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"Performance Evaluation of Manually Operated Paddy Drum Seeder in Puddled field."

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Abstract: *Direct seeding and transplanting are the two methods of planting rice. The traditional method followed by many years in Allahabad district is transplanting of seeding raised in nursery. Transplanting method involves seedbed preparation, nursery growing, care of seeding in nursery, uprooting of seeding, 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 puddle field 1-2 days after paddling using perforated drum seeder. Eight row paddy seeder is manually drawn low cost equipment. Direct paddy drum seeder tested was manually drawn. The laboratory calibration was carried out with different combinations of drum fill level viz., full, half, quarter, and travel speed viz., 1 km/h, 1.5 km/h and 2 km/h. From the laboratory calibration test the combination of half drum fill level and 1 km/h speed were selected for field evaluation of drum seeder. The drum seeder was tested on puddle field. The theoretical field capacity 0.16 ha/h. While effective field capacity of the drum seeder was observed to be 0.131ha/h. The field efficiency of the seeder was found to be 82.08 percent. The number of seeds dropped per hill was 5. The hill to hill spacing was 14.5 cm. The number of hills per square m was 30. The hill missing was 5.8 percent. The cost of operation of drum seeding is Rs. 42.67 per hour and Rs. 341.36 per ha.*

I. Introduction

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. Rice one of the most important crops of India and occupies 23.3% of gross cropped area of the country. Rice contributes 43% of total grain production and 46% of total cereal production. India has largest area under rice crop and it is about 45 million hectares. The total rice growing area in Uttar Pradesh state is about 5.90 million hectares. Rice is grown in all the 72 districts of Uttar Pradesh with low to high acreage. The monsoon starts at late fortnight of June and continues up to the end of November. Therefore most of farming done Kharif season. Rice being a tropical and sub-tropical crop requires farily high temperature ranging from 30°C to 40°C. The optimum temperature required is 30°C.

Direct seeding and transplanting are the two methods of planting rice. The traditional method followed from many years in Allahabad 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 preparations of seedbed sowing are done 30 days before planting. The seedbed area required is about 10 percent of 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 percent and delay by two months results in 70 percent reduction in yield (Khan and Majid 1989). The rice farmers practicing transplanting are facing problem of storage 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 the puddle 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 the puddled soils 1-2 days after paddling 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 Allahabad region for seeding in Kharif and Rabi season with proper irrigation practices.

II. Advantages And Limitations Of Direct Wet Seeding

The advantage of drum seeder is that row-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.

Limitations

- Precision levelling and water management is a must.
- Uneven emergence of rice seeding.
- Weed management is very difficult.

III. Materials And Methods

The present study on, **"performance evaluation of manually operated paddy drum seeder in puddled field"**, was conducted. The following steps and procedures were adopted to achieve the objectives of the study.

3.1 Location of the study.
3.2 Constructional details and working principle of the machine.
3.3 Preparation of paddy seeds for direct sowing.
3.4 Calibration of the direct paddy drum seeder.
3.5 Experimental details.
3.6 Field performance evaluation.
3.7 Variables and their measurement.
3.8 Cost of operation.

3.1 Location of study

The laboratory calibration of the direct paddy drum seeder was carried out at Department of Farm Machinery and Power, Vaugh School of Agricultural Engineering and Technology, Sam Higginbotham Institute of Agriculture, Technology and Sciences (Formerly Allahabad Agricultural Institute) Deemed University, Allahabad, Uttar Pradesh.

The field testing of direct paddy drum seeder was carried out at farmer's field at village Mohabbatganj, chaka Block of Allahabad District during kharif season.

3.2 Constructional Details and Working Principle of the Machine

Direct paddy seeder is one of the revolutionary equipments that changed the face of sowing paddy seeds in wetland field. Direct paddy drum seeder has eliminated the need of transplantation and hours of manual work which will literally break the back of the farmers involved in sowing the paddy seeds to the field. At one stretch with single operator effort, it covers 8 rows of 20 cm row to row spacing at a time. Made up of plastic material, which makes it easy.

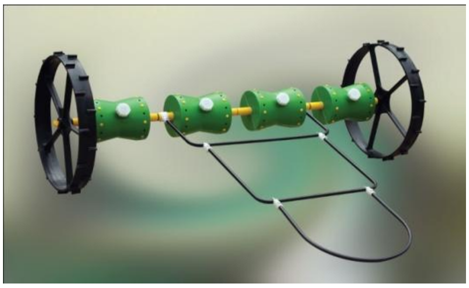

Plate. 3.1 Complete view of direct paddy drum seeder

3.2.1 Parts of Drum Seeder:

1. Seed drum
2. Baffles
3. Ground wheel
4. Handle base and handle

3.2.1.1 Seed Drum
The seed drum is hyperboloid shaped with 200 mm diameter. There are 8 number of seeding metering holes of 9mm diameter hole.
3.2.1.2 Baffles
Baffles are provided inside the seed drum between the seed holes to ensure the uniform seed rate in operation as well as to ensure hill dropping of the seeds.
3.2.1.3 Wheel Ground
Wheels are provided at both ends. These wheels are made up of plastic material to provide floating characteristics. Wheel diameter is 2 feet.
3.2.1.4 Handle Base and Handle
One square shaft, handle base and handle. Four seed drums are assemble together with the square shaft. The handle if meant to pull along.

Table No.3.1 Specification of direct paddy drum seeder

General specifications of paddy drum seeder		
Sr. No.	Particular	Specifications
1	Model	Aishwarya
2	Manufacturer's Address	K.S.N.M. marketing, Hall mark, 320N NSR Road, Saibaba Colony, Coimbtore -641011
3	Power transmission	Ground wheel
4	Power source	Single labours

Specifications of drum		
Sr. No.	Particulars	Specifications
1	Material of construction	Polypropylene copolymer sheet of thickness 2.5mm
2	Number of drums	4
3	Shape of drum	Hyperboloid
4	Drum diameter(outer), cm	20.00
5	Drum diameter(middle), cm	16.25

Specifications of holes of drum		
Sr. No.	Particulars	Specifications
1	Number of holes on one side of drum	8
2	Average diameter of holes, mm	9
3	Peripheral spacing between two holes, mm	60
4	Shape of holes	Circular
5	Number of rows per drum	2
6	Spacing between two rows in a drum, mm	200

Specifications of ground wheel		
Sr. No.	Particulars	Specifications
1	Material of construction	Plastic
2	Type of wheel	Lugged ground wheels
3	Diameter of wheel, mm	600
4	Spacing between two consecutive lugs, mm	80
5	Average width of wheel, mm	75

3.3 Preparation of Pre-germinated Paddy Seeds
Seed preparation for wet seeding, the salt was mixed with water in the proportion of 1:10 (i.e. 100 g salt with 1liter 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 next 24 hours. Length of sprout expected to be 1mm to 2mm. The sprout lengths more than this limit will result in intervening of root 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.

Plate 3.2 Paddy seed preparation

3.4 Calibration of Direct Paddy Drum Seeder

The procedure of testing direct paddy drum seeder for correct seed rate is called calibration of direct paddy drum seeder. It is necessary to calibrate the direct paddy drum seeder before putting it in the field for actual use to find the desired seed rate with other parameters.(RNAM & BIS test code).

3.4.1.1 Metering Test

To determine the seed rates obtainable at different speed of travel and drum fill percentage. The series of test full, half, quarter capacity of the drum were conducted. The step by step procedure was as follows:

1. Determine the nominal width of coverage of paddy drum seeder. The nominal width is equal to the multiplication of the number of openings and the spacing between the openings.
2. Find the length of strip, having the nominal width as determine in (1) above, necessary to make one hectare.
3. Determine the number of revolutions the ground wheel has to make to cover the length of the strip determined in (2) above. It is recommended that this should be done by actually operating the paddy drum seeder in the same field and soil conditions as will be used for field operation test. Count the number of revolutions in a given distance, say, 100 meters. A 60 cm diameter wheel will probably make about 53 revolutions in 100 meters.
4. From the value found in (3) above, select a number of revolutions of the ground wheel to cover a convenient fraction of a hectare, say, 1/25. A drum seeder having a nominal width of 1 m and ground wheel diameter of 60 cm will require about 212 revolutions to cover 1/25 hectare.
5. Calculate revolutions per minute of ground wheel in case of manually drawn seeder and revolutions per minute of metering device in case of tractor drawn seeding machine. The travelling speed for manually operated paddy drum seeder should be 1km/hr and for tractor drawn seeding machine the speed should be 3 and 5 km/hr. A 60 cm diameter ground wheel makes about 9 revolutions per minute when travelling at a speed of 1 km/hr.
6. Practise running the drum seeder at the speed calculated in (5) above, if running has to be done manually for manually drawn direct paddy drum seeder.
7. Select the pre germinated paddy seeds and place seeds in the drum. Either in static position with drive wheel above the ground turn drive wheel 50 turns and collect seed from outlets of the every drum.
8. Weigh the quantity of seeds collected from each drum and calculate the seed rate kg/ha.
9. Repeat the process at least three times.

Calculation

1. Effective width of direct paddy drum seeder

W=N x S

Where, N=No .of seed openings as rows

S=Spacing between two adjacent rows

2. Longitudinal distance to cover one hectare=10000/W

3. Longitudinal distance to cover $1/100^{th}$ of ha, in m

$$= \frac{10000 \times 1}{W \times 100} = \frac{100}{W}$$

4. Suppose the drive wheel of diameter D makes N number of revolution to cover 100/w, m

Therefore, $N = \frac{100}{\pi \times D \times W}$

5. Seed rate (kg/ha) $= \frac{w \times 10}{A}$

Where, **w** is weight of collected seeds in grams and A is the area in m^2 covered by the direct paddy drum seeder,

$A = Distance\ traveled \times Width\ of\ machine$

3.4.1.2 Uniformity of seeding

Carry out the following test to ensure the uniformity seeding device of the direct paddy drum seeder.

1. Sticky Belt Method
2. Sand Bed Method

Uniformity of seed spacing is the manner of placing of seeds. The uniformity of seed distribution is checked as; a bed of polythene measuring 15m x1.6cm was spread on the hard surface. The polythene was coated with white grease that helps in striking of seeds without rolling or bouncing on the bed surface. Direct paddy drum seeder was manually operated forward maintaining the speed of 1, 1.5 and 2 km/h. The seed metering system of the direct paddy drum seeder was set to place the pre germinated paddy seeds. Seed spacing of 100 -100 seeds of pre germinated paddy were measured on the sticky bed to estimate the performance indices and to check the dropping pattern. The test was replicated three times.

Performance parameters for the direct paddy drum seeder

The International Organization for Standardization (1984), define a number of measures for the assessment of the precision planter on the base of theoretical spacing, misses and multiples of seed. Theoretical spacing is the distance between seeds or plants assuming that there were no skips, multiples or variability and is based on recommended seed spacing for particular crop. Since the seed spacing and standard deviation do not help to access the actual performance of precision planter (Kachman and Smith, 1995, planning et. al., 2000), the data were statically analyzed to determine the effect of tilt angle of cup and forward speed of planter on performance indices namely mean seed spacing, misses index, multiple index quality of feed index and precision in spacing. Theses indices were calculated as;

(A) **Miss index**

Miss index (M) is the percentage of spacing greater than 1.5 times the set spacing (X),

$$M\ (\%) = \frac{n_1}{N}$$

Where n_1= Number of spacing>1.5X, N=Total number of spacing measured.

(B) **Multiple index**

The multiple index (D) is the percentage of spacing that are less than or equal to half of the set spacing (X),

$$D\ (\%) = \frac{n_2}{N}$$

Where n_2=Number of spacing $\leq$ X.

(C) **Quality of feed index**

The quality of feed index (A) is the percentage of spacing that are more than half but not more than 1.5 times of the set spacing. The quality of feed index is an alternate way to present the performance as a result of combined effect of misses and multiples.

Quality of feed index, (%) =100-(miss index + multiple index).

Plate 3.6 Hill dropping pattern of direct paddy drum seeder

3.4.2 Field Test

Prior to the start of field test, size and area of plot were measured. Field was prepared by ploughing, paddling and levelling. According to the area of field and variety of paddy chosen for the test, quantity of the seeds recurred was calculated and pre geminated seeds were prepared. After paddling, 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 in to three parts are uniform distribution of water and ensuring the straight travel of the seeder during seeding operation.

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

Field test was done manually in well prepared puddled field. The puddled field for the testing of manually drawn direct paddy drum seeder was prepared with the help of tractor. Field evaluation of the manually drawn direct paddy drum seeder having hyperboloid drum type metering system was conducted under the sandy loam soil with pre germinated paddy seeds. Row to row distance was fixed 20 cm for pre germinated paddy seeds. Spacing between hills was measured randomly 15 m at three locations. The observation was statically analyzed and compared with the laboratory test result. The paddy drum seeder was operated in the field to test the following;

3.5 Experimental Details

Sr. No.	Particulars	Details
1	Methods of seeding	Drum seeding
2	Crop and variety	Paddy and kirtiman Heena
3	Locations	Vill- Mohabbatganj, Block- chaka, Dist- Allahabad, UP

4	Type of seed	Pre-germinated paddy seed
5	Replications	Three
6	Statistical Design	RBD

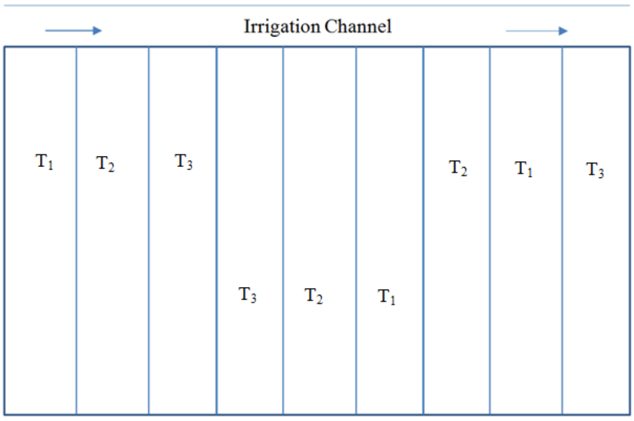

Fig. 3.1 Layout of experimental field

3.6.1 Effective field capacity

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

$$E.F.C = \frac{A}{T_P + T_e}$$

Where,
E.F.C = effective field capacity ha/h.
A =
T_p = T_1 tive T_2 T_3
T_e = time loss h

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

3.6.2 Theoretical field capacity

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

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

Where,
T.F.C =theoritical field capacity, ha/h
W = width of implement, m
S = speed of operation, km/h

3.6.3 Field efficiency

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

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

Where,
F.E = field effeciency percent
E.F.C = effective field capacity, ha/h
T.F.C = theoritical field capacity ha/h

3.6.4 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 number of hill in the frame area were counted.

3.6.5 Row to Row spacing

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

3.6.6 Number of speed per hill

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

3.6.7 Average hill to hill distance

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

3.7 Variables and their measurement

Some variables were taken to evaluate the performance of manually drawn direct paddy drum seeder. There were mainly two types of variables under which all the factors were considered which are given below:

3.7.1 Independent variables

Independent variables were those variables which were controlled by the operator. The independent variables which were taken are given below:

1. Walking speed (km/h): 1, 1.5, 2
2. Drum fill level : full, half, quarter

3.7.2 Dependent variables

Dependent variables were those variables whose values were dependent on the independent variables. The dependent variables which were taken are given below:

1. Effective field capacity
2. Theoretical field capacity
3. Field efficiency
4. Number of seeds /hill
5. Hill to hill spacing
6. Number of hills /square m
7. Hill missing index

3.7.3 Measurments

1. Speed

Four poles A,B,C and D as shown in the figure were placed vertically in the center of the field at adistance of 10 meters. When the seeder was in motion and its axel came in line with the poles A and B, the stop watch was started. At the other end again when the axel of seeder came in line with the poles C and D, the stop watch was stopped. The readings were taken 5 times in each direction of travel. The readings of time taken was averaged and the speed of operation was calculated as given below:

$$\text{Speed (km/h)} = \frac{\text{Distance (m)} \times 60 \times 60}{\text{Time (sec)} \times 1000}$$

2 Moisture content of soil

Moisture content (%) on dry basis of the soil was measured by gravimetric method. Core having 20.4 sq.cm cross-section area was used sample the puddle soil. The sample was oven dried and water content was calculated (Gupta 1992)

$$Mc = \frac{W-D}{D}$$

Where,

Mc = soil moisture db%

W = weight of wet soil, g

D = weight of oven dry soil,

3 Bulk density of soil

Bulk density is the oven dry mass was per unit volume of the soil. It was measured by core cutter method before and after pudding and expressed as (Gupta 1992)

$$p = \frac{M}{V}$$

where,

p = bulk density of the soil, g/cm

m = oven dry mass contained in core sampler, g

v = volume of the cylinder core sampler, cm^2

4 Cone index

Cone index is a measure of soil hardness. Cone index was measured with the help of a cone pentrometer. A circular cone (base area= $322m^2$) is pushed into the soil at a constant speed, the force on cone is shown on the field gauge. The cone index is calculated as

$$CI = \frac{Force\ on\ cone}{Base\ area\ of\ the\ cone}\ , KPa$$

5 Puddling Index

In order to find out paddling index the sample of puddle soil were collected randomly from the plot. The sample of 25 cc immediately after paddling were collected by inserting glass tube to a depth about 10 to 12 cm. puddle sample were allowed to settle for 24 hrs in a graduated cylinder. The volume of the settled soil sample and clean water was recorded (Gupta 1992).

$$PI = \frac{Vs}{V} \times 100$$

Where,

Vs = volume of the settle soil, cm^3

V = total volume of sample, cm^3

PI = paddling index (%)

3.8 Cost of operation

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

3.8.1 Fixed cost

It includes

(i) Depreciation: This cost reflects the reduction in value of a machine with use and time. While actual depreciation would depend on the sale price of the machine after its use, on the basis of different conmputational method dipreciation can be estimated. The straight line method for estimation of dipreciation was used.

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

(ii) Interest: Anual charges of interest were calculeted on the basis of the actual rate of interest payable.

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

Where,

C = cost of seeder Rs

S = salvage value (10% of initial cost), Rs

I = interest rate, (10%percent)

L = life of seeder 7 year

H = annual use of seeder 300hr

(iii) Housing rate @ 1.5 % of initial cost

Fixed cost = sum of 1 to 3

3.8.2 Variable cost

In this consider following cost

(i) Repair and maintenance @ 6% of total cost

(ii) Operator's cost per day = Rs.150/-

- Total variable cost = repair and maintenance cost + operator's cost

3.8.3 Total Cost of Seeding Per Hour

Total cost = fixed cost per hour + variable cost per hr.

Plate 3.11 View of paddy crop after one month seeded by direct paddy drum seeder

IV. Result And Discussion

The implement is used for sowing pre-germinated paddy seeds (24h soaking + 24 h incubation). The sprouted seeds are filled in the drums of seeder and single person pulls the seeds 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 puddle field. The field performance test was carried out for the field capacity, field efficiency etc. in puddle field.

4.1 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 seeders was calibrated for three different speeds viz., 1km/h, 1.5km/h, 2km/h and for initial drum fill percentage from full, half and quarter. The seeds collected after each fifty revolutions were weighed. The observations the graphs of distance travelled. 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 10m distance travelled. For the next successive points i,e. up to 20m distance travelled seed rate was observed increasing continuously. For the distance travelled from 9.4m to 20m, the variation in the seed rate was found to be 5 kg/ha.

Fig. 2 shows that up to initial 6m distance travelled the seed rate was nearly constant; for next 15m distance travelled the seed rate was increasing continuously. For next 10m travelled the seed rate was again found to be constant. For the distance travelled from 9.4m to 20m, the variation in the seed rate found to be 4.5kg/ha. Fig. 3 shows that seed rate up to first 6m distance travelled, was constant. For the next 6m distance travelled, it was decreased and for further 12m distance travelled seed rate was found to be increased continuously. For the distance travelled from 9.4m to 20m, the variation in the seed rate was found to be 3.2 kg/ha. Fig. 4 shows that seed rate was observed continuously increasing as distance travelled was increased. Also the variation of seed rate for each 5 revolutions of drum i.e. 9.4 m distance travelled was found to be less as compared to the other graphs. For the distance travelled from 9.4m to 24m, the variation in the seed rate was found to be 8kg/ha. In this Fig. 5 up to 6m distance travelled, seed rate was found to be nearly constant. For the next 14m distance travelled it was increasing continuously and for further 9.4m distance travelled it was constant.

For the distance travelled from 9.4m to 24m, the variation in the seed rate was found to be 10kg/ha.

Fig. 6 shows that the drastic change in the seed rate for 6m distance travelled the seed rate was increased continuously. For the distance travelled from 9.4m to 24m, the variation in the seed rate was found to be 13kg/ha. 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 to full and half drum fill. For the distance travelled from 9.4m to 12m, the variation in the seed rate was found to be 4.8kg/ha

Fig. 8 shows that least variation in seed rate was observed for 12m distance travelled and it was 3kg/ha but it was for less distance travelled.

Fig. 9 shows that continuous increases in seed rate also the variation in seed rate also the variation in seed rate from 9.4 mto12m distance travelled was found to be 2.5kg/ha.

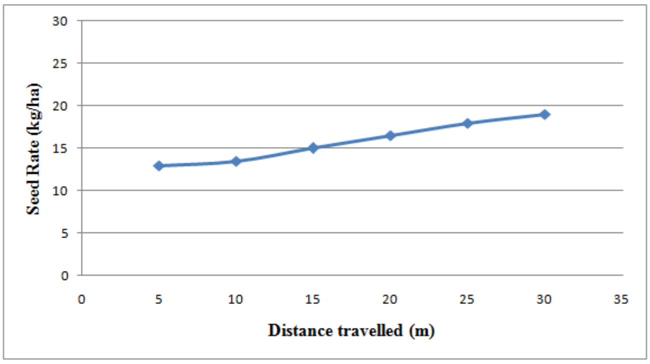

Fig. 4.1 Variation of seed rate with distance travelled at full drum fill and 1 km/h travel speed

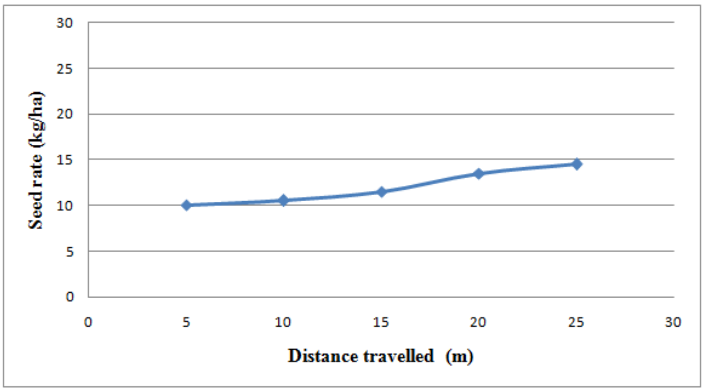

Fig. 4.2 Variation of seed rate with distance travelled at full drum fill and 1.5 km/h travel speed

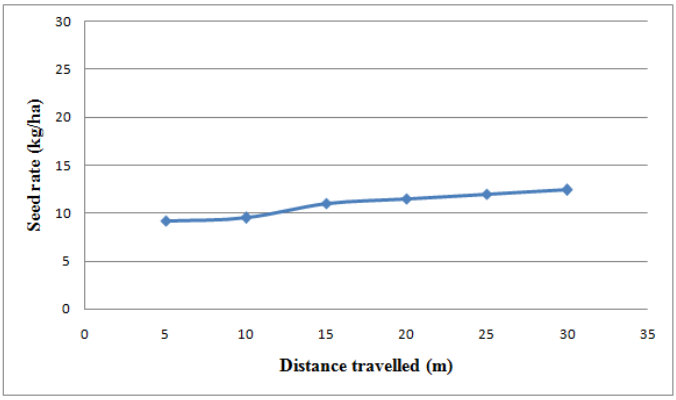

Fig. 4.3 Variation of seed rate with distance travelled at full drum fill and 2 km/h travel speed

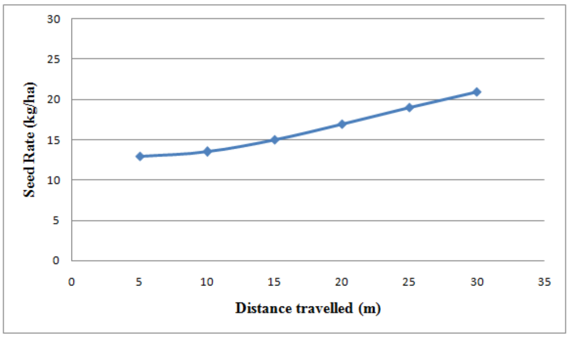

Fig. 4.4 Variation of seed rate with distance travelled at half drum fill and 1 km/h travel speed

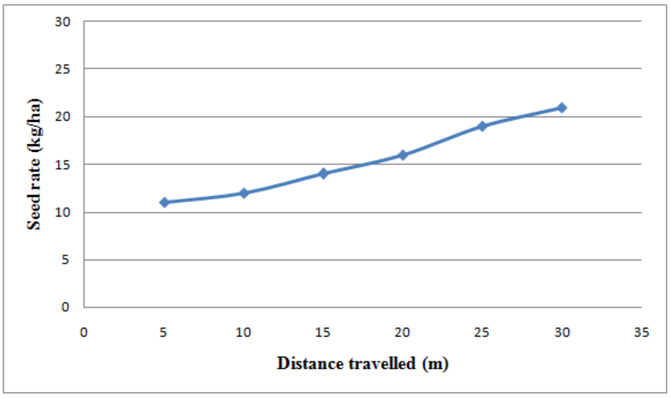

Fig. 4.5 Variation of seed rate with distance travelled at half drum fill and 1.5 km/h travel speed

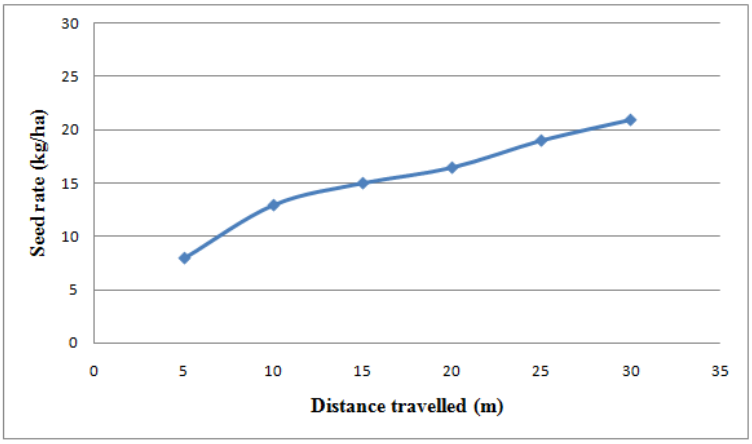

Fig. 4.6 Variation of seed rate with distance travelled at half drum fill and 2 km/h travel speed

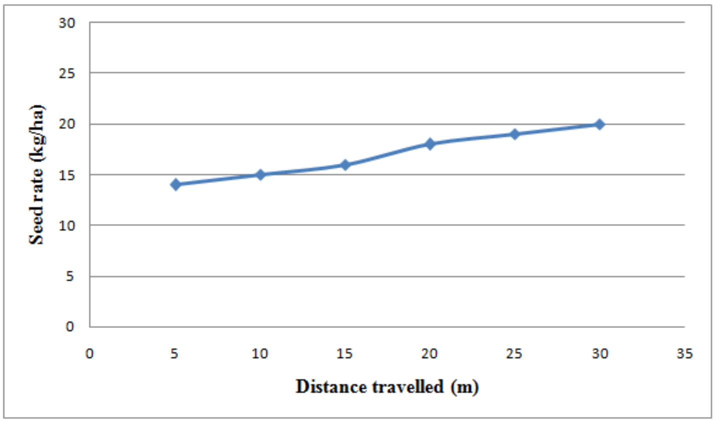

Fig. 4.7 Variation of seed rate with distance travelled at quarter drum fill and 1 km/h travel speed

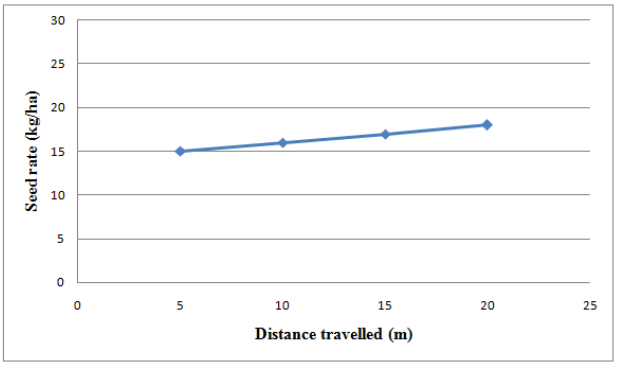

Fig. 4.8 Variation of seed rate with distance travelled at quarter drum fill and 1.5 km/h travel speed

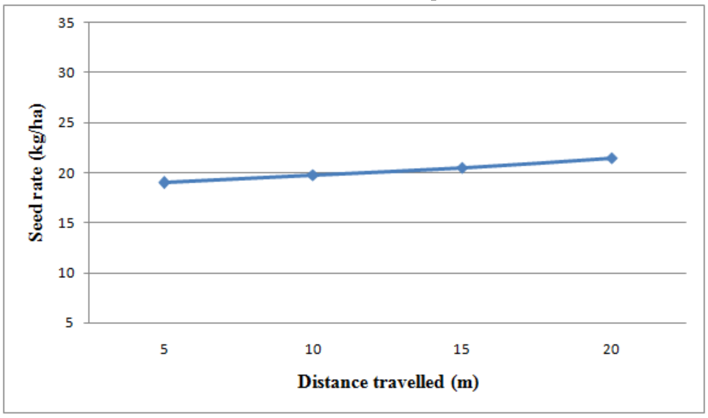

Fig. 4.9 Variation of seed rate with distance travelled at quarter drum fill and 2 km/h travel speed

Table No.4.5 Effect of drum fill level and travel speed of implement on seed rate, hill to hill spacing, seeds/hill and hill missing index

Drum fill level	Treatments	Seed rate	Hill to hill spacing	Seeds /hill	Hill missing index
Full	T1	9.09	14.67	4	7.5
	T2	9.53	16.33	3	12.57
	T3	9.97	17	2	15
Half	T1	21.16	14.53	5	7.5
	T2	21.50	15.66	5	10
	T3	23.05	16.66	4	12.5
Quarter	T1	24.16	14.43	6	5.83
	T2	25.93	15.23	6	7.5
	T3	28.59	16.53	5	10

Seed rate (kg/ha)
The comparative performance of all combination at different drum fill level and travel speed is presented in fig. 4.14
The maximum seed rate was found to be 28.59 kg/ha with T_3 (seeding by drum seeder at the speed of 2km/h) at quarter drum fill level. The minimum seed rate was 9.09 kg/ha with T_1 (seeding by drum seeder at the speed of 1 km/h) at full drum fill level.
The treatment under study at different drum fill level and travel speed was found statistically significant at 5% level of significant (Table 4.5)

Hill to hill spacing (cm)
The comparative performance of all combination at different drum fill level and travel speed is presented in fig. 4.15
The maximum hill to hill spacing was found to be17 cm with T_3 (seeding by drum seeder at the speed of 2km/h) at full drum fill level. The minimum hill to hill spacing was 14.43 cm with T_1 (seeding by drum seeder at the speed of 1 km/h) at quarter drum fill level.
The treatment under study at different drum fill level and travel speed was found statistically non significant at 5% level of significant (Table 4.5)

Number of seeds/hill
The comparative performance of all combination at different drum fill level and travel speed is presented in fig. 4.16
The maximum number of seeds/hill was found to be 6 cm with T_1 (seeding by drum seeder at the speed of 1km/h) at quarter drum fill level. The minimum number of seeds/hill was 2 with T_3 (seeding by drum seeder at the speed of 2 km/h) at quarter drum fill level.
The treatment under study at different drum fill level and travel speed was found statistically significant at 5% level of significant (Table 4.5)
Hill missing (%)
The comparative performance of all combination at different drum fill level and travel speed is presented in fig. 4.17 The maximum hill missing was found to be 15% with T_3 (seeding by drum seeder at the speed of 2km/h) at full drum fill level. The minimum hill missing was 5.8% with T_1 (seeding by drum seeder at the speed of 1 km/h) at quarter drum fill level.
The treatment under study at different drum fill level and travel speed was found statistically non significant at 5% level of significant (Table 4.5)

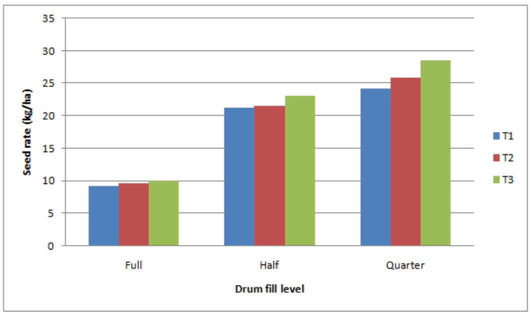

Fig. 4.14 Effect of travel speed and drum fill level on seed rate

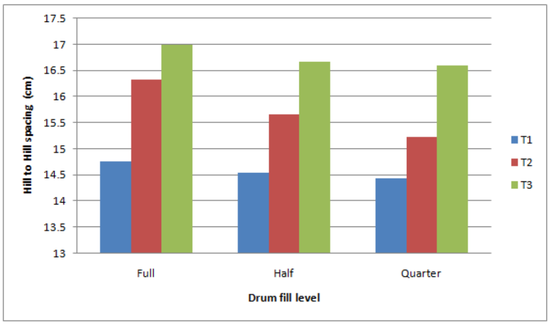

Fig. 4.15 Effect of travel speed and drum fill level on hill to hill spacing

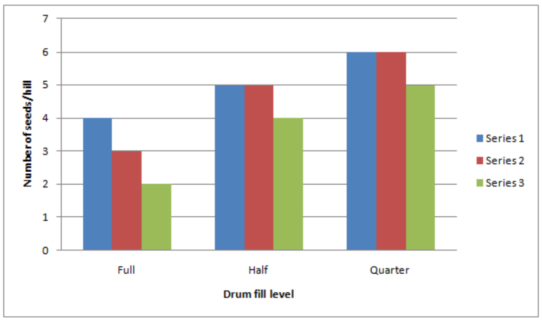

Fig. 4.16 Effect of travel speed and drum fill level on number of seeds /hill

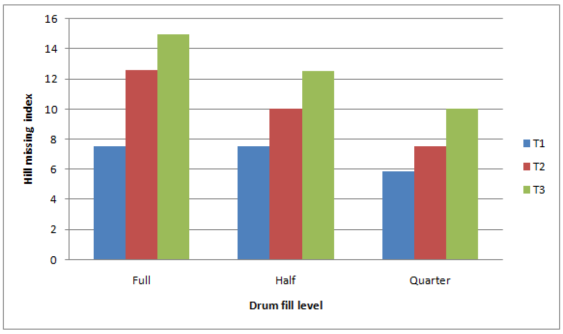

Fig. 4.17 Effect of travel speed and drum fill level on hill missing index

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 effective field and theoretical field capacity.

The effective field capacity and field efficiency of paddy drum seeder at plot1,2 and 3 were determined and are presented in table 4.6. The data presented in table 5 shows that theoretical field capacity at all three plots were same and was 0.16ha/h. The effective field capacity at plot 1 was 0.131 ha/h and field efficiency was observed to be 81.88 %. Similarly the effective field capacities at plot 2 and 3 were 0.128 ha/h and 0.135 ha/h, respectively. The field efficiencies at plot 2 and 3 were observed to be 80% and 84.38%. The average effective field capacity was 0.131 ha/h and the average field efficiency at the test plot was 82.09%.

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, 41.62% 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 half drum fill and 1 km/h travel speed. The actual seed rate during the field test observed was 27.5 kg/ha. Whereas in the laboratory test for the same drum fill and travel speed, it was 21.16 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.

Table No.4.6 Performance data of drum seeder used for seeding of pre germinated paddy

Sr.No.	Particular	Plot 1	Plot 2	Plot 3
1	Actual operating time, sec	185	190	180
2	Turning time, sec	12	14	11
3	Loading time, sec	65	66	61
4	Time taken to travel 30m, sec	108	110	108
4	Actual area covered, ha	0.00675	0.00675	0.00675
5	Travel speed, km/h	1	1	1
6	Effective field capacity, ha/h	0.131	0.128	0.135
7	Theoretical field capacity, ha/h	0.16	0.16	0.16
8	Field efficiency, %	81.88	80.00	84.38
9	Average hill to hill distance, cm	14.5	16	15
10	Average number of seeds/ hill	5	6	5
11	Number of hills/m^2	30	30	30
12	Hill missing (%)	5.8	5.6	6

V. Summary And Conclusions

The study was performed in laboratory to check the constant seed rate under given distance travelled and to select the travel speed and suitable drum fill level of drum seeder in field evaluation. This study was undertaken to investigate the effect of different drum fill level and travel speed of direct paddy drum seeder on seed rate, hill to hill spacing, number of seeds/hill, hill missing.

The following conclusions were drawn from the present study:

1. The combination of half drum fill level and 1 km/h travel speed of direct paddy drum seeder was found to be suitable for operating the seeder in the field.
2. The hill dropping pattern of direct paddy drum seeder was found during the laboratory calibration and also during the field operation.
3. The recommended seed rate for the variety under test i.e. kirtiman Hina was 25 kg/ha for direct seeding. From the laboratory calibration the half drum fill level and 1 km/h operating speed were found to give the average seed rate of 21.16 kg/ha for pre germinated paddy seeds. Actually in the field the seed rate observed was 27.5 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 direct paddy drum seeder in the field.
4. From the field performance test it was found that average number of seeds dropped per hill was 5.
5. From the field performance test it was found that the hill to hill spacing was 14.5 cm.
6. From the field performance test it was found that the average number of hills per square meter was 30
7. From the field performance test it was found that the average hill missing was 5.8 percent.
8. The effective field capacity of the direct paddy drum seeder was observed to be 0.131 ha/h
9. The theoretical field capacity of direct paddy drum seeder was observed 0.16 ha/h.
10. The field efficiency of the seeder was found to be 82.08%
11. The cost of operation of drum seeder worked out to be 42.67 Rs/h and 341.36 Rs/ha.

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