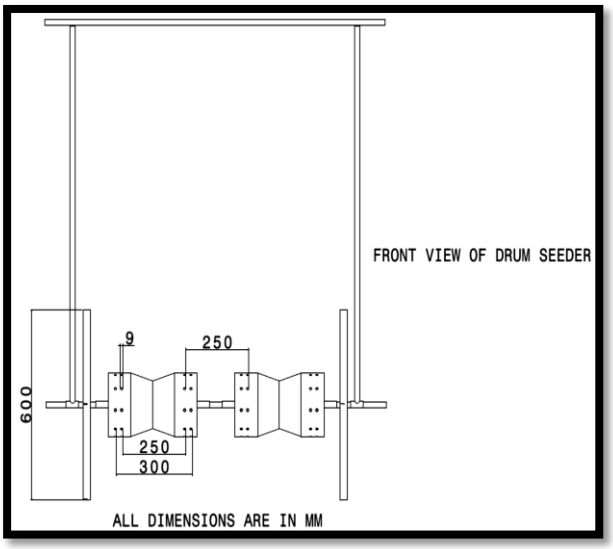


Fig- 4- Views of drum seeder.

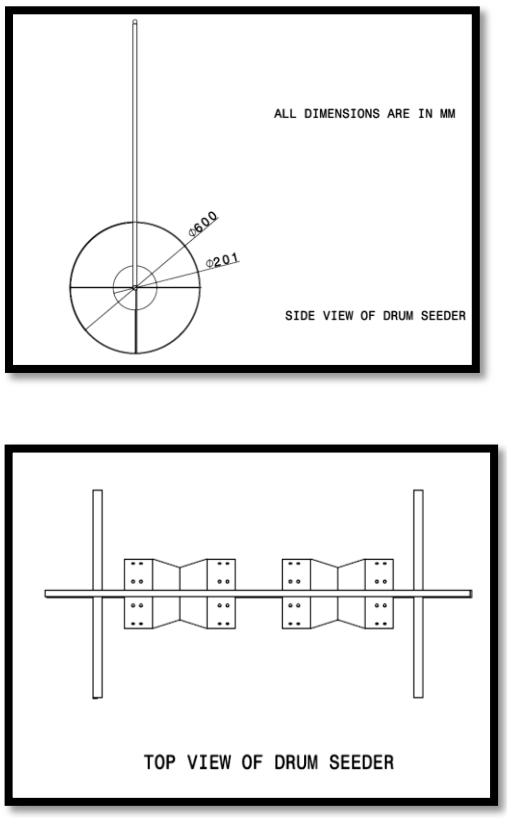


Fig- 4- Views of drum seeder.

Table-1- *Specifications of fabricated drum seeder.*

Sl. No.	Descriptions	Details
1	Power Source	Hand operated
2	Row to row spacing	250 and 300 mm (Adjustable)
3	Shape of the seed drum	Hyperboloid
4	Number of rows	4 rows
5	Diameter of the drum	200 mm
6	Diameter of the seed metering hole	9 mm
7	Number of seed metering hole	9 Nos.
8	Weight of the unit	13 Kg.
9	Type of ground wheel	Lugged wheel
10	Diameter of the ground wheel	600 mm

Testing of drum seeders in laboratory

A laboratory calibration of fabricated drum seeder was carried out with sprouted seed of BPT – 5204 variety by filling the half volume of the drum. The sprouted seeds were prepared by soaking the seeds in water for 24 hours, followed by 16-18 hours of incubation at room temperature. The best method of calibration would be to count the number seeds dropped per unit revolution of drum or unit area covered [3]. The drum seeder was kept on the floor and drag by manually, then the amount of seeds dropped from the seed metering hole was collected for the 10 revolutions of the ground wheel. The seed collected were weighed and seed rate was reported. The sprouted seed calculation was made on dry weight basis. Therefore, when dropping seeds per unit area, farmers could easily count. The calibration of drum seeder in the laboratory was shown in [Fig-5].

Fig- 5- Calibration of drum seeder in laboratory for different spacings

Methodology for field and seed preparation for drum seeder application

The field was properly puddled with sufficient number of ploughings. Then, a day before sowing, the water in the field was removed. The sprouted seeds were prepared by soaking the seeds in water for 24 hours followed by 16-18 hours of incubation at room temperature [9] and [2]. The sprouted seeds were shown in [**Fig-6]** and the direct sowing of paddy crop by the drum seeder was shown in [**Fig-7]**. The seed variety used in the experiment was BPT- 5204. The fabricated drum seeder has got both 25 and 30 cm spacing's so that while operating for one recommended spacing of either 25 or 30 cm the other spacing orifices were covered with Teflon tape and adjust the cotter pin fixed on axle carefully for required spacing. Once the sprouted seeds were prepared the drum seeders were filled with half volume and pulled backward along the length wise to reduce the number of turnings. After sowing operation a week bird watching was necessary to protect the crop.

Field performance of fabricated drum seeder for 25 and 30 cm spacings.

During the experiment the parameters like seed rate, speed of operation, effective field capacity, theoretical field capacity, and field efficiency were recorded by using the following procedure. Moreover, the data on crop parameters like number of hills per square meter, tillers per square meter, panicles per square meter, panicle weight, test weight and grain yield were recorded.

Seed rate, kg/ha

The seed rate was determined by taking the weight a of seed before and after sowing operation. Then subtracted the final weight of seed from initial weight of seed so that the seed rate was obtained and the results were expressed in terms of kg ha^{-1}.

Speed of operation, kmph

To determine the speed of operation, mark the length of 5 m and the machine was operated in the marked run length. A stopwatch was used to record the time for the machine to traverse the marked run so that the speed of travel was computed in m s^{-1}.

Effective field capacity, ha/h

Effective field capacity was measured by the actual area covered by the machine, based on its total time consumed and its width. Effective field capacity was determined by the following relationship.

$$\text{Effective field capacity, ha h}^{-1} = \frac{Total\ area\ covered,\ ha}{Total\ timetaken,\ h}$$

Theoretical field capacity, ha/h

Theoretical field capacity is the rate of field coverage of the machine, based on 100 percent of time at the rated speed and covering 100 per cent of its rated width. The theoretical field capacity was determined by using the following relationship.

$$\text{Theoretical field capacity, ha h}^{-1} = \frac{Width(m) X Speed(km/h)}{10}$$

Field efficiency, %

Field efficiency is the ratio of the effective field capacity to theoretical field capacity. It was determined by the following formula.

$$\text{Field efficiency, \%} = \frac{Effective\ field\ capacity,\ (ha/h)}{Theoretical\ field\ capacity,\ (ha/h)} \text{ x } 100$$

Cost analysis

The total cost of operation of the machine in Rs./h was calculated by considering the fixed cost and operational cost of the machine by making following assumptions. The cost of operation was based on the prevailing market rates during the season and location.

Fixed cost

Fixed cost includes depreciation, interest.

Depreciation

It is the loss of value a machine with the passing of time.

$$D = \frac{C - S}{L\ H}$$

Where,
C = Capital cost
D = Depreciation, Rs. /h
S = Salvage value, 10 per cent of capital
H = Number of working hours per year, and
L = Life of machine, year

Interest

Interest was calculated on the average investment of the machine taking into consideration the value of in first and last year.

$$I = \frac{C + S}{2} x \frac{i}{H}$$

Where,
I = interest per year
i = interest rate per year, per cent
C = Capital cost

Operating cost

Operating cost includes repairs, maintenance, and other costs.

Repairs and maintenance

Cost of repairs and maintenance was taken as 10 per cent of the initial investment of the machine.

Other costs

It includes wages for operator, labour cost based on the prevailing market rates per day of 8 hours.

Fig- 6- View of sprouted seed.

Fig- 7- View of paddy crop sown by drum seeder.

Results And Discussion

Based on laboratory and field experiments conducted during kharif 2013, the sprouted seeds of BPT- 5204 variety were taken for calibration of drum seeder and the seed rate of 37.99 and 33.33 kg/ha was achieved with the 25 and 30 cm row spacing's respectively. The results of the calibration of drum seeder are reported in [Table-2]. The field performance of drum seeder for 25 and 30 cm row spacing's were conducted and the data was reported in [Table-3]. Based on the data the field capacity of 25 cm row spacing was observed that 0.07 kg/ha with the field efficiency of 77.41 per cent at the seed rate of 38 kg/ha whereas the field capacity of 30 cm row spacing was 0.08 ha/h with the field efficiency of 76.16 per cent at the seed rate of 33.85 kg/ha.

Table- 2- *Calibration data of drum seeder for 25 and 30 cm spacing's.*

Sl. No.	Observations	Drum seeder spacing, cm	
		25	30
1	Number of rows	4	4
2	Effective working width, m	1	1.2
3	Diameter of driving wheel, cm	60	60
4	Circumference of the driving wheel, m	1.88	1.88
5	Area covered in one revolution of driving wheel, m^2	1.88	2.26
6	Area covered in ten revolutions of driving wheel, m^2	18.80	22.56
7	Weight of sprouted seed collected for ten revolutions of ground wheel, g (dry weight basis)	71.42	75.20
8	Seed rate, kg/ha	37.99	33.33

Paddy when sown at 25 and 30 cm spacing's, its grain yield and certainly yield attributes like panicle weight and test weight were not affected, whereas tillers and panicles were influenced. Maximum tillers of 561/ m^2 and panicles of 509 / m^2 were recorded with 30 cm spacing whereas the tillers of 491/ m^2 and panicles of 440/ m^2 were recorded for 25 cm row spacing. Paddy sown with 30 cm drum seeder recorded grain yield of 5820 kg/ha, which was 4 per cent higher over 5588 kg/ha of 25 cm row spacing. The results of yield and yield attributes of drum seeder for 25 and 30 cm row spacing's were reported in [Table-4].

Table -3- *Machine and operational parameters of drum seeder for 25 and 30 cm spacing's.*

Sl. No.	Observations	Drum seeder spacing, cm	
		25	30
1	Number of rows	4	4
2	Effective working width, m	1	1.2
3	Speed, kmph	0.87	0.83
4	Theoretical field capacity, ha/h	0.09	0.10
5	Area covered, ha	0.0278	0.0278
6	Total time taken, h	0.42	0.37
7	Effective field capacity, ha/h	0.07	0.08
8	Field efficiency, %	77.41	76.16
9	Seed Rate, kg/ha	38.00	33.85

Table- 4-*Yield and yield attributes as influenced by drum seeder for 25 and 30 cm spacing's*

Sl. No.	Observations	Drum seeder spacing, cm	
		25	30
1	Number of hills / m^2	32	27.8
2	Number of tillers/ m^2	491	561
3	Number of panicles/ m^2	440	509
4	Panicle weight, g	2.65	2.33
5	Test weight (1000 seed weight), g	12.23	12.25
6	Grain yield, kg/ha	5588	5820

The highest operating cost was found to be Rs. 1820.79 per ha with 25 cm row spacing whereas the lowest operating cost was found to be Rs. 1598.26 per ha with 30 cm row spacing. The results are presented in [Table-5]. From the results 30 cm row spacing has got more yield and less operating cost which is more economical and suitable for farmers.

Conclusions

Based on the experimental results, the following conclusions are drawn. From the calibration of drum seeder the seed rate of 37.99 and 33.33 kg/ha was achieved with the 25 and 30 cm row spacing's respectively.

The field capacity of 25 cm row spacing was observed that 0.07 kg/ha with the field efficiency of 77.41 per cent at the seed rate of 38 kg/ha whereas the field capacity of 30 cm row spacing was 0.08 ha/h with the field efficiency of 76.16 per cent at the seed rate of 33.85 kg/ha.

Maximum tillers of 561/ m^2 and panicles of 509 / m^2 were recorded with 30 cm spacing whereas the tillers of 491/ m^2 and panicles of 440/ m^2 were recorded for 25 cm row spacing.

Rice sown with 30 cm drum seeder recorded grain yield of 4 per cent higher over 25 cm row spacing.

The highest operating cost was found to be Rs. 1820.79 per ha with 25 cm row spacing whereas the lowest operating cost was found to be Rs. 1598.26 per ha with 30 cm row spacing.

From the results, 30 cm row spacing has got more yield and less operating cost which is more economical and suitable for farmers.

Conflicts of Interest: None declared.

Table- 5- Cost economics of drum seeder for 25 and 30 cm spacing's.

Sl. No.	Observations	Drum seeder spacing,cm	
		25	30
1	Initial cost of drum seeder (C), Rs.	2800	2800
2	Life of the machine (L), years	6	6
3	Working hours per year (H), h	500	500
4	Salvage value (S), Rs.	280	280
5	Depreciation (D), Rs./h	0.84	0.84
6	Interest (I), Rs./h	0.31	0.31
7	Total fixed cost, Rs./ha	17.14	15.07
8	Repairs& maintenance cost, Rs./h	0.28	0.28
9	Wages for operator, Rs./h	18.75	18.75
10	Number of labour required , man-h/ha	14.93	13.13
11	Labour cost, Rs./h	18.75	18.75
12	Seed cost, Rs./ha (Rs.40/kg)	1519.57	1333.33
13	Total variable cost, Rs./ha	1803.66	1583.19
14	Total cost of operation, Rs./h	121.97	121.73
15	Total cost of operation, Rs./ha	1820.79	1598.26

References

[1] Chandima Ratnayake R.M and Balasoriya B.M.C.P. (2013) *American Society of Agricultural and Biological Engineers,* 29(2), 139-147.

[2] Chandrasekhararao C., Jitendranath S. and Murthy T.G.K. (2013) International *Journal of Agriculture and Food Science Technology,* 4(3), 239-246.

[3] Devnani R.S. (2008) Agricultural *Mechanization in Asia, Africa and Latin America,* 39(2), 23-33.

[4] Duraisamy V.M., Senthilkumar T. and Subbalakshmi S. (2011) *Agricultural Mechanizationin Asia, Africa and Latin America,* 42(1), 42-44.

[5] Gill M.S. (2008) *International Journal of Agricultural Sciences,* 78(9), 766-770.

[6] *Hassan Akhgari and Behzad Kaviani(2011) African Journal of Agricultural Research, 6(31), 6492-6498.*

[7] *Manjunatha M.V., Masthana Reddy B.G., Shashidhar S.D and Joshi V.R. (2009) Karnataka Journal of Agricultural Science, 22(2), 385-387.*

[8] *Sahoo P.K., Pradhan S.C and Das D.K. (1994) Agricultural Mechanization in Asia, Africa and Latin America, 25(1), 21-24.*

[9] *Syedul Islam Md. and Desa Ahmad (1999) Pertanika journal science and technology, 7(2), 85-98.*