Design and Development of Manually Operated Seed Sowing Machine

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Abstract-*Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. This Paper deals with the various sowing methods used in India for seed sowing and fertilizer placement. The comparison between the traditional sowing method and the new proposed machine which can perform a number of simultaneous operations and has number of advantages. As day by day the labor availability becomes the great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and spacing, cover the seeds with soil and provide proper compaction Over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agricultural and climatic conditions to achieve optimum yields and an efficient sowing machine should attempt to fulfill these requirements.*

Keywords-Velocity ratio, Speed ratio, Seed rate, Torque, Sowing machine.

I. INTRODUCTION

The agricultural has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for produce grows as well. Hence, there is a greater need for multiple cropping in the farms and this in turn requires efficient and time saving machines. In traditional methods seed sowing is done by broadcasting manually, opening furrows by a plough and dropping seeds by hand. The main objective of this paper is to develop seed sowing machine for agricultural field so it is helpful for small and medium scale formers. The sowing operation is to put the seed desired depth and seed to seed spacing cover the seeds with soil and provide proper compaction over the seed. Seed sowing machine is a device which helps in the sowing of seeds in a desired position hence assisting the farmers in saving time and money.

II. LITERATURE REVIEW

Ramesh. D., Girishkumar. H.P.“ Development of Agriculture seed sowing Equipment”,2013. In this paper they contribute the main aim of this paper is to develop multipurpose seeding equipment in order to reduce the human power. Seeds continuously feed to the earth surface without restriction while in flowing. Comparing to other machines cost of this equipment is economical. This paper provides information about the various types of innovations done in seed sowing machine available for plantation. The seed sowing machine is a key component of agriculture field. The performance of seed sowing device has a remarkable influence on the cost and yield of agriculture products. Presently there are many approaches to detect the performance of seed-sowing device. [1].

Kyada, Patel. A.R. “The design and development of manually operated seed planter machine”,2014. In this paper they contribute this manual seed planter machine has considerable potential to greatly increase productivity. Other Countries of the world where the two wheel tractor is the main traction unit in farming. The main task now is to promote this technology and have available to farmers at an affordable price. The manual Seed Planter machine can be readily made from local components in workshops. [2]

Prof. Pranil V. Sawalakhe. “solar powered seed sowing machine”,2015. In this paper they contribute the seed sowing machine is a key component of the agriculture field. High precision pneumatic planters have been developed for many verities of crops, for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed spacing.The real power required for machine equipment depends on the resistance to the movement of it. Even now, in our country 98% of the contemporary machines use the power by burning of fossil fuels to run IC engines or external combustion engines.[3].

B. Mursec, P. Vindis 2007 [11] Research on “Analysis of quality of sowing by pneumatic sowing machines for sugar beet”. In this paper they contribute the depth of sowing decreases with the increase of the speed. The average deviation is the greatest on the pneumatic pressure sowing machine Aeromat - Becker, where it is equal to 0.7 cm with 12 km/h. The paper presents two sowing machines for interval sowing, differing in the mode of operation. [4].

III. FACTORS AFFECTING SEED EMERGENCE

Mechanical factors, which affect seed germination and emergence, are:

- Uniformity of depth of placement of seed.
- Uniformity of distribution of seed along rows.
- Transverse displacement of seed from the row.
- Prevention of loose soil getting under the seed.
- Uniformity of soil cover over the seed.
- Mixing of fertilizer with seed during placement in the furrow.

Table 1 Diameters of different seed.

Seed name	Diameter(mm)
Arugula	2.5
Beet	7.5
Broccoli	3.5
Cabbage	3.5
Carrot	3.5
Cauliflower	3.5
Corn	13.5
Cucumber	9
Lettuce	6
Okra	7.5
Onion	6
Pea	10
Radish	4
Sun flower	2.5

IV. SCOPE

Top priority is given only for safety operation lost reduction; the multipurpose sowing machine is fabricated with safety operation and reduced cost. Since, top priority is given only for cost reduction and safety operation, It is noted that we should improve the strength of the machine members such as tiller and seed metering mechanism. No priority is given for strength and rigidity at the time of initial design. Afterinstallation and establishing successful working of the machine, it is proposed to concentrate on value engineering to increase the future value of the machine in all aspects. Presently, full focus is given only to design modification in seed metering mechanism for the benefit of the small farmers. At present, seed metering mechanism is used for sowing different types of seeds with single metering mechanism. We can use separate metering mechanism for every seeds. Thus, we can increase the value of the machine in future.

V. DESIGN AND ANALYSIS

A. Design of Belt-pulley

The Belt-Pulley are mostly used to transmit motion and powe from one shaft to another, when the center distance between their shafts is short

The Speed (velocity) ratio (S.R.) of a Belt-Pulley drive is given by

S.R. = n/N = D/d

Where,

N = Speed of rotation of bigger pulley in rpm,
n = Speed of rotation of smaller pulley in rpm,
d = diameter on the smaller pulley in mm, and
D = diameter on the larger pulley in mm.

S.R = n/25 = 100/40

n = 62.5 rpm

The average velocity of the belt is given by

$V = \pi DN/60$

Where D = diameter of bigger pulley in mm, and
N = Speed of rotation of bigger pulley in rpm,

$V = \pi dn/60$

Velocity ratio = D/d = 100/40 = 2.
Length of Belt and Centre Distance:

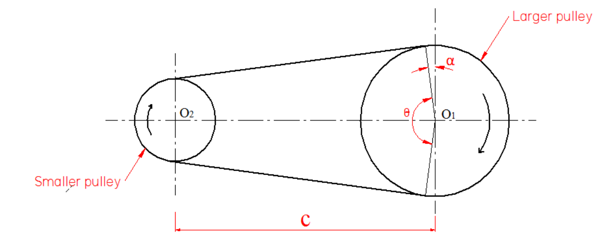

Fig.1. V-Belt Pulley

Let

d = diameter on the smaller pulley in mm
D = diameter on the larger pulley in mm.
C = Centre distance.
L = length of the belt.
L = 758.4313mm

The center distance is given by

$$L=2C+\frac{\pi(D+d)}{2}+\frac{(D-d)^2}{4C}$$

Putting

D = 100 d = 40

We get C = 270.92mm

Centre distance between the two pulley = 270.92mm

The average velocity of belt is given by

$V=\pi DN/60$

V = (π x 0.1 x 25) / 60

V = 0.1 m/s

B. Calculation of Seed sowing after every 4 ft

The dimensions of the groundnut seed are as follow:

1. Diameter : 9mm, 8mm, 7mm etc.
2. Length : 13mm, 11.5mm, 15.5mm etc.
3. So coming to average dimensions of the groundnut seed:
4. Diameter :8mm
5. Length :12mm

So there are two shafts at respective places soon in CAD model.Dimensions of the shaft are as follows

1.Upper pulley :32mm
2.Down pulley :32mm

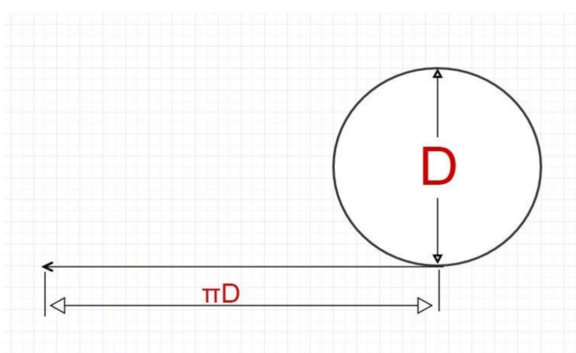

Fig.2. Upper shaft with one hole at the tip of shaft

Hence D= 32mm
πD = 100.53
= 4 Ft

C. Design of shaft.

1. Length of shaft = 660mm
2. waterpully is at = 180mm from left side.
3. Seed pully is at = 118mm from right side.

D. Selection of Pump

Let's consider a farm of size 1000m by 1000m in which fertilization is to be done

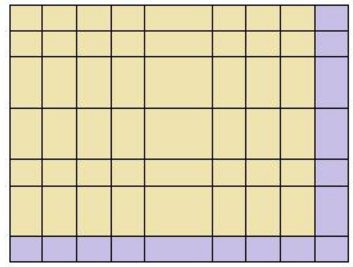

Fig.3. Square of 1000m by 1000m.

The fertilizer is mixed in the water. (Further noticed as water)

Total amount water required for a land of size 1000 m x 1000 m = 300-350 liters

Fertilization of this size land is to be done in 2.5 to 3 hours Consider 1 box of the farm of size 100m by 100 m Thus total number of boxes = 100

100 boxes are to fertilized in 2.5 hour
i.e. Total water to spread is 350 liters in 2.5 hour

Therefore 350 / (2.5 × 60) = 0.0388 liter/sec
Discharge (Q) = 0.388lps = 2.34lpm

So we need to select a pump of discharge capacity 2 liters per minute. Now from the market selecting the pump whose discharge capacity is in range.

Discharge = 2 to 5lpm
Pressure = 4-7 kg/cm2
Operating RPM = 150 to 200

The theoretical discharge of the pump is given by

Q = ALN/60

Where, A = Area of piston
D = Diameter of piston = 35mm
L = Length of stroke = 25mm

Q = (π/4)*35*35*25*120/60

Q = 2.78 lpm

E. Selection of Nozzle

Proper selection of a nozzle type and size is essential for correct and accurate fertilizer application. The nozzle is a major factor in determining the amount of spray applied to an area, uniformity of application, coverage obtained on the target surface, and amount of potential drift. In spraying systems, nozzles break the liquid into droplets and form the spray pattern. Nozzles determine the application volume at a given operating pressure, travel speed, and spacing. Selecting nozzles that produce the largest droplet size, while providing adequate coverage at the intended application rate and pressure, can minimize drift. Follow the steps below to determine the correct nozzle type and capacity needed.

Step 1: Consult the label: - The most important source of information is the packet label. Not only will the label specify the application rates, controllable pests, and conditions needed to apply the fertilizer or pesticide, it often will provide information concerning the droplet classification, nozzle type, and spacing as well. Follow the guidelines outlined on the pesticide's cover label.

Step 2: Select operating conditions: - Select or measure ground speed in miles per hour (mph). Select the desired nozzle spacing and spray volume. Correct selection of a spray volume is important. It will influence several spray characteristics such as drift potential, coverage, droplet size, acres per tank, and pesticide efficacy.

Step 3: Calculate required nozzle discharge: - To select a specific orifice size, the spray volume, nozzle spacing, and travel speed are needed for the following calculation:

Equation 1:-

Nozzle discharge (LPM) =
Travel speed x nozzle spacing x spray volume
Where,
Travel speed = meters per minute
Nozzle spacing = meters
Spray volume = liters per meter square

Step 4: Consult a nozzle catalogue: - Once the nozzle discharge has been determined, consult a nozzle catalogue for a specific nozzle number or size. Review the specification of these nozzles in the discharge-capacity column. Several consecutive nozzles may meet your needs, but select a nozzle that operates at a low pressure and gives the desired droplet classification that allows a range for "fine-tuning".

The selected spray is of 3 to 5 lpm and the pressure of 5 to 8 kg/cm^2

F. Selection of tank

In order to store fertilizer in liquid form small size tanks are used. The existing system of fertilizer spraying i.e. the back pack sprayer has the tank capacity of 16 to 20 liters. So we need to replace it by increasing the capacity up to 3 times. So we have used the tank of capacity 50 liters. It will last longer and more area of land will be covered in one round. Material of the tank is simple plastic, even empty cans in some used way can be washed and used for this purpose.

VI. MECHANISM OF SEED SOWING MACHINE

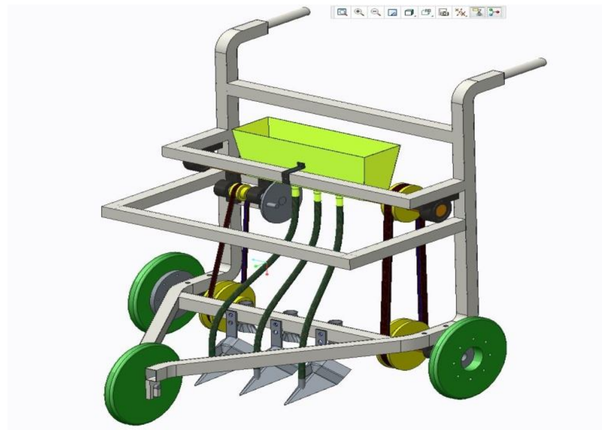

Fig.4. Developed Seed Sowing Machine.

VII. APPENDIX

Tank – fertilisercontenair
Hopper – Seed container
Nozzle – A Device spray the fertiliser.
Pump – A Device Use for pressurisefertiliser fluid.
Pully - Power Transmission Device
Seed rate – Rate of seed emergence.
Seed Placement- leaving of seed at particular distance.
Seed spacing – distance between two consecutive seed.
Seed Depth – placement of seed at particular depth.
Seed metering – leaving of seed from hopper.
V-Belt- Power Transmission Device.

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