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DESIGN AND DEVELOPMENT OF SEED SOWING MACHINE ALONG WITH FERTILIZER SPRAYER

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ABSTRACT

This article based on enhancement farming processes .This machine is made up to accomplish to task first one is seed sowing and another task is fertilizer spraying. Both of these mechanism work at a same time. The main objectives of these operations are to place the seed as well as fertilizer at proper place and seeds at proper distance from each other with appropriate soil compaction.

Increase in population demand also increases to meet the requirement new techniques of cropping have to be implemented in farming sector. The basic requirements of seed sowing machine are, it should be simple in design and construction affordable for low budget farmers. Easy to handle and repair by farmers. The main intention of this project is to reduce the cost of machine and get optimum yield.

Keywords: Seed sowing, Fertilizer spraying

I, INTRODUCTION

India is agricultural country. And whose economic balance is based on farming. Development in farming increases economic level of country. In India farmers have to face lots of problem due to ineffective time consuming farming techniques, lack of labors which ultimately increases the cost of farming.

This project is about to plant seeds and maintains proper distance between two seeds, spacing between two rows and planting seeds at proper depth of soil with appropriate soil compaction. As variety of seeds changes shape and size also changes which requires to change certain parameters like distance between two rows and two seeds as well as depth of the seed plantation. The main intention is to produce cost effective machine which will reduces cost as well as time of plantation and enhances overall productivity.

Conventional way of farming based on consideration of seed to seed distance level of seed plantation which is highly ineffective, time consuming and besides of this it's require lots of efforts Farmers are facing one more serious problem because of different harmful pests and insects. Farmers use conventional way of pesticide spraying by carrying the heavy pump on their back throughout the field which requires lots of efforts and time. This machine use as seed planter machine along with pesticide sprayer.

1.1 Traditional Seed Sowing And Fertilizer Spraying Techniques:-

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Fig.1 Line Sowing

Fig. 2 Broad casting

Fig.3 Dibbling

Fig. 4 Old method of Fertiliser spraying

1.2 Objective:-

The basic objective of sowing operation is:-

1. To put the seed and fertilizer in rows and at desired depth and achieve desirable distance between to seeds.
2. The recommended distance between two seed to seed and depth of seed vary from crop to crop and it also depend upon agro-climate conditions.

II. METHODOLOGY

First step is to manually fill the hopper with seed and the fertilizer in container. Mechanism uses the manual push force for running. Rotary motion of wheels given to the sowing shaft by sprocket or belt drive. With measured distance interval, seed sowed in the soil vie pipe connecting seed hopper with the digger and then the seed is covered with the soil and provide compaction over seed.

Sprayer mechanism work on battery. Electrically operated pump is used which is placed at the front of machine. Which is chargeable can be charged after specified interval of time, it's depend on capacity of battery.

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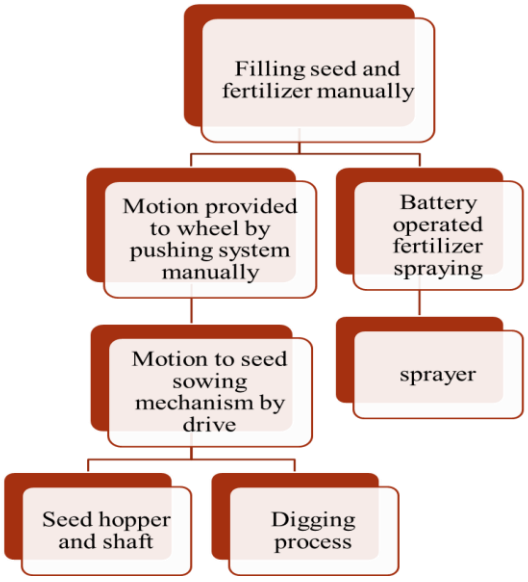

Fig. 5 Working of setup

III. DEVELOPMENT OF SEED PLANTER MACHINE

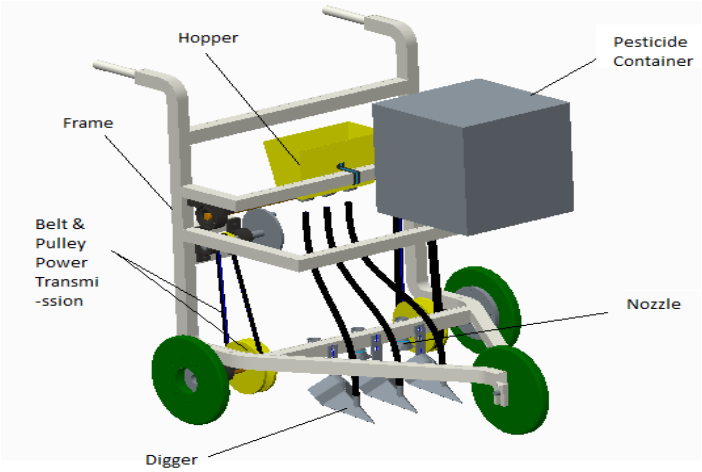

Fig. 6 Seed sowing machine

3.1 Seed meter mechanism:-

Using sprocket the Rotary motion of wheels is given to the sowing shaft (Positioned in seed hopper). Due to motion provided to the shaft the shaft rotates and it drop the seed in the hose from seed container to the digger.

3.2 Digger mechanism:-

For digging and seeding Digger mechanism is used. With the help of nut and bolts digger is connected to the frame. We used adjustable diggers so we can adjust depth of digger.

3.3 Power transmission mechanism:-

Belt pulley transmission system is used for transmitting the power. To get required distance between the two seed different pulleys are used. For achieving necessary space among two seeds the belt is move from one pulley to other.And to achieve required distance adjustable wheels are connected to frame.

3.4 Sprayer Mechanism:-

Electrically operated pump is used which is placed at the front of machine. Which is chargeable can be charged after specified interval of time, it's depend on capacity of battery.

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IV. DESIGN OF COMPONENTS:

4.1Design of shaft:-

The shaft is subjected to 20 kg of load.

W = 20 Kg

F = 300 N

L = length of the shaft =752 mm

Radius of shaft = 7.5 mm

Bending Moment is given by,

$M = WL/4$

M = 20*9.81 ×752 /4

M = 36885.6 N-mm

Twisting Moment is given by

T = FR

T = 300 × 7.5

T = 2250 N- mm

Permissible stress is given by

Applying A.S.M.E code

Ultimate tensile stress = Sut = 770 N/mm^2

τper = 0.18 × 0.75 × Sut

τper= 103.95 N/mm^2

A.S.M.E. code for Shaft design is given by,

$(\pi /16) \times d^3 \times \tau per = \sqrt{(KbM)^2 + (KtT)^2}$

Where,

Shock Factor in bending = K_b= 1.5

Shock Factor in torsion = K_t= 1.2

$(\pi /16) \times d^3 \times 103.95 = \sqrt{(1.5 \times 36885.6)^2 + (1.2 \times 2250)^2}$

d = 13.9 mm

This is ideal diameter of shaft which is needed. Since a shaft may be subjected to extra load as it has to work in rough conditions and from availability point of view, we chose a safe diameter of 15 mm. Thus diameter of shaft, d = 15 mm

4.2 Checking Safety of Shaft:

Bending Stresses is given by

Bending moment = Moment of resistance

$(M/ I) = (B_{induced} /y)$

Where,

Polar Moment of Inertia = $\pi/ 32 \times d^4$

= 4970.097mm^4

Distance from Natural Axis is given by,

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y= d/ 2

= 7.5 mm

Bending moment = Moment of resistance

36885.6/4970.097= $B_{induced}$ /7.5

$B_{induced}$ = 55.66 N/mm^2

Failure stress is given by

Failure stress = B_{steel} / F.O.S

Where,

B_{steel} =360 N/mm^2

F.O.S = 3

Failure Stress = 360/3

Failure stress = 120 N/mm^2

As,

$B_{steel} > B_{induced}$

Thus Design of shaft is safe.

4.2 Design of Belt-pulley:-

Height of the setup is taken by considering the average height of normal person and aesthetic considerations.

The diameter of wheels = 200 mm

So for every one revolution of wheel, setup will move forward linearly of distance = 3.1416 * 200

= 628.32 mm

According to conventional pattern of seed sowing. Assumption is taken that the distance between two consecutive seeds is approximately 110 mm

So for every one revolution of wheels min 6 seeds must be sowen.

So we take the chain drive of ratio 2

Taking the Diameter of Lower sprocket = 120 mm

Diameter of upper sprocket = 60 mm

The rings that are used for placing the seed in the digging part through pipe having 3 holes are produced. So when the upper pulley is moved by one revolution, 6 seeds must be placed.

Finally after one rotation of wheel, there is two revolutions of upper sprocket and so six seeds sowen in field.

4.3 Selection of Pump:-

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

From the conventional observation approximately 350 litre of liquid required to fertilize one acre of land and approximately 3 hours needed to seed sowing process.

So the discharge of the pump = 350/3 = 116.667 litre/hr

= 1.944 litre/min

So the pump should deliver the discharge above 1.944 lpm

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.

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Discharge = 2 to 5lpm

Pressure = 5-8 kg/cm2

Operating RPM = 200 to 250

V. MATERIALS REQUIRED

The push operated pump can be construct using local material and skill.

1. Steel pipes of square cross-section Size 25.2 mm x 25.2mm

Thickness 1 mm(Gauge 16)

Total length =30 foot

2. Angular cross section for handle Total Length = 1 foot

3. Pump for compressing liquid

Discharge = 2 to 5lpm Pressure = upto 10 kg/cm^2 Operating RPM = 200 to250

4. Wheels

3 in numbers

Smaller 1 Wheel diameter 50mm

Bigger 2 Wheel diameter 200mm

5. Belt pulley System 1 set

6. Tank for fertilizer storage

1 in Number

Volumetric Capacity = 10 liters Material = Plastic

7. Sprayer and nozzle arrangement

8. Plastic pipes

9. Baring and Housing

4 in Number

10. Welding machine and Fabrication arrangement

VI. ADVANTAGES OF MACHINE:

Following are the advantages of manual seed planter machine are

- Planting efficiency get increased.
- Optimum crop yield achieved.
- Seed can be placed uniformly in a row with required distance between plants and required depth.
- Maintenance cost is less.
- Less labour required.
- Properly cover the seed with soil.
- Even Spraying can be achieved.

VII. CONCLUSIONS

- Required distance between two seed is obtained and put the seed and fertilizer and desired depth.
- Properly cover the seed with seed with soil and provides proper compaction over the seed.

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- Achieves optimum yield.

VIII. ACKNOLEDGEMENT

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