Madras Agric. J. 90 (1-3) : 129-134 January-March 2003

Performance evaluation of a manual paddy dibbler

BINI SAM AND M.R. SANKARANARAYANAN
College of Horticulture, Kerala Agricultural University, Vellanikara, Thirssur - 689 654, Kerala.

Abstract: A light weight manually operated dibbler for dry sowing of paddy was developed at Kelappaji College of Agricultural Engineering and Technology, Kerala Agricultural University, Tavanur, India. A plunger with a metering groove was employed for dropping the seeds and making the hole. In this study laboratory and field tests were carried out to assess the quality and rate of work, ease of operation and adjustment and suitability of dibbler The performance of dibbler was satisfactory with an emergence percentage of 76. The field efficiency was 68.68 per cent. The area covered by the dibbler was 0.022 ha h^{-1}, which is significantly better than Naveen seed dibbler developed at CIAE, Bhopal, India (0.013 ha h^{-1}).

Key Words: Dibbler plunger system, Emergence percentage, Paddy dibbler.

Introduction

Hill dropping is known for higher yield compared to row crop drilling. The demand of dibblers is increasing gradually. Number of researchers had investigated the performance of dibbler in comparison with conventional drills (Wurr *et al.* 1985 and Bufton *et al.* 1987). Scattering of seeds is one of the problems in the hill drop planters. But the plunger metering technique employed in this dibbler drill place desired quantity of seeds without scattering at regular intervals along the row. Thus the intercultural operations like weeding, hoeing and fertilizer application became easy besides saving time and cost.

The success of crop establishment depends on factors directly related to planter performance. Glenn and Daynard (1974) tested plant spacing uniformity at a desired population. The reduced variability in spacing resulted 5.5 percent increase in corn yield. Pinter *et al.* (1978) tested corn plant populations and spacing uniformity and their relationship with grain yield. The highest yield resulted from the best space uniformity.

Materials and Methods

Description of the equipment

The dibbler drill consists of seed box, plunger with seed metering mechanism, seed tube, frame, handle and marker (Fig.1). The top and bottom portion of the seed box was made circular and truncated cone of height 0.1 m respectively. The bottom portion was set at an angle same as the angle of repose (35°) of paddy. Three such seed boxes made of mild steel sheet with a capacity of 4 kg of paddy seeds were fabricated and assembled on a main frame with other components. A circular seed tube made of mild steel sheet was connected directly to the bottom of the seed box for guiding the seeds into the soil. The plunger was the most important feature of the machine. It was used for metering the seeds and for making hole in the soil. The plunger was divided into three portions. The top portion helped the insertion of the spring around it. The middle portion contained the vertical slot for metering the seeds. The end of the bottom portion was provided with a collar having spikes around the periphery in order to avoid clogging by clods. During operation of the implement, the plunger was pushed into the soil and seed hole was opened for dropping the seeds. At a small downward travel, the plunger move upward by the soil pressure and the portion of the plunger having the vertical slot came in contact with seeds and seeds were transferred and carried to this slot (Fig. 2). When the implement was lifted from the soil, the soil pressure on the plunger was released and due to spring pressure the plunger move downward and seeds in the slot were released and pass through the seed tube by gravity. The upward movement of the plunger could be varied by changing the position of the stopper provided on the plunger. The downward travel

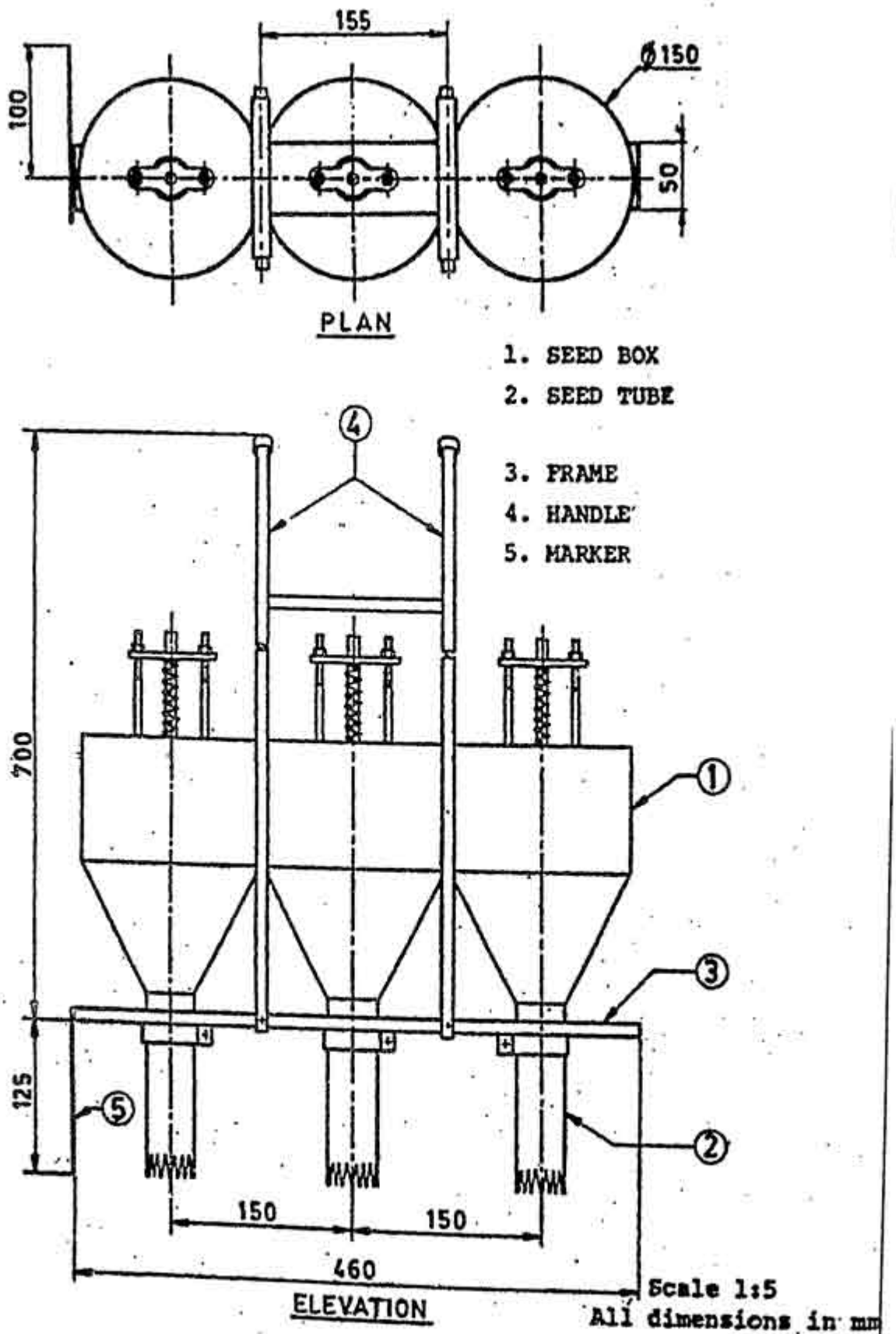

Fig.1. PADDY DIBBLER

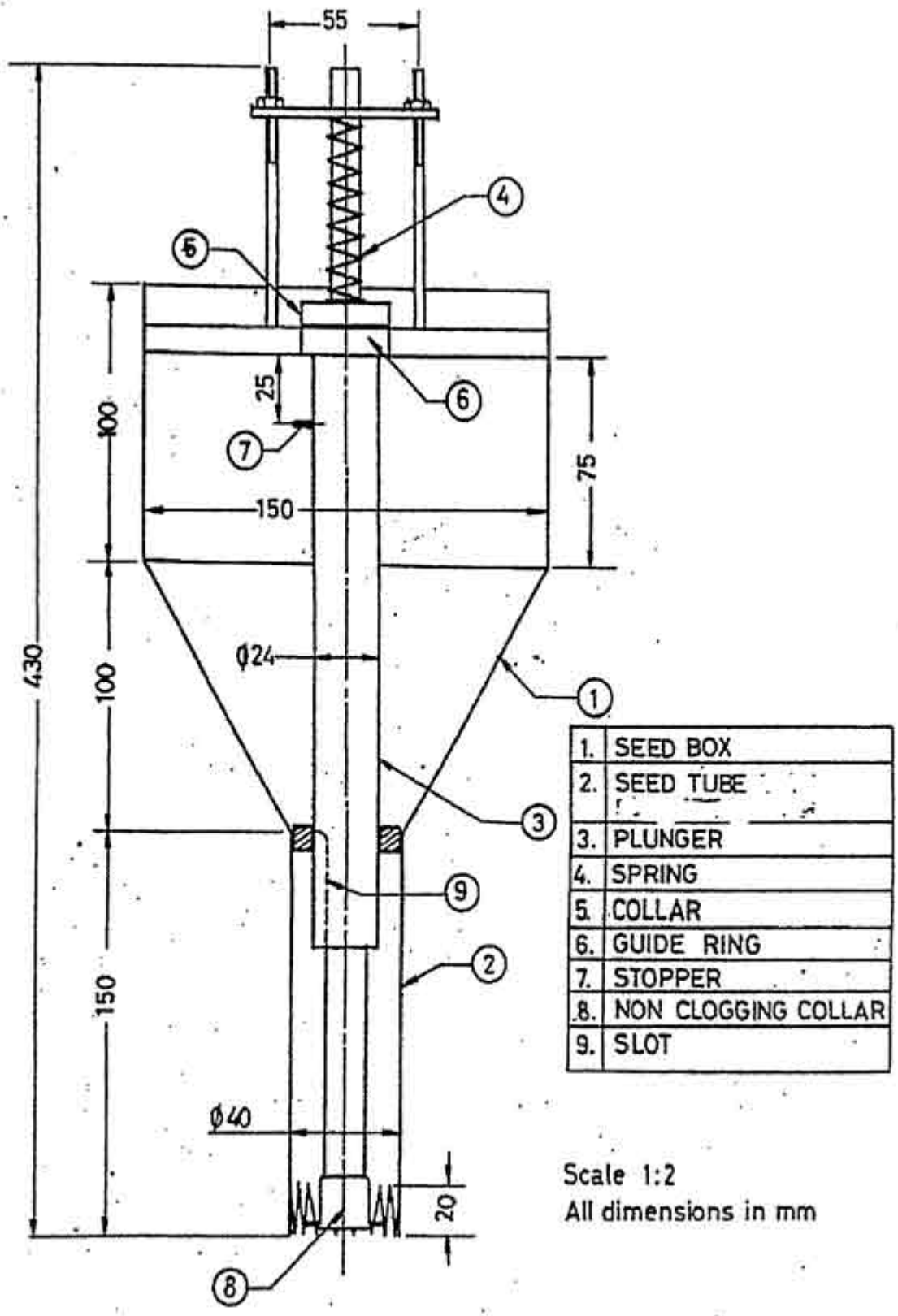

Fig.2. SECTIONAL VIEW OF SEED BOX WITH PLUNGER

Table 1. Calibration of the dibbler

Seed rate setting : 4 to 6 seeds / hill; Recommended seed rate : 80 to 90 kg ha^{-1}

Test number	Area (ha)	Initial weight of seeds (kg)	Weight of seeds after sowing (kg)	Difference in weight (kg)	Seed rate (kg ha^{-1})
1	0.000525	3	2.955	0.045	85.71
2.	0.000525	3	2.9555	0.0445	84.76
3.	0.000525	3	2.954	0.046	87.76

Table 2. Field efficiency of the dibbler

Trial No.	Area (ha)	Total time spent (h)	Field capacity (ha h^{-1})	Theoretical field capacity (ha h^{-1})	Field efficiency (%)
1	0.01	0.633	0.0158	0.0230	68.69
2.	0.01	0.613	0.0163	0.0230	70.87
3.	0.01	0.555	0.0180	0.0270	66.67
4.	0.01	0.526	0.0190	0.0270	70.37
5.	0.01	0.467	0.0214	0.0324	66.05
6.	0.01	0.444	0.0225	0.0324	69.44
Average					68.68

of the plunger was limited by a collar provided at the top of the plunger.

Performance evaluation of dibbler

Tests were conducted in the laboratory and in the field to evaluate the dibbler. The field trials were undertaken in Agricultural Research Station, Mannuthy, Thrissur. The variety of paddy seed was Jyothi with a moisture content of 14 per cent. The grain was 7.8 mm length, 2.7 mm breadth and 2 mm thick.

Mechanical damage

The damage to the seeds while using mild steel and wooden plunger was observed. After filling the hoppers with seeds, the metering mechanism was operated. The samples from each seed tube were collected and the number of seeds damaged was noted by visual observation and represented in percentage. The material of plunger with minimum mechanical damage was selected.

Calibration of the dibbler

By varying the stroke length of the plung the vertical slot coming in contact with see could be varied. For different selected strol lengths (20, 25 and 30 mm) the number seeds dropped was noted. The stroke leng was selected in such a way that the numb of seeds dropped was in the range of 4 6. The hopper was filled with a known weig of seeds and allowed to operate at the selecte stroke length over a sand bed of 3.5 m leng and 1.5 m width having a moisture conte of 4 per cent (wet basis). After sowing, th weight of the remaining seeds was recorde and the difference in weight divided by th area sown gave the seed rate for the selecte stroke length of the plunger.

Seeding uniformity

The seedling uniformity was studied b the method of sand bed test. The dibbler wa operated over a sand bed of 3 m length an

.5 m width (effective width of the dibbler) t forward speeds of 0.5, 0.6 and 0.7 km '. Seeds dropped per hill were noted by visual bservation.

ield evaluation

The time taken to cover a known area vas observed and field capacity was calculated s area covered/actual time. The theoretical ield capacity was calculated as ws/10.

Where,

w = width of the machine, m
s = speed of travel, km h^{-1}

The field efficiency was calculated as he ratio of effective field capacity to theoretical ield capacity.

To find the plant germination, both sand bed and field tests were conducted. The metering mechanism of the dibbler was operated 20 times with seeds in the hopper (wooden roller). The seeds were collected, counted and put in sand bed for germination. The germinated seedlings were noted. The same procedure was used for field test also.

Results and Discussion

Mechanical damage

Initially plunger of mild steel was selected. But the mechanical damage was found to be 20.67 per cent. In order to reduce the damage, the mild steel plunger was replaced by a wooden plunger for which the mechanical damage was 4.84 per cent. Therefore the wooden plunger was selected for fabrication. This also reduced the weight of the machine.

ible 3. Seeding uniformity

.No.	Speed (km h^{-1})	Arithmetic mean (X)	Standard deviation (s)	t-value	Coefficient of variation (per cent)
	0.5	4.62	2.27	0.420	49.13
	0.6	5.14	2.53	0.135	49.22
	0.7	4.47	2.21	0.587	49.44

– value at 5 per cent level of significance for 7 observations is 2.447.
= $X - \mu (\sigma / \sqrt{n-1})$. Hence the hypothesis that the average number of seeds per hill which is taken as 5 is acceptable.

Table 4. Plant germination (%) of paddy dibbler

.No.	Sand bed test			Field test		
	Number of seeds dropped after 20 times of operation	Germinated seedlings	Germination percentage	Number of seeds dropped after 20 times of operation	Germinated seedlings	Germination percentage
	110	95	85	100	78	78
	120	104	84	108	83	75
	115	101	86	115	89	74
	100	82	82	120	95	75
	118	106	88	115	91	76
verage			85			75.6

Calibration of the dibbler

The average number of seeds dropped was 3,5 and 10 for different selected stroke length of 20, 25 and 30 mm respectively. Since the recommended number of seeds is 4 to 6 per hill, 25 mm stroke length was selected. The results of the test conducted for calibration is shown in Table 1. The average seed rate obtained was 86 kg ha^{-1}. The recommended seed rate for dibbling is 80 to 90 kg ha^{-1}.

Seeding uniformity

The uniformity of seeds dropped from each seed tube was analysed statistically at 5 per cent level of significance (Table 2). It was found that the average number of seeds dropped per hill was 5, which is the average of the recommended rate of 4 to 6 seeds/ hill. The seeding uniformity was also analysed by coefficient of variation method at 0.5, 0.6 and 0.7 km h^{-1}. The coefficient of variation was same for the three speeds. The values of coefficient of variation obtained at three speeds were 49.13, 49.22 and 49.44 per cent respectively. It reveals that the uniformity in seeding was same for the three speeds.

Field evaluation

The effective field capacity obtained was 0.022 ha h^{-1} which is better than that of the Naveen seed dibbler developed at CIAE, Bhopal, India (0.013 ha h^{-1}). The average field efficiency of the present dibbler drill was 68.68 per cent (Table 3).

The percentage plant germination was 85 and 76 respectively for sand bed and field test as shown in Table 4.

The cost of sowing one hectare of land was Rs. 717 /- which is less compared to the manual dibbling (John, 1989).

Conclusions

A manually operated dibbler employin a simple dibbler plunger system has been teste and successfully performed in the field. Th dibbler drill produced a nominal 40 per cer improvement in field capacity than that of Navee seed dibbler developed at CIAE, Bhopal, Indi The dibbler performed satisfactory with 76 p cent emergence. The cost of sowing one hecta of land was Rs. 717/- which is less than th cost of sowing one hectare of land by manu dibbling (Rs. 979/-). More over manual dibbin is done in a bending position which is arduou to the farmr. But in the present design c dibbler, a suitable handle is provided whic ensure easy and comfortable operation in sraight posture.

References

Bufton, L.P., Brown, F.R. and Grundon, P.M. (198 Seed drill design and crop establishmer Divisional Note DN 1413. National Institu of agricultural Engineering, Silsoe.

Glenn, F.B. and Daynard (1974). Effects of genotyp planting pattern and plant density on plan to-plant variability and grain yield of cor *Canadian J. Plant Sci.* **54**: 323-330.

John, M.J. (1989). Design, development and testir of an animal drawn dibbler for padd M.Sc.(Agrl. Engg.) Thesis. Submitted Kerala Agricultural University, Thrissu Kerala, India.

Pinter, L., Nemeth, J., Pinter, Z. and Szirbik, N (1978). Trend of grain yield in maize (*Z mays* L.) hybrids as a function of pla number per unit area and sowing uniformit *Acta Agronomica Hungaricae,* 27: 398-40

Wurr, D.C.E., Fellow, J.R. and Bufton, L.. (1985 Effect of seed covering treatments on th emergence and seedling growth of crisp lettu drilled with the NIAE dibbler drill. *J. Agri Sci.* **105**: 535-541.

(Received : January 2002; Revised : January 200