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Effect of seed release height on seed scattering at different Bt cotton seed category

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ABSTRACT : The purpose of this research was to examine the effect of different seed release height of planting cotton with reference to the precision planting. The planter was operated at a fixed tractor forward speed of 4 km/h. The seed uniformity (seed to seed distance in row), with in 10m sown by the planter and number of seeds per hill and hill to hill distance, distribution of seed and seed scattering were recorded. The minimum scattering of seeds within the hill was observed at seed release height of 30 cm in the entire seed category. The maximum scattering of seeds in hill distance was recorded at 90 cm seed release height. It is also clear that average hill to hill distance was sown within acceptable seed spacing (72.5 to 77.5 cm) in all combination. Minimum co-efficient of variation hill to hill spacing was observed at seed release height of 30 cm in all the seed size. The maximum co-efficient of variation of hill distance was recorded at 90 cm seed release height.

KEY WORDS : Distribution pattern, Seed scattering, Seed release height

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Precision planters are planting a desired quantity of seed without scattering, at regular intervals along the row. Therefore, seed metering unit for a precision planters should grip a desired amount (number of seed) of seed per hill and drop them on the soil at equal spaced. The scattering of seeds results unevenly sown hills, which require an additional work to thin or transplant later. It is generally known that the scattering is caused mainly by the improper design of the metering unit and seed tube. Straight and short seed tubes reduce the scattering. Planters like the inclined cell plate type Bt cotton planter reduce the scattering by seed metering unit in the lower part of seed tube low enough to reduce the impact velocity against soil. The precision seeding offer numerous advantages to the research which reduce thinning cost reduced to shock to plants during thinning. Basin (1966) maintains that the key factor of precise drilling with belts is the timely placement of seeds into the belt opening and adequate filling of each hole of the drilling unit. He states that the process of filling the holes with seed proceeds in three steps. The first step is the arrival of seed to the hole on the belt, the second step is its entry into the hole and the third step is the placement of seed into the hole. The course of each step depends on different factors, such as the difference between the whole dimensions and the seed size, linear speed of the drilling belt and seed weight (Howard, 1986).Buzenkov and Brandt (1970) established that after the seed is ejected from the drill mechanism, it drops into the small furrow made by the coulter. The characteristics of seed ejection depend on the amount of kinetic energy that makes seeds bounce against the bottom of the furrow. To reduce this bouncing, a decrease in the kinetic energy of the seed may be achieved by lowering the height of the drill mechanism above the soil surface, and by eliminating the horizontal component of seed velocity through ejection in the direction opposite to the drill movement (Brunotte, 1986). Reduction of the seed kinetic energy to zero does not fully eliminate seed bouncing against the furrow bottom because the seed is not always round and the furrow bottom is not level.

Seed scattering has been a problem in inclined cell plate type Bt cotton planter. The Bt cotton planting machine was improved from planters for existing cotton planter.

The inclined cell plate type planter for Bt cotton seed was used in this study. The experiment conducted during of the year 2009-10 in department of farm power and machinery, CCS HAU, Hisar (Haryana).

Table A : Seed specifications of different Bt cotton seed

Sr. No.	Seed category	Seed dimensions, mm (L × b × t)	Avg. weight of 100 seed, g	Sphericity, %
1.	C-1	8.34×4.91×4.38	8.03	67.62
2.	C-2	7.20×4.42×3.40	6.83	66.18
3.	C-3	9.45×5.37×4.75	10.86	64.01

The tractor operated Bt cotton planter under actual field condition, it was tested at three different heights of seed release (90 cm, 60 cm and 30 cm), at two seed size Bt cotton. Bt cotton seed with seed specification are given in Table A. Theoretical seed to seed spacing (70-80 cm) and seed rate (2.25 to 2.75 kg/ ha) were selected based on farmer practices in Haryana state.

The uniformity of seed delivery within the row was determined by using sand-bed test. A sand bed was prepared with sand spread uniformly over a levelled surface. The planter was pulled over the sand bed.

The forward speed of tractor was adjusted equal to the speed of an operator (4 km/ h) in the actual field. The uniformity of seed distribution (seed to seed distance in row), with in 10m sown by the planter and number of seeds per hill and hill to hill distance, distribution of seed and seed scattering were measured.

The seed release height in a planter has considerable effect on the seed distribution pattern in the furrow. Seed spacing with in row was measured by hand after experiments.Performance of planter was evaluated hill to hill distance and seed scattering. The experimental result (seed scattering) was divided according to seed distribution per spacing group.

The accuracy of planting of Bt cotton seeds of three different categories by the inclined cell plate metering unit was evaluated under actual field conditions. Number of seed was recorded on an average 2-3 seeds per hill were obtained with the machine. The seed distribution patterns reported in Table 1 clearly indicate that minimum scattering of seeds (seed to seed distance per hill) within the hill was observed at seed release height of 30 cm in the entire seed category. The maximum scattering of seeds in hill distance were recorded at 90 cm seed release height. When seed release height was increased, the scattering also increased by effect of seeds bouncing of seed tubes and also gravity action on seeds. To reduce bouncing, a decrease in the kinetic energy of the seed may be achieved by lowering the height of drill mechanism above the soil surface (Brunotte,1986). Parish and Bracy (2003)

Table 1 : Seed scattering per hill in different spacing group at different seed release height and seed category

Height of seed release	Seed category	Seed scattering per hill group, %				
		0-4, cm	4-8, cm	8-12, cm	12-16, cm	16-20, cm
30	C-1	14.29	50.00	35.71	-	-
	C-2	41.18	58.82	-	-	-
	C-3	40.00	60.00	-	-	-
60	C-1	10.00	30.00	60.00	-	-
	C-2	36.84	21.05	21.05	21.05	-
	C-3	28.57	71.43	-	-	-
90	C-1	7.69	30.77	7.69	38.46	15.38
	C-2	23.53	11.76	17.65	11.76	35.29
	C-3	14.29	28.57	28.57	28.57	-

Table 2 : Hill to hill distance and coefficient of variation at different seed release height and seed category

Height of seed release	Seed category	Average hill to hill distance, cm	Coefficient of variation, %
30	C-1	76.00	6.42
	C-2	75.20	8.31
	C-3	72.50	9.14
60	C-1	75.50	7.92
	C-2	74.40	12.86
	C-3	74.10	13.54
90	C-1	73.00	13.17
	C-2	77.50	13.53
	C-3	75.12	17.00

studied the drop height influence on seed spacing uniformity and also reported similar results. Wanjura and Hudepseth (1969) reported short seed drop is desirable for best pattern uniformity. Therefore, the seed metering by cell plate and their distribution within the rows were quite satisfactory in all seed category at 30 cm seed release height.

Hill to hill distance had no effect of combination of seed sizes and seed release height. It is also clear from the Table 2 that average hill to hill distance were sown within acceptable seed spacing (72.5 to 77.5 cm) in all combination. The co-efficient of variation for hill to hill distance between seed release height 30 cm, 60 cm and 90 cm were 6.42, 7.92 and 13.17 % in C-1 seed, 8.31, 12.84 and 13.53 % in C-2 seed and 9.14, 13.54 and 17.00 in C-3 seed, respectively. It is clear from table that the co-efficient of variation the hill to hill spacing increased with corresponding increase in seed release height. Minimum co-efficient of variation hill to hill spacing was observed at seed release height of 30 cm in all the seed size.The maximum co-efficient of variation of hill distance was recorded at 90 cm seed release height.

The seed release height from the ground as well as cell plate roller speed ratio significantly influenced the seed distribution pattern in the row. Uniformity of seed distribution in the planted row improved with the decrease in seed release height from 90 cm to 30 cm in all the three varieties (large, medium and small) of Bt cotton. Optimum seed release height in all the three seed sizes observed was 30 cm from the ground level.

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