

STUDY OF SEED AND FERTILIZER DROPPING IN VARIOUS SEED-CUM-FERTILIZER DRILL

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ABSTRACT

Seed-cum-fertilizer drill performs the sowing operation of the seeds and fertilizer at particular seed rate and fertilizer rate at which farmer want to sowing. Calibration of two different types of seed-cum-fertilizer drills (shutter opening and lifting hopper type) was done to find the seed rate of wheat and pigeonpea. The fertilizer (DAP) rate was also calibrated for both type of seed-cum-fertilizer drill. In shutter opening type seed-cum-fertilizer drill, seed rate and fertilizer rate was found as 196 to 206 kg/ha for wheat (Variety: MP Sortex), 29 to 30 kg/ha for pigeonpea (Variety: GT 101), and 101 to 111 kg/ha for fertilizer (DAP). As same experiment, in lifting hopper type seed-cum-fertilizer drill, seed rate and fertilizer rate was found as 141 to 146 kg/ha for wheat (Variety: GW 496), 27 to 31 kg/ha for pigeonpea (Variety: GT 101), and 143 to 147 kg/ha for fertilizer (DAP). There was also experimented for the measuring the mechanical damage to the seeds and no mechanical damage found after experiment. The variation in distribution of seeds and fertilizer in different furrows was measured. As per the IS-6316:1993, the variation in weight of seeds and fertilizer dropping in particular outlet should not be more than 7 per cent and 12 per cent, respectively from the average quantity obtained, which were satisfied in both type of seed-cum-fertilizer drill.

KEY WORDS: *Fertilizer, pigeonpea, rate, seed, seed-cum-fertilizer drill, wheat.*

INTRODUCTION

The basic objective of sowing operation by seed-cum-fertilizer drill is to put the seed and fertilizer in rows at desired depth and maintain seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed without mechanical damage. The traditional method of ground sowing involves the seed dropping by hand in the furrow opened by a country plough or metallic funnel fitted to the plough. But this method is very slow, labour consuming and there is lack of precision, which

affects the yield per hectare. The seed requirement is 10 to 20 per cent higher and it also requires thinning operation (Kalkat, 1978). Seed-cum-fertilizer drill facilitates line sowing and proper application of seed and fertilizer in the field. Thus, there is saving of 10-15 per cent inputs. About 30 per cent saving of fertilizer is estimated, if properly applied (Sahay, 1990).

A seed-cum-fertilizer drill requires calibration to ensure the highest chance of success in any seeding. If you do not calibrate your

drill, you can lose the money you have invested, either by over-seeding some areas or not placing enough seed on the site. Even though you may have set the drill to seed at the desired rate, it is important to calibrate the drill to ensure proper seeding rate (Pratt and Rasmussen, 2001).

Seed-cum-fertilizer drill controls depth of sowing and width of sowing lines of crop that it manages the sowing operation. The use of seed-cum-fertilizer drill has much influenced on the production as well as reduction of labour. Timely sowing and proper fertilizer application shows great effects on the growth of plant and ultimately the production increases.

MATERIALS AND METHODS

For this experimentation, the performance was evaluated with two types of seed-cum-fertilizer drill as; 1. A-Type: Shutter opening type seed-cum-fertilizer drill and 2. B-Type: Lifting hopper type seed-cum-fertilizer drill. The performance was evaluated as calibration of seed and fertilizer rates for seeds of wheat (Variety: MP Sortex) in A-Type seed-cum-fertilizer drill and also wheat (Variety: GW 496) in B-Type seed-cum-fertilizer drill. It was also evaluated for seeds of pigeonpea (Variety: GT 101) in both types of seed-cum-fertilizer drill. This study was done with fertilizer Di-ammonium phosphate in both types of seed-cum-fertilizer drill. Also mechanical damage to the seeds during metering the seeds was measured in both type of seed-cum-fertilizer drill and variation from the average of the seed and fertilizer dropping in the all outlets of both seed-cum-fertilizer drill was calculated and compared with the IS-6316:1993.

Experimental site

The calibration was conducted at the Department of Farm Machinery & Power, Collage of Agricultural

Engineering and Technology, Junagadh Agricultural University, Junagadh (Gujarat).

Hopper and metering mechanism

In A-Type seed-cum-fertilizer drill, the feed rate is controlled by shutter opening. The shutter lies between hopper and seed or fertilizer metering mechanism of an MS channel. Adjustment of this shutter makes the clearance between hopper and seed or fertilizer metering mechanism. This clearance allows the seeds or fertilizer to fall in box of seed or fertilizer metering mechanism from where metering mechanism takes the seeds or fertilizer for metering. In B-Type seed-cum-fertilizer drill, the feed rate is controlled by up and down movement of hopper. Here, a screw is provided to up and down movement of whole hoppers. This adjustment makes clearance between the hopper and seed or fertilizer metering mechanism. This clearance allows the seeds or fertilizer to fall in box of seed or fertilizer metering mechanism from where metering mechanism takes the seeds or fertilizer for metering.

Adjustments

Various adjustments of seed-cum-fertilizer drills are presented in Table 1. **Calibration and mechanical damage**

As per the INDIAN STANDARD TEST CODE IS-6316:1993 procedure, calibration of seed and fertilizer rate of both types of seed-cum-fertilizer drills was carried out in the laboratory for wheat and pigeonpea seeds with DAP fertilizer. Aimed with field operation situation, the study was done at different three hopper filled conditions as full, 3/4, 1/2 and 1/4 capacity of hopper. Collected seeds and fertilizer amount weight was result of 15 revolutions of ground wheel in the laboratory at risen condition of seed-cum-fertilizer drill.

Mechanical damage to the seeds was found as:

$$\text{Mechanical damaged seeds (\%)} = \frac{\text{Wt. of damaged seeds}}{\text{Wt. of total collected seeds}} \times 100$$

RESULTS AND DISSCUSION

It was observed that, the performance evaluation of two types of seed-cum-fertilizer drill was tested for aspects of seed dropping rate and fertilizer dropping rate at various hopper filling. It was also tested the mechanical damages in seeds at particular situation. 100 gsample was collected from each furrow openers and there was no mechanical damage to seeds in both seed-cum-fertilizer drill was noticed after passing through the metering mechanism.

Result of A type seed –cum-fertilizer drill

The calibration of seed-cum-fertilizer drill in the laboratory was carried out result of 15 revolutions of ground wheel for wheat (Variety: MP Sortex) and pigeonpea (Variety: GT 101) seeds and fertilizer (DAP) at various full, 3/4th, 1/2 and 1/4th capacity of the hopper. The observations of collected seed and fertilizer in particular outlets and average seed and fertilizer rate were recorded and presented in Table 2. The requirements as per Indian Standard to conforming allowable percent, mechanical damage and limiting seed and fertilizer rate is presented in Table 3.

Result of B type seed –cum-fertilizer drill

The calibration of seed-cum-fertilizer drill in the laboratory was carried out result of 15 revolutions of ground wheel for Wheat (Variety: GW-496) and Pigeon pea (Variety: GT-101) seeds and fertilizer (DAP) at various full, 3/4th, 1/2 and 1/4th capacity of the hopper. The

observations of collected seed and fertilizer in particular outlets and average seed and fertilizer rate were recorded and presented in Table 4. The requirements as per Indian Standard to conforming allowable variation percent, mechanical damage and limiting seed and fertilizer rate is presented in Table 5.

CONCLUSIONS

The major conclusions drawn from this experiment were:

- 1.The average seed rate in A-Type seed-cum-fertilizer drill of wheat (Variety: MP Sortex) and pigeonpea (Variety: GT 101) was observed as 196 to 206 kg/ha and 29 to 30 kg/ha with the average fertilizer rate was 101 to 111 kg/ha, which conforms Indian Standard requirements.
- 2.The average seed rate in B-Type seed-cum-fertilizer drill of wheat (Variety: GW 496) and pigeonpea (Variety: GT 101) was observed as 141 to 146 kg/ha and 27 to 31 kg/ha with the average fertilizer rate was 143 to 147 kg/ha, which conforms Indian Standard requirements.
- 3.The mechanical damage to the seeds was not observed in both types of seed-cum-fertilizer drill, which conform Indian Standard requirements.
- 4.The variation in dropping of seed and fertilizer in both type of seed-cum-fertilizer drill was found less than 7 per cent and less than 12 per cent, respectively which conforms Indian Standard requirements.
- 5.Over-all performances of both type of seed-cum-fertilizer drill were as per the Indian Standard requirements and are satisfactory.

REFERENCES

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Table 1: Details of adjustments

Sr. No.	Details	A-Type Seed-Cum-Fertilizer Drill	B- Type Seed-Cum-Fertilizer Drill
1	Feed rate	Through opening shutters	Up and down movement of hoppers
2	Spacing of furrow openers	Through holes provided on toolbar	Through holes provided on toolbar
3	Depth of sowing	Through hydraulic control	Through hydraulic control
4	Height of covering device	Not provided	Not provided
5	Drive wheel height	Height adjustable	Height adjustable
6	Reduction ratio of drive mechanism	By interchanging drive and driven sprockets of drive wheel	By interchanging drive and driven sprockets of drive wheel
7	Bund forming device	Not provided	Not provided

Table 2: Seed and fertilizer collection in A-type seed-cum-fertilizer drill

Sr. No.	Hopper Capacity/Feed Rate setting	Average Weight of Seeds Collected From Furrow Openers (g) (Min.-Max.)	Average Seed Rate or Fertilizer Rate (kg/ha)
A. Wheat:			
1	Full capacity	105 to 118	176
2	3/4th capacity	104 to 115	170
3	½ capacity	102 to 111	169
4	1/4th capacity	106 to 118	175
B. Pigeonpea			
1	Full capacity	42 to 45	36
2	3/4th capacity	42 to 44	25
3	½ capacity	43 to 46	26
4	1/4th capacity	42 to 46	26
C. Fertilizer			
1	Full capacity	49 to 52	78
2	3/4th capacity	48 to 55	81
3	½ capacity	50 to 56	83
4	1/4th capacity	52 to 57	86

Table 3: Conformation with IS code of A-type seed-cum-fertilizer drill

Sr. No.	Performance Requirements	Observed	Conformation to IS
1	The variation in dropping of seed and fertilizer in different feeding outlets separately shall be not more than 7% and 12.5% respectively from the average quantity obtained.	Wheat:(-) 6.20 to 6.77 %; Pigeon pea: (-) 5.26 to 6.93 %; Fertilizer: (-) 6.80 to 6.81 %	Conforms
2	The seed and fertilizer rate shall be easily adjustable up to 125 kg and 1000 kg per hectare respectively.	Adjusted through opening shutter	Conforms
3	The percentage of visible damage to seed in the drill shall not exceed 0.5 percent.	Nil	Conforms
4	The variation in dropping due to box filling at $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of rated capacity shall not exceed 10%	Wheat:(-) 7.34 to 8.11%; Pigeon pea:(-) 6.85 to 9.59 %	Conforms

Table 4: Seed and fertilizer collection in B-type seed-cum-fertilizer drill

Sr. No.	Hopper Capacity/Feed Rate setting	Average Weight of Seeds Collected From Furrow Openers (g) (Min.-Max.)	Average Seed Rate or Fertilizer Rate (kg/ha)
A. Wheat			
1	Full capacity	41 to 46	115
2	3/4th capacity	42 to 46	115
3	$\frac{1}{2}$ capacity	43 to 48	120
4	1/4th capacity	42 to 47	118
B. Pigeonpea			
1	Full capacity	24 to 27	22
2	3/4th capacity	25 to 27	23
3	$\frac{1}{2}$ capacity	24 to 26	22
4	1/4th capacity	26 to 29	24
C. Fertilizer			
1	Full capacity	45 to 50	126
2	3/4th capacity	41 to 46	114
3	$\frac{1}{2}$ capacity	42 to 48	119
4	1/4th capacity	45 to 50	126

Table 5: Conformation with IS code of B-type seed-cum-fertilizer drill

Sr. No.	Performance Requirements	Observed	Conformation to IS
1	The variation in dropping of seed and fertilizer in different feeding outlets separately shall be not more than 7% and 12.5% respectively from the average quantity obtained.	Wheat:(-) 6.53 to 6.82 %; Pigeon pea: (-) 6.45 to 6.57 %; Fertilizer: (-) 6.67 to 6.99 %	Conforms
2	The seed and fertilizer rate shall be easily adjustable up to 125 kg and 1000 kg per hectare respectively.	Adjusted through hopper up-down movement	Conforms
3	The percentage of visible damage to seed in the drill shall not exceed 0.5 percent.	Nil	Conforms
4	The variation in dropping due to box filling at $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{3}{4}$ of rated capacity shall not exceed 10%	Wheat:(-) 8.52 to 9.86%; Pigeon pea:(-) 8.41 to 8.57 %	Conforms

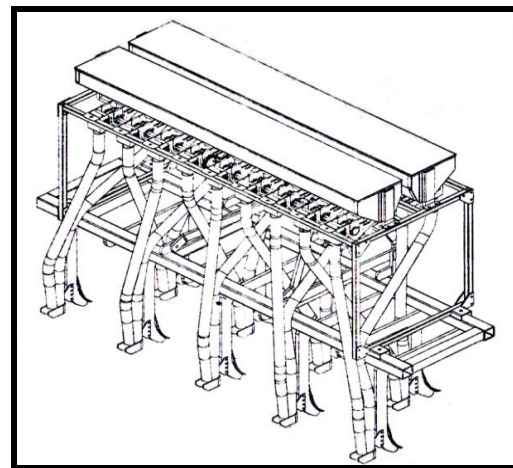
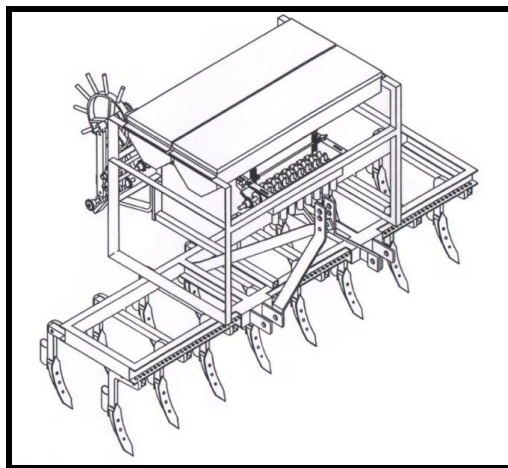


Figure 1: Schematic view of A-Type and B-Type seed-cum-fertilizer drill.

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