RESEARCH ARTICLE

DEVELOPMENT OF CENTRIFUGAL ASPIRATOR OF PNEUMATIC METERING MECHANISM PLANTER OF RAINFED SEEDS

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Abstract: A pneumatic metering mechanism for planting of different seed was developed forprecise planting for groundnut, cotton, okra, sesameseeds. Centrifugal aspirator with radial blade was designed for creating the required vacuum pressure that pressure is required to pick the single seed. The optimum vaccume pressure was found to be 5, 2, 2 and 0.3 kPa for groundnut, cotton, okra, and sunflower. The airflow velocity 3.3 m/s gave the best results, with minimum lateral displacement of the seed. Effect of the different shapes of the seed plate orifice, upon the pneumatic planting of different shaped was analyzed which showed that the proper orifice shape was circular for spherical seed and elliptical for longer and flatter seed. The dimension of the seed plate orifice was 3mm diameter circular plate for okra seed, where as for groundnut, cotton and sesame seed, the elliptical shaped orifice with dimension (5,4.5), (3,3.5),(2.24,0.80) mm longer and shorter axis gave best result. The sizes of the different shaped orifices were analyzed to the effect of seed box exposed area upon the seed picked per orifices. The result for all shaped orifices clearly indicated that the meeting rate increases with the increase in the seed exposed area.

Keywords: Pneumatic metering mechanism, Orifice plate,Centrifugal aspirator, Vacuum pressure

INTRODUCTION

Crop sowing and establishment of the proper crop stand in the field is an important farm operation in any crop production programme. Crops like cotton, groundnut, sunflower and vegetables require precise placement of the seeds for proper growth and development. For sowing of the above crops, farmers in the country are still adopting the traditional methods of sowing, which are not only time and labour consuming, but also give the nonuniform seed spacing. Further, in these methods, farmers use higher seed rate and perform additional thinning operations to obtain optimum plant density in the field. The practice results in higher cost of the seeds and results in lower crop yield of the crops, which are susceptible to proper plant population. Pneumatic metering mechanism is a relatively newer concept of planting of the seeds. These machines use vacuum seed metering principle. The principle offers several advantages, especially the single seed picking, no mechanical damage to the seed and their capability to deal with both bolder and lighter seeds. Several researchers in India and abroad have developed tractor operated pneumatic planters. Adoption of these machines has been quite limited, due to their higher initial cost. Still considering the high accuracy and precision of the machinery, these machines have great potential for adoption for production of high value cash crops; especially requiring highly viable seeds.

Kumaran and Kumar (2004) designed a vacuum precision planter for planting okra and cotton seed and found that the quality of feed index for the seed tested was 76 to 86 percent, with the precision ranging from 23-25 percent.Ozmerzi *et al.* (2002)researched on Effect of sowing depth on precision seederuniformity to determine the effects of different depths of sowing maize with reference to the precision sowing technique. Karayel *et al.(*2004) observed optimum vacuum pressure 40 kPa for maize I and II; 30 kPa for cotton, soya bean and watermelon I; 25kPa for watermelon II, melon and cucumber; 20kPa for sugarbeet; and 15kPa for onion seeds. Singh*et al.* (2005) found that the metering system with a speed of 0.42 m/s, and a vacuum pressure of 2 kPa produced superior results with a quality of feed index of 94.7% and a coefficient of variation in spacing of 8.6%.Gaikwad and Sirohi (2008) found satisfactorily suction pressures of 4.91 and 3.92 kPa and nozzle diameters of 0.46 and 0.49 mm to achieve more than 90% single seed sowing in the case of capsicum and tomatoin low-cost pneumatic seeder for nursery plug trays for manual indenting and small vegetable seeds.Yazgi and Degirmencioglu (2007) on seed spacing uniformity performance of a precision metering unit when vacuum plates with different number of holes were used for the cotton and corn seeds. The forward speed values were as selected as 1.0, 1.5 and 2.0 m/swhile vacuum plates with hole diameter of 3.5 mm for cotton and 4.5 mm for corn seeds were used.. In the experiments, vacuum pressure was applied at 6.3 kPa.

MATERIAL AND METHOD

Development of pneumatic metering mechanism planter of lighter and bolder seed for groundnut, cotton, sesame and okra seeds. Study on physical

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parameter of seed and Factors affecting the performance of pneumatic metering mechanism and design of aspirator blower, optimization of suction pressure, different shapes of orifice openings of seed plate.the study was carried out at CIAE Bhopal.

Concept of pneumatic planting

The pneumatic planting concept is based on the suction pressure. An aspirator is used, to develop the suction pressure in the suction chamber, inside the pneumatic disc. The seeds are held against the orifice, made on the seed metering plate, due to the suction pressure, as the plate passes through the seed hopper. The seeds are held on the orifices, till it reaches the chamber open to the atmosphere. In the chamber open to the atmosphere, the seed is exposed to the atmospheric pressure. Thus, the suction pressure is cut off and the seeds are dropped on the grease belt or on the soil surface, under gravity.

Factors affecting the performance of pneumatic metering mechanism planter

The size, shape and weight of the individual seed have predominant effect upon the performance of the pneumatic seed metering mechanism. Variation of sizes and weight of the seeds would require variation in size of orifice on the seed plates and range of suction pressures for effective single seed pick up without misses. The leakage of the suction pressure from the vacuum chamber into the chamber open to the atmosphere, in the pneumatic disc would result in improper release of the lighter seeds. Similarly, the different shapes of the different seeds would also have some effect upon the planting accuracy. These aspects need suitable solution for development of an effective pneumatic planter for adoption. The leakage of the suction pressure from the vacuum chamber intothe chamber open to the atmosphere, in the pneumatic disc would result in improper release of the lighter seeds.

Physical dimensions of the seeds

From the design point of view of the pneumatic planting system, it was necessary to determine the various physical dimensions of the seeds. The average length, width & thickness of the different seeds were determined by randomly selecting the 100 kernels of each seed from the seed lot.

Different shapes of orifice openings on the seed plate.

Seed plate orifices of different shape viz, circular, elliptical and triangular were selected. The sizes of all the shapes were determined, with the consideration that the exposed area to the seed is same for all the three shaped orifices.

Sphericity of the seeds was calculated by the Following formula,

$$\text{sphericity, } \phi = \frac{[lbt]^{\frac{1}{3}}}{l} 100 \qquad \text{....1}$$

Where Φ is Sphericity in %, l,b,t is Average length, width, and thickness of the seeds.

Circular shaped orifice

The size of metering orifice was determined from the following relationship

$$d_0 = 0.6 b_{av} \qquad \text{....2}$$

Where, d_o is the size of metering orifice in mm, b_{av} is Average width of seed to be held in mm.

Then, the seed exposed area was determined from the following equation;

$$A = \frac{\pi}{4} d^2 \qquad \text{....3}$$

Where, A is Seed exposed area in mm^2, d_o is Size of metering orifice (mm)

Triangular shaped orifice

The dimension of the triangular shaped orifice was calculated from the following equation;

$$A = \frac{\sqrt{3}}{4} s^2 \qquad \text{....4}$$

Where, A is Seed exposed area in mm^2, s is Side of the equilateral triangular orifice in mm.

Elliptical shaped orifice

For finding the dimension of the elliptical shaped orifice, the ratio of the average thickness and average width was taken and the length of the longer axis of elliptical shaped hole was taken equal to the multiplication of the ratio to the shorter axis.

Mathematically,

$$A = \pi \gamma a^2 \qquad \text{....5}$$

Where, A is Seed exposed area in mm^2,a is longer axis of the elliptical shaped hole in mm, b is Shorter axis of the elliptical shaped hole in mm equal to γ. a, γ is ratio of the average thickness to the average width of the seed.

Theoretical design consideration of pneumatic metering mechanism planter

During operation of the centrifugal aspirator, energy from the shaft is transferred to the air flowing through impeller blades. The air is rotated about the center of the impeller at an angular velocity. The resulting centrifugal force moves the air towards the periphery and through it into the passage, surrounding the impeller. As the air is moved, from the center to the periphery of the impeller, the work done by the centrifugal force in the impeller channel, changes the flow energy and the kinetic energy of the air is converted into the pressure energy.

Air flow and static pressure requirement

The airflow rate required for the aspirator was decided on the basis of the terminal velocity required to pick single seed and the total cross sectional area of the suction chamber in the pneumatic disc. As groundnut was the heaviest of the seeds, its terminal velocity 10.87; for variety JL-24 was considered (Kachru *et al*., 1994). For creating the suction pressure inside the pneumatic disc, the total cross sectional area of the suction chamber was calculated. Slot was made between the PCD 220mm and 200 mm on the vacuum baffle for creating the suction. The suction chamber was over 330^0 portion of the disc. Thus, the cross sectional area was calculated from the given formula,

$$A = \frac{\pi}{4} \times \frac{\theta}{360} \times \left(d_2^2 - d_1^2\right)n \qquad ....6$$

Where, A is Cross sectional area of the vacuum chamber in m^2, θ is Angle of slot of the vacuum chamber on the pneumatic disc in degree, d_1, d_2 is Outer and inner diameter of the vacuum chamber in m n is Number of suction chambers in pneumatic metering unit.

$$A = \frac{\pi}{4} \times \frac{330}{360} \times \left(0.22^2 - 0.20^2\right) \times 4$$

$$A = 0.024m^2$$

Therefore, the actual quantity of the airflow required, Q was calculated as,

$$Q = A \times V \qquad ......7$$

$$Q = 0.024 \times 10.87$$

$$Q = 0.26m^3/s$$

The static head is the difference of the outlet and the inlet pressure. The design pressure at the inlet was chosen as suction requirement of groundnut seed (Singh *et al.*, 2001), and pressure at the outlet was decided such that the suction pressure of 5.4 kPa is maintained at the inlet. Thus, static pressure 'H' worked out as,

H= Outlet pressure – inlet pressure

=(Atmospheric pressure + inlet pressure) – inlet pressure

=(10.33 + 0.54) – 0.54

=10.33 m of water column.

Thus, the aspirator was to be designed for airflow of 0.26 m^3/s and total head of 10.33 m of water column.

Design of the impeller

Impeller inlet diameter was calculated from the equation,

$$d_1 = 3.65 \times (Q/N)^{\frac{1}{3}} + 0.02 \qquad .....8$$

Where,d1 isimpeller inlet diameter in m, N is rpm of the impeller; taken as 6000 rpm,

Therefore, $d_1$for the design parameters worked out as,

$$d_1 = 3.65 \times \left(\frac{0.26}{6000}\right)^{\frac{1}{3}} + 0.02$$

$$d_1 = 0.15m$$

The ratio of the impeller outlet to the inlet diameter generally varies from 1.6 to 2.7. Taking the ratio as 2.7,

$$d_2 = 2.7 \times d_1 \qquad ...9$$

$$d_2 = 2.7 \times 0.15$$

$$d_2 = 0.4m$$

Where, d2 isOuter diameter of the impeller in m.

Diameter of the shaft

The diameter of the shaft was decided from the torque requirement, which in turn, was determined from the power requirement at a given speed. The power requirement of the aspirator was calculated as,

$$P_{mot} = m\frac{Q'H'g}{1000\eta\eta_{tr}} \qquad .....10$$

Where, Pmot **is** Power required for running the motor in hp, Q' is Actual air flow required; taken as 1.2 times theoretical airflow required, m^3/s H' is Actual static head, taken as 1.05 time theoretical head in m, η is Efficiency of the motor, assumed to be 75%, ηtrisTransmission efficiency, taken as 92% for V-belt transmission.

$$P_{mot} = 1.2\frac{1.20 \times 0.26 \times 1.05 \times 10.33 \times 9.81}{1000 \times 0.75 \times 0.92}$$

$$P_{mot} = 0.06kW$$

$$P_{mot} = 0.08hp$$

Torque transmitted was calculated from the formula,

$$P_{mot} = \frac{2\pi NT}{4500} \qquad ...11$$

Where, P is Power required in hp, N is Impeller speed in rpm, T is Torque transmitted in kg-m

$$0.08 = \frac{2\pi \times 6000 \times T}{4500}$$

$$T = 0.01kg - m$$

$$T = 1kg - cm$$

Diameter of the shaft was calculated from the given equation,

$$T = \frac{\pi}{16} f_s d^3 \qquad .....12$$

Where, T is Torque transmitted by the shaft in kg-cm, f**s is** Torsional strength of the material, taken as 600kg/cm^2 for mild steel

d = Diameter of the shaft, cm

$$d^3 = \frac{16 \times 1}{\pi \times 600}$$

$$d = 0.2cm$$

As the calculated diameter of the shaft was very small, a shaft of standard diameter 2.5 cm was selected for the study (Pandya and Shah, 1983).

Design of Impeller hub

Impeller hub diameter is taken as 1.2 to 1.4 d.

$$d_{hub} = 1.2 \times d \qquad ....13$$

$$d_{hub} = 1.2 \times 2.5$$

$$d_{hub} = 3cm$$

The length of the hub is taken as 1 to 1.5 times the hub diameter.

$$l_{hub} = 1.4 \times d_{hub} \qquad ...14$$

$$l_{hub} = 1.4 \times 3$$

$$l_{hub} = 4.2cm$$

Design of the blades

The inlet blade width is determined from the discharge equation,

$$b_1 = \frac{Q}{\pi d_1 c_1 \mu_1} \qquad ....15$$

Where, Q is Air flow rate in m^3/s d1 is Impeller vane inlet diameter in m, c1 is velocity at the impeller eye in m/s, μ_1 is Factor against the blockage of air by the blades; taken as 0.85.

The velocity at the impeller inlet is calculated from the equation,

$$c_1 = \frac{4Q}{\eta_v \pi \left(d_2^2 - d_{hub}2\right)} \qquad ...16$$

Where, $\eta_v$isVolumetric efficiency; taken as 0.98

$$c_1 = \frac{4 \times 0.26}{0.98 \times \pi \times \left(0.15^2 - 0.03^2\right)}$$

$$c_1 = 15.65 m/s$$

Putting the value of $c_1$in equation15,

$$b_1 = \frac{0.26}{0.85 \times \pi \times 0.15 \times 15.65}$$

$$b_1 = 0.041m$$

$$b_1 = 4cm$$

For the uniform thickness of blades, the width of the blade at the outer end is taken equal to the width of the blade at inlet i.e. 4 cm.

As in the Fig.1 *i* is the inclination of the blade with the disc plain; assumed to be 4^0.

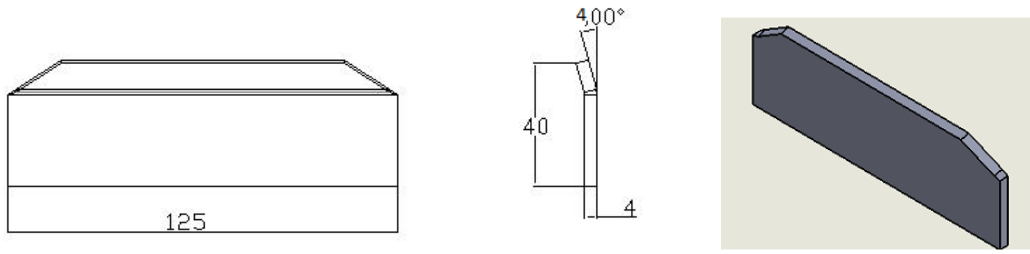
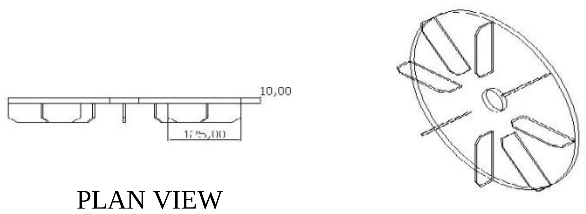


Fig.1. Impeller blade profile



PLAN VIEW

ISOMETRIC VIEW

Fig.2. Side view of impeller blade.

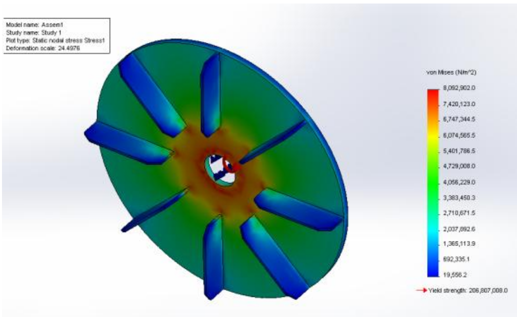


Fig. 3. static stress analysis.

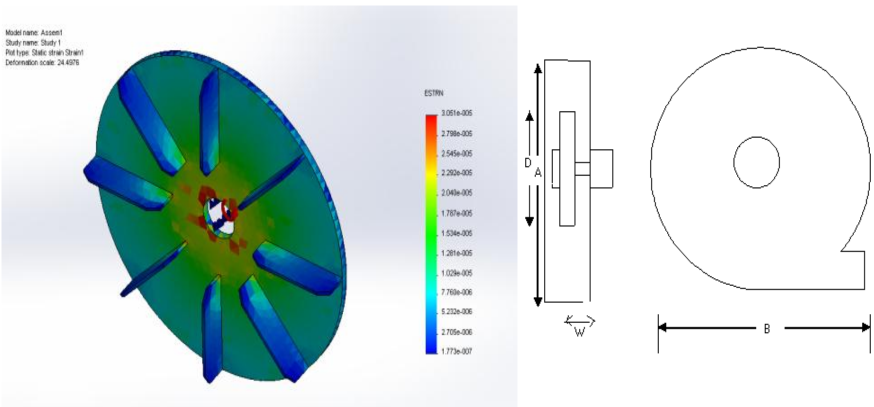


Fig.4. static strain analysisand Impeller casing

The value of β_1 is calculated from the equation,

$$\tan\beta_1 = \frac{c_1}{u_1} \quad \text{....17}$$

Where, u1 is Peripheral component of the velocity at the impeller inlet, in m/s and was calculated as follow

$$u_1 = \frac{\pi d_1 N}{60} \quad \text{....18}$$

$$u_1 = \frac{\pi \times 0.15 \times 6000}{60}$$

$$u_1 = 45.65 m/s$$

Putting the values of c1 and u1 in equation 3.17,

$$\tan\beta_1 = \frac{15.65}{45.65}$$

$$\beta_1 = 19^0$$

Thus, β_{1v} can be calculated as

$$\beta_{1v} = \beta_1 + i \quad \text{....19}$$

$$\beta_{1v} = 19 + 4$$

$$\beta_{1v} = 23^0$$

β**2v** is the blade angle at the outlet and is taken as twiceβ_{1v}, thus its value was 46^0.

Therefore, number of blades was calculated from the Pliederer empirical formula,

$$Z = 6.5\frac{m+1}{m-1} Sin\frac{\beta_1+\beta_2}{2} \quad \text{....20}$$

Putting the values of m, $\beta_{1v}$and β_{2v}in the above equation,

$$Z = 6.5\frac{2.7+1}{2.7-1} Sin\frac{23_1+46}{2}$$

$$Z = 8.01$$

Thus, the number of blades was selected to be 8.

Design of aspirator housing

The configuration of aspirator housing considerably affects the performance of a centrifugal aspirator and thus, it is as important as aspirator impeller. The size of housing should be decided, based on the space availability. The purpose of the housing is to control the airflow, from the inlet to the discharge, and in the process, to convert the velocity head into the static pressure head. Pressure conversion is accomplished, as the cross-section of the air stream increases, in the increasing annular space. The dimensions of the different section of the aspirator housing were determined by following formula:

$$A = 1.7d_2 \quad \text{......21}$$

$$A = 1.7 \times 40$$

$$A = 68cm$$

$$B = 1.5d_2 \quad \text{......22}$$

$$B = 1.5 \times 40$$

$$B = 60cm$$

$$C = 1.25b + 0.1d_2 \quad \text{....23}$$

$$C = 1.25 \times 4 + 0.1 \times 40$$

$$C = 9cm$$

Table1. Design values of Aspirator.

S.NO.	Centrifugal Aspirator	Values
1	Impeller outside diameter, cm	40
2	Impeller inlet diameter, cm	14.50
3	Impeller thickness, cm	4
4	Type of blade	Radial
5	Number of blades	8
6	Inlet blade angle	23^0
7	Outlet blade angle	46^0
8	Diameter of the shaft, cm	2.50
9	Diameter of the hub, cm	3.0
10	Hub length, cm	4.2
11	Type of casing	Volute type
12	Height of the casing, cm	68
13	Width of the casing, cm	60

Table2. Physical properties of different seed.

Particulars	Ground Nut	Cotton	Sunflower	Okra
Variety	Vaishali	Jk-4	MSH-17	Anamika
Average length, mm	11.51	7.78	9.52	5.80`
Average width, mm	7.49	4.35	5.12	5.03
Average thickness mm	6.76	3.50	3.27	4.70
Weight of 1000 grain g	460	59	49	56
Sphericity, %	72	63	57	89
Designed size of seed plate orifice, mm	4.5	2.6	3.07	3.0

RESULT AND DISCUSSION

Physical properties of different seed

In view of the objective of the study a laboratory pneumatic planting system consisting of aspirator and seed metering assembly was designed and developed.Physiscal properties of different seeds were measured for deciding the shape and size of the seed plate orifice for single seed pickup. Physical properties such as length, width, thikness, sphericity and thousand of weight was measured for groundnut, cotton, sesame and okra as shown in Table 2.

From Table 2 it was observed that groundnut was the largest of the seeds where the average length,width,thickness of seed were 11.51,7.49,and 6.76mm respectively, where as sesame seed was the shortest of the seeds where the average length,width,thickness were 3.19,2.24,and 0.80mm respectively. Groundnut was the heaviest seed in thousand grain weights of 460g while sesame, cotton, and okra of thousand grain weight were of 2.37,59 and 56g respectively.

From the table it was observed that sphericity of okra seed was found 89% which was largest of the seed selected for the all seeds. Being a flat seeds the sphericity of sesame seed was 56% which was least while cotton and groundnut of 63 and 735 respectively in elliptical shape. Seed plate orifice for the groundnut and sesame was longest 4.5mm and 1.35mm respectively. The orifice diameter of okra and cotton were found to be 2.6 and 3mm respectively.

Performance of the circular orifice seed plate under varying suction pressure for different seeds

The study for groundnut, sesame, cotton and okra were carried out with sees plate with circular shaped orifice with 4 number of orifices .the diameter of seed plate orifice for groundnut,cotton,sesame and okra seeds was 4.5,3,1.5, and 3mm respectively.

The Table 3, 4, 5 and 6 shown the placement behavior of the seeds in terms of the number of seeds dropped (skip, single, multiple) for the different seeds. As shown in Table 3 for groundnut seed test conducted at pressure from 3.5to 5.4 kPa and observed that with the increase in the suction pressure, the number of seeds, picked by each orifice increased. The percent of missing and multiple was highest at the suction pressure of 3.5kPa with 32 and 5.4 kPa with 13%.at the suction pressure of 5.0kPa the seed plate gave the highest single seed pickup 93% with no misses and minimum multiple of 7% which was the best performance under the different suction pressure.For cotton seeds test conducted at pressure from 1 to 2.5kPa and observed that the percent missing was highest at suction pressure 1kPa whereas percent of multiples was highest at suction pressure of 2.5kPa.The highest percent of single seed were picked at a suction pressure of 2.0kPa with 92% with no missing and 8% multiples shown in Table 4.

For sesame seed test conducted at pressure from 0.1 to 0.35kPa and observed that percent missing was highest at suction pressure 0.1kPa whereas percent of multiples was highest at suction pressure of 0.35kPa. The highest percent of single seed were picked at a suction pressure of 0.30kPa with 92% with no missing and 8% multiples shown in Table 5. For okra seed test conducted at pressure from 1 to 2.5kPa and observed that percent missing was highest at suction pressure1kPa whereas percent of multiples was highest at suction pressure of 2.5kPa. The highest percent of single seed were picked at a suction pressure of 2kPa with 91% with no missing and 9% multiples shown in Table 6.It was observed that suction pressure required to pick the individual seed dependent upon the weight of the seeds. Due to heavier weight of Groundnut it requires high suction pressure while in sesame require low pressure due to lighter weight.This result resemble the work done by Short and Hubber (1970) and Karayel(2004).

Table 3. Performance of the 4.5 mm circular orifice seed plate under varying suction pressure for groundnut seed

S.No	Suction pressure inside pneumatic disc kPa	Particulars of seed per orifice	% picking
1	3.5	Skip (0)	32
		Single (1)	68
		Multiple (>1)	0
2	4.5	Skip (0)	14
		Single (1)	84
		Multiple (>1)	2
3	5.0	Skip (0)	0
		Single (1)	93
		Multiple (>1)	7
4	5.4	Skip (0)	0
		Single (1)	87
		Multiple (>1)	13

Table 4. Performance of the 3.0 mm circular orifice seed plate under varying suction pressure for cotton seed

S. No	Suction pressure inside pneumatic disc kPa	Particulars of seed per orifice	% picking
1	1.0	Skip (0)	26
		Single (1)	73
		Multiple (>1)	1
2	1.5	Skip (0)	10
		Single (1)	85
		Multiple (>1)	5
3	2.0	Skip (0)	0
		Single (1)	92
		Multiple (>1)	8
4	2.5	Skip (0)	0
		Single (1)	84
		Multiple (>1)	16

Table 5. Performance of the 1.5 mm circular orifice seed plate under varying suction pressure for sesame seed

S.No	Suction pressure inside pneumatic disc kPa	Particulars of seed per orifice	% picking
1	0.1	Skip (0)	32
		Single (1)	68
		Multiple (>1)	0
2	0.25	Skip (0)	11
		Single (1)	85
		Multiple (>1)	4
3	0.3	Skip (0)	0
		Single (1)	92
		Multiple (>1)	8
4	0.35	Skip (0)	0
		Single (1)	84
		Multiple (>1)	16

Table 6. Performance of the 3.0 mm circular orifice seed plate under varying suction pressure for okra seed

S.No	Suction pressure inside pneumatic disc kPa	Particulars of seed per orifice	% picking
1	1.0	Skip (0)	23
		Single (1)	74
		Multiple (>1)	3
2	1.5	Skip (0)	12
		Single (1)	83
		Multiple (>1)	5
3	2.0	Skip (0)	0
		Single (1)	91
		Multiple (>1)	9
4	2.5	Skip (0)	0
		Single (1)	81
		Multiple (>1)	19

Table 7. Effect of size of the seed plate orifice upon pneumatic planting

S No	seed	Shape of the orifice	Dimension (mm)	Miss	Single	Multiple
1	Groundnut	Elliptical	(5.5 x 5)	0	89	11
			(5 x 4.5)	0	93	7
2	Cotton	Elliptical	(3.5 x 3)	0	86	14
			(3 x 2.5)	0	92	8
3	Okra	Circular	(3.50)	0	87	13
			(3.0)	0	91	9
4	Sesame	Circular	(2.4 x 0.8)	0	93	7
			(1.5 x 0.8)	10	90	0

Effect of size of the seed plate orifice upon pneumatic panting

For the studying of effect of sizes of the seed plate orifice upon pneumatic panting of the single seeds, tests were connected to optimized suction pressure of the different seeds using the seed plates of different shape.

Test were conducted at optimized suction pressure o 5kPa using elliptical shaped orifice of longer and shorter axis (5,4.5) and (5.5,5) mm respectively for groundnut. Elliptical shaped orifices with longer and shorter axis 5 and 4.5 mm gave best results with 93% single seed picking with no misses and minimum multiple 7%. As showin Table 7For cotton elliptical shape orifice of longer and shorter orifice axis 3 and 2.5 mm gave the best results with 92% and no misses while in sesame (2.24,0.80) and (1.50,0.80) mm respectively with air flow velocity of 3.3 m/s of positive pressure chamber of the pneumatic disc. In sesame, elliptical orifices with longer and shorter axis 2.24 and 0.80 mm gave best results with 93% single seed picking and 7% multiple. In cotton test results showed that seed plate with 3mm diameter orifice gave the best results with 91% single seed picking. It was observed that with the increase in the dimensions of the orifice there was simultaneous increase in the number of multiples whereas decrease in the orifice dimension resulted in increase in the no of misses it is due to the reason that with the increase in the orifice opening more number of seeds are exposed to the suction pressure.

SUMMARY AND CONCLUSION

It was concluded that in this study that the centrifugal type radial blade aspirator with the impeller outer diameter 40cm and 8 numbers of blades on the impeller was sufficient to create the required suction pressure. For groundnut, cotton, okra and sesame seed the optimum suction pressure for single seed pickup through circular orifice were 5.0, 2.0,2.0 and 0.3 kPa respectively. It was also concluded that increase in suction pressure increased in the number of seed selected per orifice. The shape of the seed plate orifice has considerable effect upon the pneumatic planting of the different seeds.

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