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Calibration Studies of Drum Seeder Slot Response to different High Yielding Paddy varieties in Tamil Nadu

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ABSTRACT: A calibration study and field experiment were carried out at Agricultural College and Research Institute, Madurai to evaluate the suitability of modified drum seeder slots with high yielding varieties during *Kharif* 2021. Uneven seed drop and seed scattering is more in normally used drum seeder. In this context experiment was taken out to reduce the seed scattering, seed rate and seed drop per hill. Experiment design adopted was split plot. Main plot consists of Varieties like ADT 45 (Medium slender), MDU 6 (Long slender) and ASD 16 (Short bold) and medium duration variety VGD 1 (Short Slender). Drum seeder slots *viz.* round slot, oval slot, round slot with guiding pipe, oval slot with guiding pipe and self metering slot were taken in sub plots. Calibration study was carried out using paddy drum seeder to evaluate seed flow rate, total seed dispersion, seed dispersion rate and seed rate. Results revealed that oval slot with guiding pipe registered less seed flow rate (4.5 g), total seed dispersion (88.5 g), seed dispersion rate (5.62 seeds m^{-1}) and seed rate (9.25 kg ha^{-1}) compared to other slot modifications. Among the varieties tested, VGD 1 registered less seed flow rate (), total seed dispersion (297.6 g), and seed rate (31.01 kg ha^{-1}) due to the nature of grain shape. While seed dispersion rate was less with ASD 16 (11.07 seeds m^{-1}). Plant population m^{-2} was minimum with oval slot with guiding pipe (49.3 plants m^{-2}) and ASD 16 (55.04 plants m^{-2}). Response of ASD 16 and MDU 6 was on par when used with oval slot fitted with guiding pipe.

Keywords: Direct sowing, Slot modification, Drum seeder, Calibration.

INTRODUCTION

One of the most significant food crops in the world and a staple food for more than half the world's population is rice (*Oryza sativa* L.). After wheat, it is the second-most significant food source, providing 43% of the calories needed by more than two-thirds of the Indian population. In India, 45.1 million ha of rice are planted, producing 122.27 million tonnes of rice annually (Indiastat, 2020-21). The yield and productivity of rice in Tamil Nadu are 7.17 million tonnes and 3.76 t ha^{-1}, respectively, on an area of 1.90 million ha (Indiastat, 2019-20).

The process of transplanting includes preparing the nursery, sowing, caring for the seedlings, uprooting them, transporting them and transplanting. Traditional transplanting techniques have been associated with issues like higher labor costs, fragmented and small land holdings, and insufficient water and other inputs (Kumar et al., 2017).

Three direct seeding techniques for rice are dry seeding (sowing dry seeds in unpuddled soil), wet seeding (sowing pre-germinated seeds in puddled soils), and water seeding (sowing seeds in standing water) (Akhgari and Kaviani 2011). Reduced greenhouse gas emissions and savings in irrigation water, labor, energy, and time are just a few benefits of direct seeding (Kaur and Singh 2017). In terms of yield, direct seeding of rice in puddled soil was superior to transplanted rice. Additionally, depending on the season, region, and type of direct seeded rice, it uses 11–18% water and 11–66% labor than puddled transplanted rice (Selvaraj and Hussainy 2020).

Direct sowing in rows with a drum seeder allowed for effective weed control, fertilizer application, and plant protection measures (Tayade, 2017). In puddled conditions, direct seeding of sprouted paddy seeds led to significant improvements in yield qualities like the number of productive tillers (Mohanta *et al*., 2019) and equivalent grain yields to puddled transplanted rice (Sarangi *et al*., 2019). Likewise, when compared to transplanted rice, direct-seeded rice can be harvested in 7–10 days (Mohanta *et al*., 2019) and 8–10 days (Chandrasekhrarao *et al*., 2013).

As the number of seeds in the drum is reduced, the seeding rate rises (Karim *et al*., 2015). All of these factors were taken into consideration while the current experiment was conducted with the objective of calibrating the seed flow rate, seed dispersion per rotation, and seed rate per hectare.

MATERIALS AND METHODS

Experimental details. Field experiments were laid out in split plot design with three replications. The main plot with seed types and sub plots as slot modification. During *kharif 2021*, the gross plot size was 6.4 m × 5 m and the net plot size was calculated as per TNAU Paddy Drum seeder spacing. The short duration rice varieties *viz*. ADT 45 (Medium slender), MDU 6 (Long slender) and ASD 16 (Short bold) and medium duration variety VGD 1 (Short Slender) were used as test variety for this study. Different slot modification such as round slot, oval slot, round slot with guiding pipe, oval slot with guiding pipe and self metering slot were used.

Evaluation of modified drum

Flow rate of drum seeder. The drum seeder was fixed in a platform where it can freely rotate and then sprouted paddy seeds were filled to 3/4 level in each of 4 drums, and uniformly made five rotations. The seeds were collected after five rotations, and the total number of seeds were counted and weighed, and expressed as flow rate in Nos and g.

Seed dispersion in one running meter length. The number of seeds which were dispersed in one running meter length was recorded by counting the seeds which germinated in one meter length and expressed in number.

Effect of different drum slots used on seed rate. 1000 gram of seeds were filled in the four drums of a drum seeder and after sowing, the final weight of the seeds used in different slots were estimated and expressed as kg ha$^{-1.}$

Effect of different drum slots on plant population m^{-2}. The population was computed using a quadrat (0.25 m^2) at 3 different spots in each plot randomly. The mean value was expressed as No. hill m^{-2}.

RESULTS AND DISCUSSION

Seed flow rate (g). The data depicted on Table 1 shows that with regard to slot modification, the minimum flow rate (3 g five rotations^{-1}) was noticed with Oval slot fitted with guiding pipe (S_4) and it was followed by self metering slot (S_5) (5.6 g five rotations^{-1}). The maximum flow rate (16.3 g five rotations^{-1}) was observed in Round slot (S_1). As for as varieties concerned VGD 1 shows lesser seed dispersion (4.1 g five rotations^{-1}) due to the smaller size of the grain. There was significant difference among the factors due to nature of grain size and size of the hole with orientation in the drum seeder. Similar finding given by Lakra *et al.* (2020).

Table 1: Effect of various slot modifications and their applicability to diverse seed shapes on seed rate during kharif 2021.

Seed flow rate (No)/Five rotation							Flow rate (g)/Five rotation						
	RS	**OS**	**RS-GP**	**OS-GP**	**SMS**	**Mean**		**RS**	**OS**	**RS-GP**	**OS-GP**	**SMS**	**Mean**
SS	970.0	738.0	512.0	147.0	275.0	**528.0**	**SS**	7.0	5.7	4.1	1.3	2.3	**4.1**
MS	992.0	757.0	562.0	166.0	312.0	**558.0**	**MS**	18.0	14.1	10.7	3.2	6.0	**10.4**
LS	1001.0	769.0	551.0	159.0	308.0	**557.0**	**LS**	15.7	12.4	9.2	2.7	5.2	**9.1**
SB	1047.0	798.0	575.0	174.0	354.0	**590.0**	**SB**	24.4	19.2	14.3	4.5	9.0	**14.3**
Mean	**1002.0**	**765.0**	**550.0**	**161.0**	**312.0**		**Mean**	**16.3**	**12.8**	**9.6**	**3.0**	**5.6**	
	M	S	M at S	S at M				M	S	M at S	S at M		
SEd	15.67	16.30	16.73	16.65			**SEd**	0.25	0.26	0.35	0.33		
CD (p=0.05)	33.54	34.89	NS	NS			**CD (p=0.05)**	0.55	0.57	0.77	0.72		

Note: (i) Seed type: VGD 1 Short Slender (SS), ADT 45 Medium Slender (MS), MDU 6 Long Slender (LS), ASD 16 Short Bold

(ii) Slot modification: Round Slot (RS), Oval Slot (OS), Round Slot with guiding pipe (RS-GP), Oval Slot with guiding pipe (OS-GP), Self Metering Slot (SMS)

Seed dispersion in one running meter length (seeds m^{-1}). The data illustrated in Table 2 revealed that seed types and slot modification significantly influence the seed dispersion. As regards slot modification, the minimum seed dispersion (5.62 seeds m^{-1}) was noted with Oval slot fitted with guiding pipe (S_4) and it was followed by self metering slot (S_5) (9.96 seeds m^{-1}). The maximum seed dispersion (16.58 seeds m^{-1}) was observed in round slot (S_1). As for as varieties concerned ASD 16 shows lesser seed dispersion (11.07 seeds m^{-1}) due to the size of grain and was found to be on par with MDU 6 (11.09 seeds m^{-1}). There was significant difference among the factors due to size of the grain and size of the hole with orientation in the drum seeder. Similar findings were found by Singh *et al*. (2016).

Table 2: Effect of various slot modifications and their applicability to diverse seed shapes on total seed dispersion in one running meter length (seed m^{-1}) during kharif 2021.

Seed dispersion (seed m^{-1}) at 2021						
	RS	**OS**	**RS-GP**	**OS-GP**	**SMS**	**Mean**
SS	18.22	18.02	13.50	6.83	12.37	**13.79**
MS	16.12	15.48	11.52	5.64	9.82	**11.72**
LS	16.38	15.24	10.16	5.18	8.48	**11.09**
SB	15.60	15.08	10.64	4.84	9.18	**11.07**
Mean	**16.58**	**15.96**	**11.46**	**5.62**	**9.96**	
	M	S	M at S	S at M		
SEd	0.25	0.21	0.67	0.67		
CD (p=0.05)	0.59	0.44	1.20	1.20		

Note: (i) Seed type: VGD 1 Short Slender (SS), ADT 45 Medium Slender (MS), MDU 6 Long Slender (LS), ASD 16 Short Bold
(ii) Slot modification: Round Slot (RS), Oval Slot (OS), Round Slot with guiding pipe (RS-GP), Oval Slot with guiding pipe (OS-GP), Self Metering Slot (SMS)

Seed rate (kg ha^{-1}). Total seeds used in drum was evaluated by rate of seed dispersed. With respect to slot modification, seed rate was minimum (9.25 kg ha^{-1}) in Oval slot fitted with guiding pipe (S_4) followed by self metering slot (S_5) (18.18 kg ha^{-1}). The maximum seed rate (56.94 kg ha^{-1}) could be observed in round slot (S_1). As for as varieties concerned VGD 1 shows lesser seed rate (31.01 kg ha^{-1}) due to lesser test weight of the grain. Similar trend of seed rate usage under wet seeding by manipulating the seed holes in the drum seeder were earlier reported by Mohanta *et al.* (2019). There was significant difference among the factors due to test weight of the grain and size of the hole with orientation in the drum seeder. Influence of slot modification with variety on seed rate was presented in Fig. 1 and 2.

Plant population m^{-2} . On close examination of data furnished in Table. 3 clearly showed that there was significant difference between seed types with respect to slot modification, the minimum plant population m^{-2} (49.30) was noticed with Oval slot fitted with guding pipe (S_4) followed by self metering slot (S_5) (52.65). Maximum plant population m^{-2} (60.35) in round slot (S_1). There was significant influence regarding variety. As for as varieties concerned VGD 1 shows lesser plant population m^{-2} (54.72) due to lesser seed drop, similar findings were observed by Susanti *et al.* (2022).

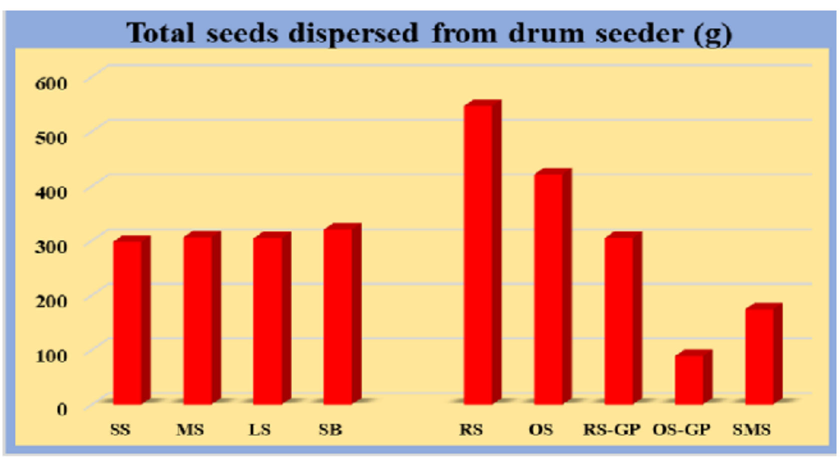

Fig. 1. Effect of various slot modifications and their applicability to diverse seed shapes on seed dispersed from drum (g) during kharif 2021.

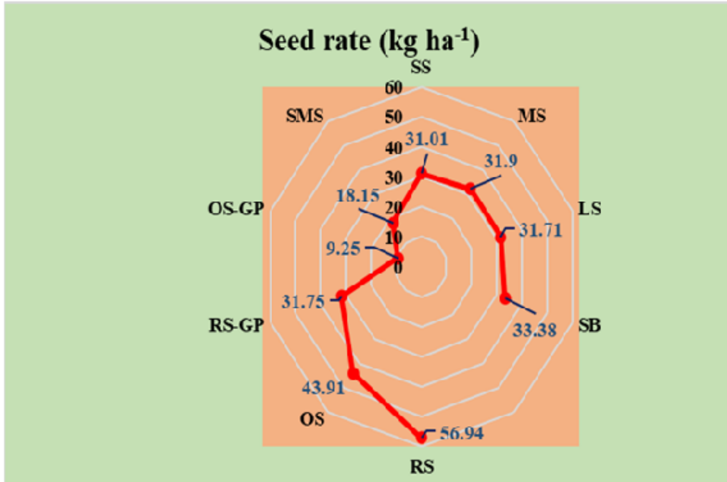

Fig 2. Effect of various slot modifications and their applicability to diverse seed shapes on seed rate kg ha^{-1} during kharif 2021.

Table 3: Effect of various slot modifications and their applicability to diverse seed shapes on plant population m^{-2} during kharif 2021.

	Plant population (m^{-2})					
	RS	**OS**	**RS-GP**	**OS-GP**	**SMS**	**Mean**
SS	60.20	58.60	53.10	52.40	49.30	**54.72**
MS	60.60	58.40	54.30	52.80	49.60	**55.14**
LS	60.00	58.80	54.60	52.60	49.30	**55.06**
SB	60.60	58.60	54.20	52.80	49.00	**55.04**
Mean	**60.35**	**58.60**	**54.05**	**52.65**	**49.30**	

Note: (i) Seed type: VGD 1 Short Slender (SS), ADT 45 Medium Slender (MS), MDU 6 Long Slender (LS), ASD 16 Short Bold
(ii) Slot modification: Round Slot (RS), Oval Slot (OS), Round Slot with guiding pipe (RS-GP), Oval Slot with guiding pipe (OS- GP), Self Metering Slot (SMS)

SUMMARY AND CONCLUSION

Comparing the different slot modification in drum seeder using varying seed shapes the minimum flow rate, seed dispersion was noted with Oval slot fitted with guiding pipe used with different seed shapes of rice varieties used in the experiment. The maximum flow rate and seed dispersion were observed in round slot with VGD 1, ADT 45, MDU 6 and ASD 16 compared to other slot modification in drum seeder. Oval slot with guiding pipe recorded minimum flow rate and seed dispersion. There is significant influence among the varieties due to varying seed size of each variety. MDU 6 and ASD 16 recorded minimum flow rate, seed dispersion, seed rate and plant population and was presented in (Table 3). Similar findings given by Kumar *et al*. (2017).

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Conflict of Interest. None.

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