International Journal of Agricultural Engineering, Vol. 3 No. 2 (October, 2010) : 279 -287

Research Paper :

Performance evaluation of paddy drum seeder

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Accepted : *August, 2010*

ABSTRACT

Direct seeding and transplanting are the two general methods of planting rice. The traditional method followed from many years in Konkan region is transplanting of seedlings raised in nursery. Transplanting method involves seedbed preparation, nursery growing, care of seedlings in nursery, uprooting of seedlings, hauling and transplanting operations. The preparation of seedbed and sowing are done 30 days before planting. The rice farmers practicing transplanting are facing problems like shortage of labour during peak time, hike in labour charges, small and fragmented land holdings etc. direct seeding is becoming increasingly popular now days in India. The wet seeding of rice is generally followed in irrigated areas. For wet drum seeding the paddy seeds are soaked in water for 24 hours and incubated for 24-48 hours. These sprouted seeds are sown in puddled field 1-2 days after puddling using perforated drum seeder. Eight-row paddy seeder is manually operated low cost equipment. Drum seeder can be used in the Konkan region for seeding in both *Kharif* and *Rabi* season with proper irrigation practices. Drum seeder tested was manually operated. The laboratory calibration was carried out with different combinations of drum fills *viz.,* 90, 75, 50 per cent, and travel speed *viz.,* 1 km/h, 1.2 km/h, and 1.5 km/h. From the laboratory calibration test the combination of 75 % drum fill and 1 km/h speed were selected for field evaluation of drum seeder. The drum seeder was tested on puddled field. The theoretical field capacity was calculated as 0.2 ha/h. while effective field capacity of the drum seeder was observed to be 0.11 ha/h. The field efficiency of the seeder was found to be 55 per cent. The cost of operation of drum seeder is Rs. 32.73/- per hour and Rs.297/- per hectare.

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Key words : Paddy seeder, Effective field capacity, Drum fill and field efficiency

The rice plant belongs to the genus *Oryza* of Gramineae family. Out of 24 species of rice only two species *Oryza sativa* and *Oryza glaberrima* are cultivated. Further *sativa* species is grouped in three sub species *viz., indica, japonica, jaanica*. The rice grown in India belongs to Indica sub species. Rice is one of the most important crops of India and occupies 23.3 per cent of gross cropped area of the country. Rice contributes 43 per cent of total grain production and 46 per cent of total cereal production. India has largest area under rice crop and it is about 45 million hectares. The total rice growing area in Maharashtra state is about 1.519 million hectares. Major districts producing rice in western Maharashtra are Thane, Raigad, Ratnagiri and Sindhudurg. The total geographical area of Konkan region is about 3.0746 million hectares. The average annual rainfall of the region is about 3000 millimeters, which contributes about 46 per cent of the total rainfall of Maharashtra. The monsoon starts at late fortnight of May and continues up to the end of October. Therefore, most of farming is done in *Kharif* season. Rice being a tropical and sub-tropical crop requires fairly high temperatures ranging from 30^0 C to 40^0 C. The optimum temperature required is 30^0 C.

Direct seeding and transplanting are the two general methods of planting rice. The traditional method followed from many years in Konkan region is transplanting of seedlings raised in nursery. Transplanting method involves seedbed preparation, nursery growing, care of seedlings in nursery, uprooting of seedlings, hauling and transplanting operations. The preparation of seedbed and sowing are done 30 days before planting. The seedbed area required is about 10 per cent of the main area of the field (Khan and Majid, 1989). The transplanting of paddy at right time is also important parameter. A delay in transplanting by one month reduces the yield of rice by 25 per cent and delay by two months results in 70 per cent reduction in yield (Khan and Majid, 1989). The rice farmers practicing transplanting are facing problem of shortage of labour during peak time, hike in labour charges, small and fragmented land holdings, lack of technical knowledge, non-availability of ample water and other inputs. To tackle all these problems direct seeding of rice has been found most appropriate alternative to transplanting. It not only avoids seedbed preparation, nursery raising and transplanting but also gives better yield than existing manual transplanting. Therefore, direct seeding is

becoming increasingly popular now days in India. The direct seeding is further of two types *viz.,* broadcasting and row seeding by using drum seeder. The direct seeding is grouped in to first, dry seeding *i.e.* dry seeds are directly seeded on the dry soil and second wet seeding *i.e.*, sprouted seeds are sown in puddled field. The wet seeding of rice is generally followed in irrigated areas. For wet drum seeding sprouted seeds, soaked for 24 hours and incubated for 24-48 hours are sown in puddled soils 1-2 days after puddling using perforated drum seeder. Eight-row paddy seeder is manually operated low cost equipment and it is simple in construction. Drum seeder can be used in the Konkan region for seeding in both *Kharif* and *Rabi* season with proper irrigation practices. The advantage of drum seeder is that row-to row spacing can be easily maintained and dropping of seeds in hills is possible. Lack of labour during peak periods of transplanting may cause delay in the operations. In such situations, the drum seeder is an effective mean for timely sowing of rice. Also directly seeded rice may mature 7 to 10 days earlier than transplanted rice (Subbaiah *et al.*, 2002). This saving of time is important where multiple cropping patterns are followed. The objectives of study are as follows : to evaluate field performance of drum seeder and to study cost economics of drum seeding.

METHODOLOGY

Most of the drum seeders available have cylindrical shaped drum. The drum seeder tested in the present study has drum of hyperboloid shape. This enables free flow of seeds towards the metering holes. Holes are drilled on the two flat ends of the drum at 20 cm intervals. A lid with lock is provided for filling the drum with sprouted seeds. The shaft is of square in cross section. The length of the shaft can be adjusted to accommodate two or four drums for sowing four or eight rows. The drums and wheels are assembled on the shaft and held in position by means of screws. The swinging handle is provided with the unit for pulling the seeder in puddled field.

Specifications of paddy drum seeder:

Following are the specifications of drum seeder which were tested before test (Table 1a, 1b, 1c and 1d).

Table 1a : General specifications of Paddy Drum Seeder

1.	Model	Aishwarya
2.	Manufacturer's address	K.S.N.M. Marketing, Hall mark, 320N NSR Road, Saibaba Colony, Coimbtore-641 011
3.	Power transmission	Ground wheel
4.	Power source	Single labours

Table 1 b : Specifications of drum

Sr. No.	Particulars	Specifications
1.	Material of construction	Polypropylene copolymer sheet of thickness 2.5 mm
2.	Number of drums	4
3.	Shape of drums	Hyperboloid
4.	Drum diameter (outer), cm	20.0
5.	Drum diameter (middle), cm	16.23

Table 1c : Specifications holes of drum

Sr. No.	Particulars	Specifications
1.	Number of holes on single row of drums	18
2.	Average diameter of the holes (cm)	1
3.	Peripheral spacing between two holes (cm)	3.7
4.	Shape of holes	Circular

Table 1d : Specifications ground wheel

Sr. No.	Particulars	Specifications
1	Material of construction	Plastic
2.	Type of wheel	Lugged ground wheels
3.	Diameter of wheel (cm)	60
4.	Spacing between two consecutive lugs (cm)	8
5.	Average width of wheel (cm)	7.5

Parts of seeder:

Location of laboratory test and field test:

Laboratory calibration of the paddy drum seeder was carried out at Department of Farm Machinery and Power, College of Agricultural Engineering and Technology, Dapoli and Field performance test was carried out at Department of Agronomy, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli.

Experimental procedure:

Laboratory test and field test of the paddy drum seeder were carried out as per the procedure given in RNAM test code. The variety used for the calibration of seeder was Palghar-1.The agronomical specifications of

the variety is as follows,

- Seed rate for direct sowing- 80 kg/ha
- Duration of maturation -125-130 days
- Yield - 55-60 quintal/ha
- Plant spacing- 20 x 15 cm.
- Thousand grain weight -12.75 g.

Preparation of pre-germinated seeds:

Seed preparation for wet seeding, the salt was mixed with water in the proportion of 1:10 (*i.e.* 100 g salt with 1 liter of water). Seeds were then soaked in salted water in bucket. After one hour lighter seeds and other impurities floating on the water were removed. Seeds were kept in the water for 24 hours. After 24 hours excess water in bucket was drained out. The soaked seeds were placed in gunny bags and kept for incubation for next 24 hours. Length of sprout expected to be 1 to 2 mm. The sprout lengths more than this limit will result in intervening of roots and prevent free flow of seeds through the holes of the drums. For increasing the temperature during the incubation, gunny bags were kept surrounded by paddy straw.

Laboratory calibration test:

For the calibration, handle of the seeder was first dismantled and seeder was jacked up on the stand. This facilitated the rotation of the ground wheel along with the drums on the stand. Gunny bags were kept under each drum to collect the seeds being dropped. Drums were filled with sprouted seeds up to 90 per cent fill. Ground wheel was revolved for travel speed of 1 km/h. Seeds collected on gunny bags after 50 revolutions of ground wheel were weighed. The process of revolving the ground wheel for 50 revolutions and weighing collected seeds was continued from 90 per cent to 25 per cent drum fill .For the same drum fill *i.e.* 90 per cent, the seeder was tested for 1.2 km/h and 1.5 km/h. Similar observations were taken for 75 per cent and 50 per cent drum fill and for three travel speeds. From the observations the graph of distance travelled vs. seed rate for each drum fill (90%, 75%, 50%) were drawn and appropriate percentage fill and travel speed of the seeder was selected for the field test. Observations were recorded and the graphs were plotted.

Field test:

Prior to the start of field test, size and area of plot were measured. Field was prepared by ploughing, puddling and leveling. According to the area of field and variety of paddy chosen for the test, quantity of the seeds required was calculated and pre-germinated seeds were prepared. After puddling, the field was allowed to settle for the one day. Water was drained off from the field just before the operation of the seeder. The plot was divided into three parts for uniform distribution of water and ensuring the straight travel of the seeder during seeding operation.

Pre-germinated seeds were filled in the drums by closing holes to reduce the seed loss during filling of drums. After drum filling was completed the holes were opened and the seeder was operated in the field. The time required for operation of seeder, drum filling, and for shifting of seeder during operation was recorded simultaneously.

Field evaluation of seeder:

The following parameters were measured during field test,

Effective field capacity:

The effective field capacity is the ratio of total area covered in hectares to the total time required for field operation in hours.

$$\text{E.F.C.} = \frac{A}{Tp + Te}$$

where,

E.F.C. =Effective field capacity, ha / h.

A= Area, ha

Tp= Productive time, h.

Te= Time loss, h.

Time required for each pass was measured with stopwatch to get the productive time and time required for filling the drum, shifting of seeder was measured as total time loss.

Theoretical field capacity:

Theoretical field capacity is the area covered by implement at its rated width and rated speed.

$$\text{T.F.C.} = \frac{W \times S}{10}$$

where,

T.F.C. = Theoretical field capacity, ha /h

W= Width of implement, m

S = Speed of operation, km/h.

Field efficiency:

Field efficiency is the ratio of effective field capacity and theoretical capacity.

$$\text{F.E.} = \frac{\text{E.F.C.}}{\text{T.F.C}} \text{x} 100$$

where,

F.E = Field efficiency, per cent
E.F.C.= Effective field capacity, ha/h
T.F.C.= Theoretical field capacity ha/h

Number of hills per square meter:

The frame of one-meter square area was made. The frame was randomly placed in each sub plot and numbers of hills in the frame area were counted.

Row spacing:

By using the same one-meter square frame row-to-row spacing was measured in each sub plot.

Number of seeds per hill:

By using the same one-meter square frame number of seeds per hill were measured in each sub plot.

Average hill-to-hill distance:

By using the same one-meter square frame hill to hill distance was measured in each sub plot.

Cost of operation:

The cost of operation of paddy drum seeder was calculated per hour as well as per hectare basis. The cost was found out by following method;

Fixed cost:

It includes,

$$\text{Depreciation} = \frac{C - S}{L \times H}$$

$$\text{Interest} = (C + S) \times \frac{i}{L \times H}$$

where,
C = Cost of seeder, Rs.
S = Salvage value (10 % of initial cost), Rs.
i = interest rate, (10% per cent)
L = Life of seeder, 7 years
H = annual use of seeder, 300 hours

Housing rate @ 1.5 % of initial cost
Fixed cost = sum of 1 to 3

Variable cost:

In this consider following costs,

- Repair and maintenance @ 6% of total cost
- Operator cost per day = Rs.68 /-
- Total variable cost = Repair and maintenance cost + operator's cost

Total costs = Fixed cost per hour + variable cost per hour

RESULTS AND DISCUSSION

The implement is used for sowing pre-germinated paddy seeds (24 hrs soaking +24 hrs incubation). The sprouted seeds are filled in the drums of seeder and single person pulls the seeder in the field. A laboratory calibration as well as field test was included in the testing of seeder. The laboratory calibration was performed to check the constant seed rate under given distance travelled and to select the travel speed of drum seeder in puddled field. The field performance test was carried out for the field capacity, field efficiency etc. in puddled field.

Laboratory calibration:

The laboratory calibration of seeder at three different speeds and three different drum fill was performed to check the constant seed rate under given distance travelled and to select the walking speed for pulling seeder under field condition. The seeder was calibrated for three different speeds *viz.,* 1km/h, 1.2km/h, 1.5 km/h and for initial drum fill percentage from 90%, 75%, 50% to 25 %. The seeds collected after each fifty revolutions were weighed. The observations were tabulated. From the observations the graphs of distance travelled (m) vs. seed rate (sprouted seeds, kg/ha) for each percentage drum fill were drawn. The graphs are shown in Fig. 1 to 9. The nature of the graphs has been discussed as follows,

The Fig. 1 of seed rate (kg/ha) vs. distance travelled (m) shows that, the seed rate was nearly constant for initial 282.75 m distance-travelled .For the next successive points *i.e.* up to 942.48 m distance travelled seed rate was observed increasing continuously. For the distance travelled from 94.24 m to 942.48 m, the variation in the seed rate was found to be 24.54 kg/ha.

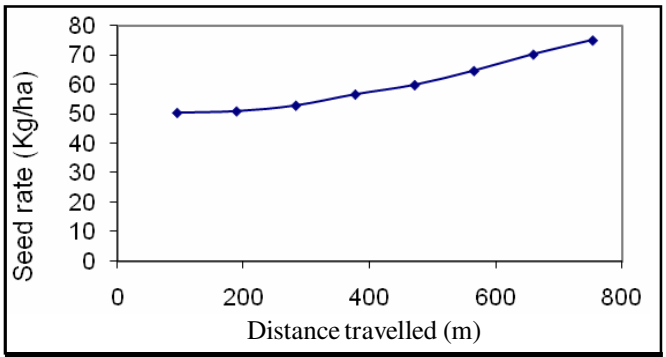

Fig. 1 : Variation of seed rate with distance travelled at 90 % drum fill and 1 km/h travel speed

Fig. 2 shows that up to initial 188.5 m distance travelled the seed rate was nearly constant; for next 565.5 m distance travelled the seed rate was increasing continuously. For next 282.75 m travelled the seed rate

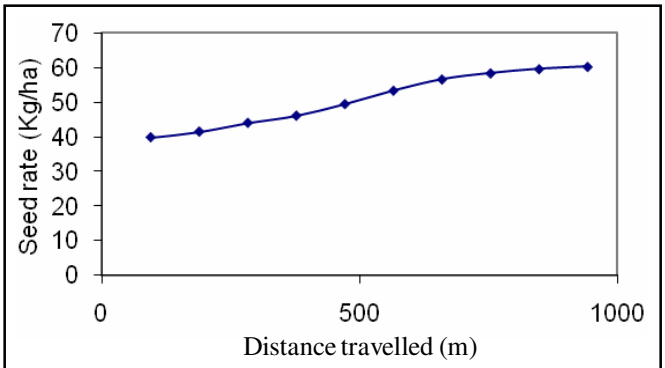

Fig. 2 : Variation of seed rate with distance travelled at 90% drum fill and 1.2 km/h travel speed

was again found to be constant. For the distance travelled from 94.24 m to 942.48 m, the variation in the seed rate was found to be 23.08 kg/ha.

Fig. 3 shows that seed rate up to first 188.5 m distance travelled, was constant. For the next 188.5 m distance travelled it was increased. Again for next 188.5 m distance it was decreased and for further 377.0 m distance travelled seed rate was found to be increased continuously. For the distance travelled from 94.24 m to 942.48 m, the variation in the seed rate was found to be 16.69 kg/ha.

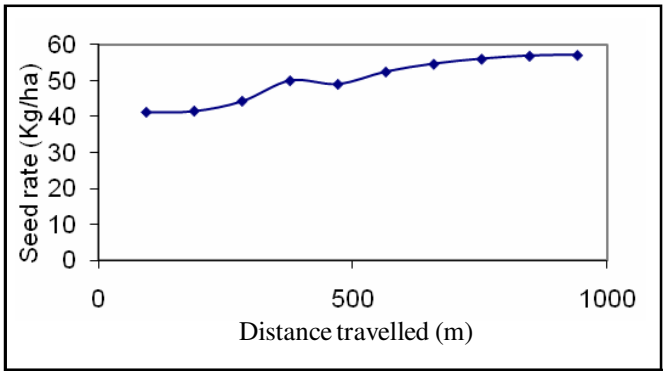

Fig. 3 : Variation of seed rate with distance travelled at 90% drum fill and 1.5 km/h travel speed

Fig. 4 shows that seed rate was observed continuously increasing as distance travelled was increased. Also the variation of seed rate for each 50 revolutions of drum *i.e.* 94.24 m distance travelled was found to be less (2.23 kg/ha) as compared to the other graphs. For the distance travelled from 94.24 m to 754 m, the variation in the seed rate was found to be 21.44 kg/ha.

In this Fig. 5 up to 188.5 m distance travelled, seed rate was found to be nearly constant. For the next 471.23 m distance travelled it was increasing continuously and for further 94.24 m distance travelled it was constant.

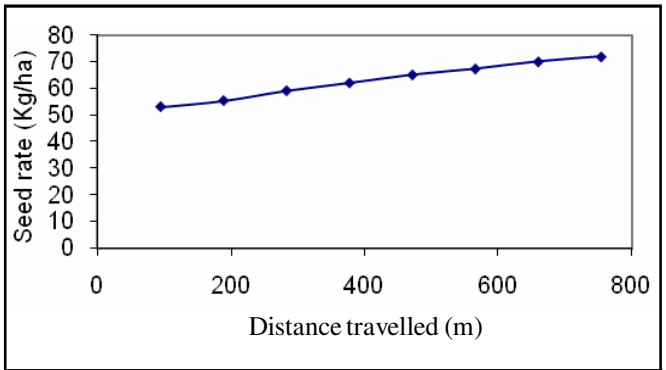

Fig. 4 : Variation of seed rate with distance travelled at 75% drum fill and 1km/h travel speed

For the distance travelled from 94.24 m to 754 m, the variation in the seed rate was found to be 24.77 kg/ha.

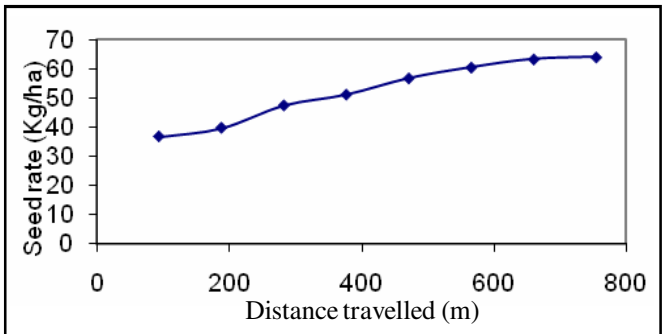

Fig. 5 : Variation of seed rate with distance travelled at 75% drum fill and 1.2 km/h travel speed

Fig. 6 shows that the drastic change in the seed rate for 188.5 m distance travelled. Then next 565.5 m distance travelled the seed rate was increased continuously. For the distance travelled from 94.24 m to 754 m, the variation in the seed rate was found to be 29.28 kg/ha.

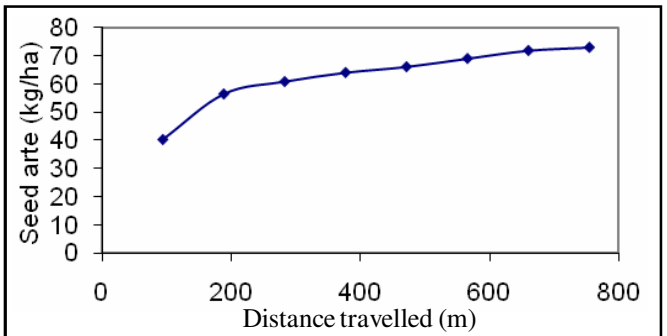

Fig. 6 : Variation of seed rate with distance travelled at 75% drum fill and 1.5 km/h travel speed

Fig. 7 shows that the seed rate was found constantly increasing and average variation in seed rate was also less. But it was for less distance travelled as compared

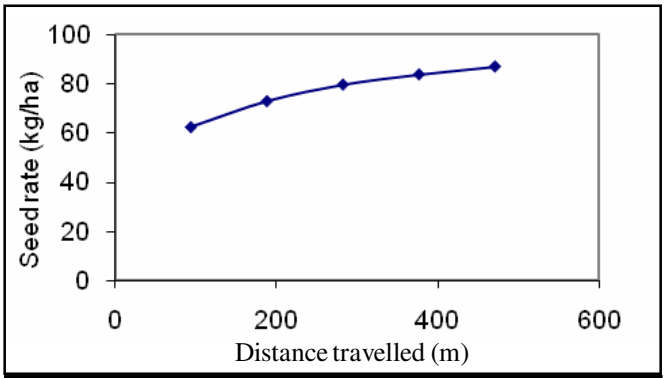

Fig. 7 : Variation of seed rate with distance travelled at 50 % drum fill and 1km/h travel speed

to 90% and 75% drum fill. For the distance travelled from 94.24 m to 377 m, the variation in the seed rate was found to be 23.81 kg/ha

Fig. 8 shows that least variation in seed rate was observed for 377.0 m distance travelled and it was 17.06 kg/ha but it was for less distance travelled.

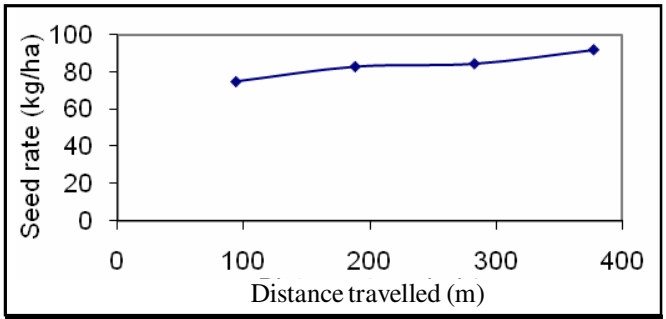

Fig. 8 : Variation of seed rate with distance travelled for 50% drum fill and 1.2 km/h travel speed

Fig. 9 shows that continuous increase in seed rate also the variation in seed rate from 94.24 m to 377.0 m distance travelled was found to be 12.95 kg/ha.

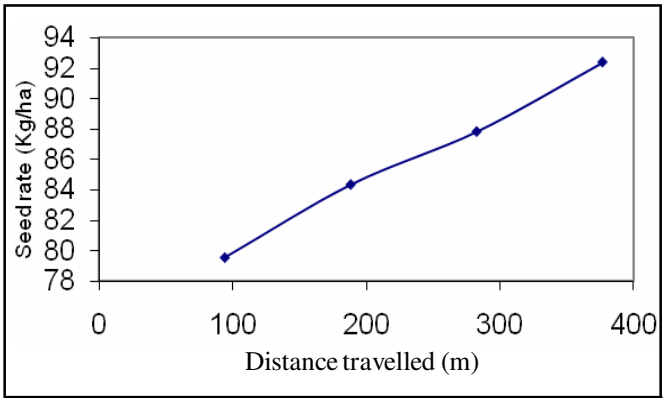

Fig. 9 : Variation of seed rate with distance travelled at drum fill 50% and speed 1.5 km/h

Comparative variation in seed rate with drum fill and travel speed:

Speed 1 km/h:

Fig. 10 shows that seed rate varied with same trend for both 90 per cent and 75 per cent drum fill at 1 km/h speed. But average seed rate obtained with 75 per cent drum fill and 1 km/h speed was 62.2 kg/ha that was higher than average seed rate obtained with combination of 90 per cent drum fill and 1 km/h speed *i.e.* 59.95 kg/ha. Average seed rate for 50 per cent was 77.56 kg/ha that was higher than other two combinations. But it was for less distance travelled *i.e.* 471.25 m. Other two combinations gave average seed rate value for 754 m distance travelled. Also seed rate variation after each successive 50 revolutions for 90, 75 and 50 per cent drum fill and at 1 km/h speed was 3.29, 2.95 and 5.94 kg/ha, respectively.

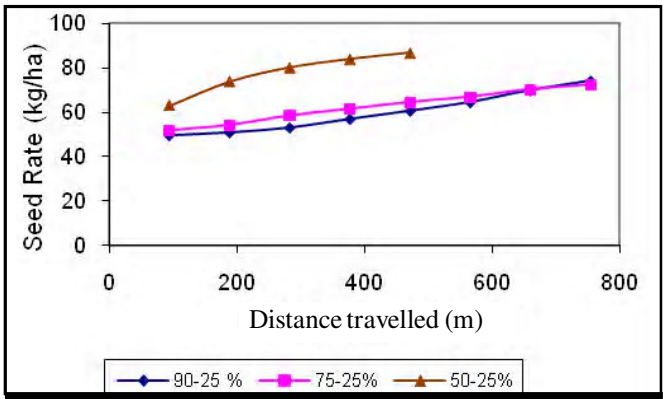

Fig. 10 : Variation in seed rate at speed 1 km/h and three drum fills (90%, 75%, and 50%)

Speed 1.2 km/h:

Fig. 11 shows that seed rate varied with same trend for both 90 per cent and 75 per cent drum fill at 1.2 km/h speed. But distance travelled for combination of 90 per

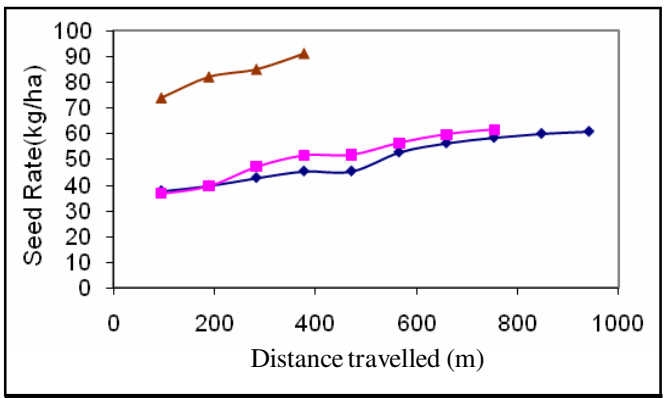

Fig. 11 : Variation in seed rate at speed 1.2 km/h and three drum fills (90, 75, 50% to 25 %)

cent fill and 1.2 km/h was higher *i.e.* 942.48 m as compared to 75 per cent and 1.2 km/h *i.e.* 754 m distance travelled. Average seed rate obtained with 75 per cent drum fill and 1.2 km/h speed was 52.1 kg/ha that was higher than average seed rate obtained with combination of 90 per cent drum fill and 1.2 km/h speed *i.e.* 50.2 kg/ ha. Average seed rate for 50 per cent was 83.09 kg/ha that was higher than other two combinations. But it was for less distance travelled *i.e.* 377 m. Also seed rate variation after each successive 50 revolutions for 90, 75 and 50 per cent drum fill and at 1.2 km/h speed was 2.58, 3.54 and 5.09 kg/ ha, respectively.

Speed 1.5 km/h:

Fig. 12 shows that for 75 per cent drum fill and 1.5 km/h speed there was drastic variation in seed rate for initial 95 m distance for further distances both graphs of 90 and 75 per cent drum fill at 1.5 km/h speed shows same trend. Average seed rate with 75 per cent fill was 63.46 kg/ha and for 90 per cent it was 50.3 kg/ha at 1.5 km/h. Average seed rate for 50 per cent was 86.37 kg/ha that was higher than other two combinations. But it was for less distance travelled *i.e.* 377 m. Also seed rate variation after each successive 50 revolutions for 90, 75 and 50 per cent drum fill and at 1.5 km/h speed was 1.84, 4.18 and 4.32 kg/ ha, respectively.

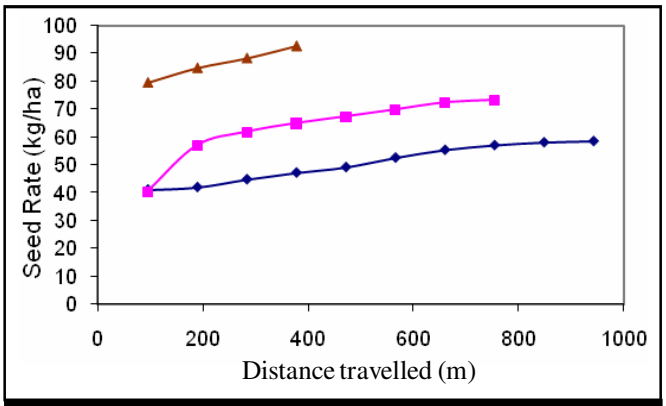

Fig. 12 : Variation in seed rate at speed 1.5 km/h and three drum fills (90%, 75%, and 50%)

Selection of suitable drum fill and travel speed:

From the laboratory calibration test, the combination of 75 % drum fill and 1 km/h speed were selected (Table 2 and 3).

From the Table 2 it is seen that the average seed rate for 90 % drum fill for all drum speed is less than the required. For 75% drum fill, the average seed rate is higher than that of 90 % drum fill but less than the required seed rate. For 50% drum fill, the seed rate approximately equal to the required seed rate. From Table 3 it can be seen that the change in seed rate for distance travelled is higher for 50% drum fill. The combination of 75% drum fill with operating speed of 1 km/h was selected though, the change in seed rate at 90% drum fill and 1.2 km/h speed and at 1.5 km/h speed is less. Because at 75% drum fill and 1 km/h speed average seed rate achieved is higher than the 90 % drum fill.

Table 2 : Average seed rate (sprouted seeds, kg/ha) for different drum fill and travel speed

Speed (km/h)	Drum fill (%)		
	90-25	75-25	50-25
1	59.95	62.2	77.56
1.2	50.2	52.1	83.09
1.5	50.3	63.46	86.37

Table 3 : Change in seed rate (kg /ha) for each successive 50 revolutions (94.24 m linear distance)

Speed (km/h)	Drum fill (%)		
	90-25	75-25	50-25
1	3.29	2.95	5.95
1.2	2.58	3.54	5.09
1.5	1.84	4.18	4.32

For 75% drum fill and 1 km /h speed to cover 1ha.area refilling of drums required to be done 13 times whereas this value in case of 50% drum fill and 1.2,1.5 km /hr speed it was 26 times, respectively. Hence for 50% drum fill more refilling is required to be done than 75 % drum fill, which will result in increase in unproductive time.

Field performance test:

The field capacity, field efficiency of paddy drum seeder was found for the field test .The field was prepared by ploughing, leveling, puddling with proper stagnation of water. The water was drained from the test field just before start of testing. The pre-germinated seeds were filled in the drums and the seeder was operated in the puddle field condition. The combination of 75% drum fill and 1 km/h travel speed was used for field test of seeder

Field capacity and field efficiency:

The effective field capacity was determined as the ratio of area covered and actual time required for the operation of seeder in the field as well as the time lost in the refilling of drums and turning the seeder (productive time + time loss). The theoretical field capacity was calculated from travelled speed and the actual working width. The field efficiency was calculated by taking the ratio of effective field capacity and theoretical field

Table 4 : Test conditions at site 1, 2 and 3

Sr. No.	Particulars	Site 1	Site 2	Site3
1.	Location of field	Agronomy farm	Agronomy farm	Agronomy farm
2.	Length of field, meter	18.13	18.13	18.13
3.	Width of field, meter	22.0	22.0	22.0
4.	Area of field, sq. meter	398.86	398.86	398.86
5.	Type of soil	Laterite and sandy loam	Laterite and sandy loam	Laterite and sandy loam
6.	Field preparation	Ploughing with M.B.plough, puddling and leveling	Ploughing with M.B. plough, puddling and leveling	Ploughing with M.B. plough, puddling and leveling

Table 5 : Field performance of paddy drum seeder

Sr. No.	Particulars	Plot 1	Plot 2	Plot 3
1.	Actual operating time, min.	22	20.75	21
2.	Actual area covered, ha	0.03989	0.03989	0.03989
3.	Traveled speed, km/h	1	1	1
4.	Effective field capacity, ha/h	0.108	0.11	0.112
5.	Theoretical field capacity, ha/h	0.2	0.2	0.2
6.	Field efficiency, per cent	54	55	56
7.	Total number of passes of seeder	9	9	9
8.	Average hill to hill distance, cm	14.2	14.0	14.5
9.	Average row to row distance, cm	22.5	21.5	22
10.	Average number of seeds dropped per hill	7	5	7

capacity.

The effective field capacity and field efficiency of paddy drum seeder at plot 1,2 and 3 were determined and are presented in Table 5. The data presented in Table 5 shows that the theoretical field capacity at all three sites was same and was 0.2 ha/h. The effective field capacity at plot – 1 was 0.108 ha/h and field efficiency was observed to be 54 %. Similarly the effective field capacities at plot 2 and 3 were 0.110 ha/h and 0.112 ha/h, respectively. The field efficiencies at plot 2 and 3 were observed to be 55 % and 56 %. The average effective field capacity was 0.11 ha/h and the average field efficiency at the test plot was 55 %.

During field test the effective field capacity was found lower. It was observed during operation of the drum seeder in the field that, out of the total time required, 34 % time was unproductive. This time was required for refilling of all the drums and for turning. This ultimately resulted in reducing the field efficiency of the drum seeder.

In the field test, the drum seeder was operated with 75 % drum fill and 1km /h travel speed. The actual seed rate during the field test observed was 84 kg /ha. Whereas in the laboratory test for the same drum fill and travel speed, it was 62.2 kg /ha. This increase in the seed rate in the field was may be due to jerks to the drum seeder resulting from uneven pulling of implement in the field.

Cost analysis:

The cost operation of eight row paddy drum seeder was worked out for a given test condition. Cost of operation was found to be Rs. 32.73 per hour which is Rs.297.00 /- per hectare.

Conclusion:

– Combination of 75 % drum fill and 1km/h was found to be suitable for operating the seeder in the field.

– Soaking of seeds for 24 hours and incubation of seeds for 24 hours was resulted in increase in seed weight by 5.04 per cent.

– The recommended seed rate for the variety under test *i.e.* Palghar-1 was 80 kg/ha for direct seeding. From laboratory calibration the drum fill of 75 % and operating speed of 1 km/h were found to give the average seed rate of 62.2 kg/ha for pre-germinated seeds. Actually in the field the seed rate observed was 84 kg/ha. The seed rate was found to be increasing during actual field operation, this was may be due to jerks to the drum seeder resulting from uneven pulling of implement in the field.

– The seed rate observed in the field for pre-germinated seeds is 84 kg/ha, as the increase in the weight

of paddy seeds after pre-germination was 5.04 %, for dry seeds the seed rate becomes 79.80 kg /ha. This seed rate is almost equal to the recommended seed rate for the variety under test.

– From the field performance test it was found that average number of seeds dropped per hill was 7. Hill to hill distance was 14.7 centimeter and row-to-row distance was 22 centimeter. Average number of hills per square meter was 30.

– The effective field capacity of the drum seeder was observed to be 0.11 ha/h and theoretical field capacity was 0.2 ha/h. The field efficiency of the seeder was found to be 55 per cent.

– The cost of operation of the drum seeder worked out to be Rs.32.73 per hour, which is Rs.297.00 per hectare.

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