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Development of laboratory calibration test rig cum sticky belt seed pattern device

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Abstract
Precise amount of seeds in rows is an important factor in crop production, which can affect growth and yield so this to a great extent depends on the performance of the metering mechanism of the seed drill and planter. The important criterion in evaluating seed drill performance is seed spacing uniformity. A laboratory test for calibration of the seed drill was conducted on a test rig. Different rotational speeds (rpm) were selected for the seed meter drive shaft. Then simulating speed in the laboratory Speeds of km/h were chosen for the movement of the test rig. Operated the drill and observation were recorded the number of seeds dropped and the average distance between two seeds for each meter of belt length Repeated the test ten times. The laboratory experimental work and measurements were carried out in the Farm Machinery testing center, CAE, DRPCAU, Pusa. Physical properties of wheat and paddy. Bulk density of wheat is average of 10 samples; it is 0.83gm/cm^3. The 1000gm average weight of wheat seed was found 43.4 gm. Similarly the average bulk density of paddy was recorded 1.5 gm/cm^2 and average weight of weight of 1000 paddy seed was found 48.2gm. The dimension of wheat and paddy seed of 100 samples was taken. The average dimensions of used seed was length, width and thickness in wheat sample was 5.87, 3.34, 2.75 and in case of paddy it was observed 7.62, 2.51, 2.17 respectively.

Keywords: Development, CAE, DRPCAU, Pusa

Introduction
The seed drill is a sowing device that precisely positions seeds in the soil and then covers them. Before the introduction of the seed drill, the common practice was to plant seed by hand. Besides being wasteful, planting was very imprecise and led to poor distribution of seed leading to low productivity Most astronomically immense portion of the upsurge in spawning is credited to increased use of mechanical power and the development of widely effective machines and implements too. Between the machines that contribute to higher yields in today's agriculture are sowing implements such as the planter and seed drill. For the seeding purpose, seed drills are the most widely used machines for planting seeds in India as well as other countries too. An increase of any crop productivity of can be attained through improvement in genetics or through applications of effectual breeding performs or through accumulation. In addition, the precise magnitude of the seeds into the rows are consequential influencer within crop generation, where growth affect & yield is highly dependent on the performance of the sowing implement *i.e.* planter and seed drill measurement mechanism. Consequently, testing of a planter and seed drill is vital important roll work to show performance Properties that influence seeding distribution, seeding rate, etc. In addition, every element of a sowing implement such as planters or seed drills, along the furrow openers, pressure wheels ground wheel & metering mechanisms of the seed metering device, disturb support of the crops. Many other elementary influences such as constant rainfall, inflation of tire, sowing equipments drive wheel slip; variances into sowing rate seeds. The subsurface sowing technique varies from others by the dispersal of seeds on the ground, not in bands or rows, above fully breadth captured by seeder machines. Therefore seeds were conventionally circulated along field. Seed placement and plants generates optimum pabulum areas, densities of seed location, friendliness and high germination in the field, increasing yield by an average of 10 to 30 percent, compared to mundane techniques and of narrow rows. Therefore, based on the analysis of the techniques, it is suggested that to use the sowing technique to acquire and get the regularity and uniformity in seed sowing and an extra ordinary high yield at less economic expenses. Deficiency of planter or seed drill test equipment has been a dilemma at the Agricultural Machinery Test Center basically known as FMTC for the purpose of calibration of seed drop pattern along other test parameters of planter, seed fertilizer planter or variant of

the measurement mechanism of seeds.

Thus, a congruous laboratory test rig cum Seed pattern contrivance is required for to develop test-rig for tracking of seed drill with test procedures and according of test at CAET, DRPCAU, Therefore, it turn out to be highly necessary for the development of the test-rig for the calibration of the seed drill with the mentioned specific objectives. To develop a test Rig for calibration of seed drill at different operational speed and seed drill and evaluate performance in wheat and paddy seed.

Test method can't be helped to expect the uniformity of spacing of the seed of sowing equipment planter in the field. The uniformity of seed spacing enumerated in laboratory tests that greater than or equivalent to the uniformity spacing of seed enumerated by field test. Specified that laboratory test technique can be valuable to eliminate seeder units along deprived uniformity in seed dosage. Tests of Field sowing equipment planter which accomplishes good at laboratory testing should be done properly enumerate the uniformity spacing of seed of planters in field. The outcomes of laboratory tests & test of field could be valuable at defining spaces of perfection of planter or seeders unit.

Review of Literature

J. W. Panning *et al.* (2000) worked on sugar beet planters where field tests as well as laboratory test was happened for seed spacing uniformity for where 5 planters structures were assessed to determine uniformity of seed spacein 3 field speeds by means of field seed placement technique& laboratory technique involved with system optoelectronic sensor. The uniformity of the seed spacing of the planter was termed using the precision coeff. Measure (CP3). The outcomes and results presented that the CP3 measurements coined that by using of laboratory test technique was significantly diverse from enumerated via field test technique. Enumerated that the laboratory Dursun (2000) effectively calculated the uniformity of seed distribution in rows of corn, wheat, carrot and potato planters, with capturing images of the seeds over belt & then evaluating images by a software basis as system of picture processing.

Singh and Raheman (2003) established the sensor basis technique of interference of the light to detect seed leaving from the planter. M. Wiesehoff, D. Karayel, A. Ozmerzi and J. Muller (2005) termed a high-speed system with camera to calculate the uniformity of seed spacing and the rate of seed falling. System Performance of technique used as the camera setup of high speed evaluating system spacing the seed which was equated to an adhesive belt test bench, applied as the reference. The CV of the seed spacing, the falling speed and the CV of the falling speed of the seeds diminished as the rollers speed improved of the metering mechanism.

Guler (2005) elaborated that the seed flow rate in the seeder increased as the dia. of the grooves, the speeds of the fluted rollers and the length dimensions of the active rollers increased. Though, their tests this carried out with the help of a test bench that included an adjustable speed motor, a speed monitor and a speed control unit. Reliant on the kind of metering mechanism applied in a seeder, 2 techniques were usually existing for adjustment of the seeding rate:

A. Varying the length of the active drive roll.
B. Varying the speed of the drive shaft of the seed dispenser.

The calibration test in the laboratory for of the seed drill as sowing equipment was performed on a test rig. 2 rotating speeds of 23 rpm another 16 rpm were particulars for the transmission shaft of the seed meter. 2.5kmph with another one 3.6 kmph Speeds of were chosen for the moving of the test rig.

E P Alekseev *et al.* (2006) stated that the uniformity of the seeds into a soil in a suitable depth of the seeds is attained when the seeds were in the same distance from each ones. Which permits to forming the same conditions for every plants to get the same quantity of heat, light, water and nutrients that disturb germination, tilling, sprouting, destemming, and formation of pods, spikes, flowering and maturation of the seeds. The process of seeds sowing with the selection of equipments of tillage as well as sowing equipments were critical to fulfil the circumstances.

Karayel *et al.* (2006) examined uniformity distribution of seed in soybean and wheat rows along 96% precision through speed camera of 750 fps associated to adhesive belt quantities below conditions of laboratory.

Karayel *et al.* (2006) successfully enumerated that wheat seed spacing 750 fps high-speed- camera. Research carried out 300 fps high-speed-camera could too use to measure spacing between seeds of wheat grains.

Norman (2006) made the optical encoder, who contains light source and disk rotating, with the light sensor as photodetector. The disc, was mounted over the shaft which was rotating, has encoded patterns of transparent sector as well as opaque sectors. Record spins, patterns disturbs emitting of light on a photodetector, producing a pulse signal output of digitally formed. Disc Encoding is the constructed of glass, for applications of extraordinary resolution of (11-16 bit) of metal or with Mylar plastic or for the applications needing a stronger construction (8-10 bit resolution).

Sukhbeer *et al.* (2006) has developed the sunflower seed's test rig to metering mechanically. Test rig developed could accommodate several seed dosing units for sunflower mechanical metering. Evaluated 4 kinds of rollers for seed metering were to optimize spacing of seeds for the sunflower at various 4 feeding speeds as 4.11m min-1, 7.97m min-1, 11.84m min-1 and 16.04. 7.97 m min-1 speed of was resulted to be appropriate for the designed mechanical metering and dosing of sunflower seeds. Uniformity in seed metering had an effect which is considerable over Peripheral speed of the metering roller. Seed metering Uniformity of in terms percentage of cell filling, seed rate, germination of seed & damage of seed they concluded to all roll.

Lemans and Destain (2007) both together finds over topic defining the sowing in the quantity needed by the seeders and evaluated& performance of seeder by camera. To do experiment here, high-speed camera system& an image processing setup with software to quantity uniformity of seeder's seed.

Aboukarima *et al*., (2008) [1] made a test rig for drive the transmission shaft of the seed meter via a motor which is operated by electricity and a pinion system by earth wheel. The Arrangement had the capability to easily drive the shaft of seed drill in laboratory with a simple way. Al-Hamed *et al.* made and established a simple setup laboratory calibration of grain seed drill testing.

Önal and Önal (2009) [15] calculated uniformity distribution of seed in rows of seeds over adhesive belt applied mouse & laser pointer in its place of ruler with meter.

Babeir and Al Suhaibani (2010) demonstrated throughout in study over the performance of 2 grains seed drill in sandy loam soil when sowing wheat that the sowing speed had a significant consequences over the emergence rate.

Anantachar *et al.* (2011) [4] described that regulating the advance speed of the sowing equipment is a significant job to attain the suggested spacing and seed rate. 3 forward speeds castoff for sowing equipment, namely 2.0 kmph, 3.5kmph and 5.0 kmph for the experiments during the sowing of peanut seeds.

Ismett *et al.* (2012) stated about developed vacuum kind unit of precision seeder along dimension of 0.64 meter dia. wheel transfers the motion towards arrangement of gears which was vertical vacuum plate. Hgt. of seed dropping were 0.1 m, with 4.5 and 3.5 mm holes were be application for cotton as well as corn in a circular vacuum plate 0.19 m in dia. The seeds out from vacuum plate were at the 60° of angle from the horizontal & applied pressure of vacuum was 6.3 kPa. Peripheral speed of Vp (vacuum plate) along advance speed of planter Vf was enumerated through relationship.

Material and Methods

The experiment was conducted in the Farm Machinery Testing Center Department of Farm Machinery College of Agricultural Engineering Dr. RPCAU Pusa, Samastipur, Bihar. It was established 15 December 2017 near the Kisan Vidyapith situated 250 42' and 260 52 north latitude and 450 42' and 860 02 east longitude.

The whole length is in three pieces and during work it was attached with nut and bolt. Welding machine with different size types of welding rods were used and many wheres the Nut- Bolt of different sizes were used for joining and fastening of frame as well as different parts of entire machine. Hand grinding machine tools and mobile type hand cutter tool for cutting and grinding and sharpening of edges were required for better finishing of machine with the help of MS steel angle iron and the UC bearing, ball bearing system were used there. Lathe machine used for many engineering work as required with the Drill tolls like the Hand drill machine as well as the workshop large drill machine were also used for drilling purpose with the help of different types of drill bits were used as according to the needs.

Test process

Mounted the seed cum fertilizer drill on the developed test rig post and allow 10 meter long belt to travel under the furrow openers or seed tubes in such a way that the speed of the belt is equal to the running speed of the power drive wheel of seed cum fertilizer drill. Apply a sticky layer of grease to the belt to facilitate the proper embedding of seeds without any displacement. The tests were piloted with the support of the developed test-rig cum seed pattern device as stationary test happened. The test rig was definite horizontal travel (not slop an any directions).

Operated the drill and observation were recorded the number of seeds dropped and the average distance between two seeds for each meter of belt length Repeated the test ten times. The laboratory experimental work and measurements were carried out in the Farm Machinery testing center, CAE, DRPCAU, Pusa Test of newly design with operational parameters regarding.

Linear seed magnitudes would performance an important part in farm machinery design Uniform seed spacing had a major role for most row crops for uniformity of plant spacing has been shown to be an important factor in effects in practices of agronomic conditions and also in crop productivity too. Along with even spacing shoot systems, and root could be grown to an optimal level and fulfill the vacant row space without overlapping which had a basically major role.

Different Two rotational speeds (N, rpm) of the driving gear, namely 50, 65 and 75 rpm, were achieved with the help of the electric motor substituted though the variable frequency drive (VFD). Therefore, the simulated speed of the lead wheel, V, could be calculated:

$$v(\text{kmph}) - \frac{N \times P \times 60}{1000}$$

Whereas the N is denoting the rotating speed (in the rpm) of the drive gear mechanisms and P is the circumference of the ground wheel (m). Resulting outcomes simulated speeds are 2.20, 2.75 and 3 km/h. Test of each thing was finished at time T and frequent repeated again and again many time up to the ten times according to BIS. The seeding rate (q, g/s) was computed by equation

$$q = \frac{W}{T} \text{ (g/s)}$$

Whereas the W is denoting the total overall mass of the wheat and paddy which was required in experimental procedure for seeds collected from different 4 tubes of the sowing implement the seeder (g) of seed drill and T is the test time (sec) for the research.

Seed spacing

$$\text{Average seed to seed spacing, cm} = \frac{\text{Sum of spacing}}{\text{Total number of spacing}}$$

Seed rate

$$\text{Seed rate, kg/ha} = \frac{\text{Total number of seeds delivered in 10 m run length} \times 1000 \text{ seed weight, kg} \times 10}{\text{Run length, m} \times \text{desired row to row spacing, m}}$$

Results and Discussions

The physical properties of used seed (wheat & paddy), Uniform seed spacing, Three rotational speeds (N, rpm) of the drive pulley, Miss % were determined. Design of experiment was used for this study. Result obtained from the experiments is presented in this chapter with the help of appropriate tables and suitable figures.

Table 1: Physical properties of used seed (wheat & paddy)

S. No.	Seed type	Bulk density (gm/cm^3)	Weight of 1000 seed (g)		
1.	Wheat	0.83	43.4		
2.	Paddy	1.45	48.2		
Seed dimensions (mm)					
Wheat			**Paddy**		
Length	**Width**	**Thickness**	**Length**	**Width**	**Thickness**
5.87	3.34	2.75	7.62	2.51	2.17

The above table shows that the physical properties of wheat and paddy. Bulk density of wheat is average of 10 samples; it is 0.83 gm/cm^3. The 1000 gm average weight of wheat seed was found 43.4 gm. Similarly the average bulk density of paddy was recorded 1.5 gm/cm^2 and average weight of weight of 1000 paddy seed was found 48.2 gm.

The dimension of wheat and paddy seed of 100 samples was taken. The average dimensions of used seed was length, width and thickness in wheat sample was 5.87, 3.34, 2.75 and in case of paddy it was observed 7.62, 2.51, 2.17 respectively.

Table 2: Speed of drive wheel at 100, 75, 50, 25% of speed at seed box of seed cum fertilizer drill dropping of wheat & paddy seeds variation on developed sticky belt

Seed Type	Replication	% of seed	Weight of grain in ten meter						Speed of drive wheel (km)	10m belt cover time (sec)
			Row 1 (gm)	Row 2 (gm)	Row 3 (gm)	Row 4 (gm)	Row 5 (gm)	Row 6 (gm)		
Wheat	R1	100	186.9	178.9	169.6	183.3	178.6	183.3	50	30.72
	R2	100	162.3	170.8	185.2	183.4	185.5	178.2	65	30.86
	R3	100	111.6	119.6	103.4	102.7	104.6	107.8	75	30.91
	R1	75	208.3	191.8	212.7	211.4	210.8	211.6	50	30.77
	R2	75	206.6	187.9	207.8	209.1	204.7	204.7	65	30.76
	R3	75	118.5	128.7	115.2	113.2	114.9	120.2	75	39.71
	R1	50	208.3	191.8	212.7	211.4	210.8	210.5	50	30.82
	R2	50	100.8	109.7	191.0	191.3	194.7	192.9	65	30.16
	R3	50	120.1	129.6	113.2	111.6	112.8	116.6	75	28.99
	R1	25	207.9	211.6	197.1	195.0	195.8	197.2	50	30.12
	R2	25	120.4	130.1	112.4	110.3	114.1	116.9	65	30.16
	R3	25	113.6	121.9	105.5	104.3	107.2	110.9	75	39.81
Paddy	R1	100	296.7	291.5	272.8	291.5	292.6	293.2	50	31.12
	R2	100	299.8	204.4	211.0	294.4	201.4	207.6	65	30.26
	R3	100	121.5	118.8	128.4	120.2	118.2	113.4	75	29.91
	R1	75	203.4	299.3	285.1	201.5	203.0	207.3	50	31.21
	R2	75	208.3	210.0	218.9	205.7	208.4	203.7	65	30.16
	R3	75	180.7	191.6	185.1	181.2	195.1	194.6	75	29.91
	R1	50	204.2	196.1	201.1	200.9	201.7	209.1	50	31.22
	R2	50	101.3	107.0	114.2	102.5	102.7	104.5	65	31.16
	R3	50	114.2	117.2	124.3	112.7	113.2	141.2	75	29.91
	R1	25	193.5	202.1	206.0	197.2	197.5	192.7	50	31.32
	R2	25	102.0	106.0	104.1	100.3	103.9	101.4	65	31.66
	R3	25	113.4	115.6	121.9	112.5	111.2	112.7	75	29.71

The R1, R2 & R3 are average replication and 50,65 & 75 is the RPM of Motor which was controlled by VFD and leaner velocity of belt outcomes simulated speeds are 2.20, 2.75 and 3 km/h.
Table 4.2 shows that the performance of developed test rig was evaluated for calibrating of seed cum fertilizer drill with the different speed with the Wheat and Paddy seed and it was observed The seed dropping from seed metering mechanism (fluted roller) to sticky belt by gravitational force. The evaluation was conducted with 50, 65, and 75 RPM motor and belt speeds are 3.20, 4.75 & 5.25 km/h and the 10 meter distance covered in about 28-32 seconds respectively.
This test was conducted with wheat and paddy grains. In case of wheat it was observed in ten meter of sticky belt the seed dropped in six row with 100, 75, 50, 25% filled seed box ranges between 169.6-186. 9 at 50 RPM of motor speed. Similarly in 55 and 65 RPM it was observed 162.3-185.2, 102.7-119.6 respectively. Similarly 75% of wheat seed in seed cum fertilizer box and it was found at 50, 65, 75 motor RPM grain was collected 191.8 -211.6, 187.9-209.1, 113.2-128.7 gm respectively.
In 50% of grain in seed drill cum fertilizer box it was 191.8-212.7, 100.8-194.7, 11.6-129.6 at the motor RPM 50, 65 and 75 respectively.
25% wheat grain in seed box it was observed at 50, 65 and 75 the grain collected in ranges 195.0-211.6, 210.3-220.4 & 104.3-121.9 gm respectively.
Similarly the evaluation was conducted with the paddy seed with same RPM and it observed at 100% or full seed at seed drill box it was 291.5-297.7, 201.4-299.8,113.4-128.4 at 50 At 75% filled seed box 299.3-201.5, 203.7-218.9, 180.7-195.1 gm at RPM 50, 65, 75 respectively.
At 50% filled seed box 196.1-209.1, 102.5-141.2 & 192.7-206.0 gm at RPM 50, 65, 75 respectively.
At 25% filled seed box 192.7-206,100.3-106.0, 11.2-121.9 gm at RPM 50, 65, 75 respectively.
At 25% filled seed box 192.7-206, 100.3-106, 11.2-121. 9g at RPM 50, 65 and 75 respectively.
Above result shows that at full load 100% seed in seed box of seed drill, the trained of dropped seed on sticky belt was collected more as compared to 75, 50 and 25% respectively. Similarly it was also observed that speed or we can say RPM increased the dropped seed was less and RPM decreased the seed was more as compare collected on the sticky belt of developed Test Rig.

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