A STUDY ABOUT THE DESIGN AND FABRICATION OF AUTOMATIC SEED SOWING AND FERTILIZER SPRAYING MACHINE

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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.

1 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 changing 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.

Researchers have presented a better speed of operation and good Seed Sowing capacity for new advanced agriculture process which includes robotic based cultivation. An agriculture robotic system is used. They has used DC motor which has four wheels. An agricultural farm is cultivated by the Plow machine, depending on the crop considering particular rows specific columns. Ultrasonic sensor detects the blocks in the path with measure the distance between both robot and block. Also senses turning position of our vehicle at end

of the each column. The seed block can be detected and solved using water pressure. This machine can be controlled on remotely. A sensor guided robot rover for digging, precise seed positioning and sowing has been proposed to reduce the human effort.

To overcome the disadvantages related with previous model, we have designed a model Running without any fuel and also easy to operate for a user. Pesticide application plays an important role in pest management. Proper technique of application of pesticide and the equipment used for applying pesticide are vital to the success of pest control operations. The application of pesticide is not merely the operation of sprayer or duster. It has to be coupled with a thorough knowledge of the pest problem. All pesticides are poisonous substances and they can cause harm to all living things. Therefore their use must be very judicious. The application techniques ideally should be target oriented so that safety to the non-targets and the Environment is ensured. Therefore, proper selection of application equipment is necessary. The requirement of coverage and spray droplet size depends upon the mobility and size of the pest. The mode of action of pesticide, its relative toxicity and other physicochemical properties, help to decide the handling precautions, agitation requirement etc. Further the complete knowledge of the equipment is necessary to develop desired skill of operation, to select and to estimate the number and type of equipment's needed to treat the crop in minimum time and to optimize use of the equipment.

1.1 OBJECTIVES

The basic objective of sowing operation is:-

- To put the seed and fertilizer in rows and at desired depth and achieve desirable distance between two seeds.
- The recommended distance between two seed to seed and depth of seed vary from crop to crop and it also depends upon agro-climate conditions.
- To manufacture seed sowing machine which can be operated by the single operator?
- To set fertilizer with sowed seed.
- To level the ground in small extent.
- To enable the machine for the sowing of several of seed like maize, wheat etc.
- To maintain the same distance between two seeds at the time of sowing process.

1.2THE SCOPE OF THE PROJECT

It helps in the sowing of seeds in the desired position hence assisting the farmers in saving time and money. So considering these points related to spraying and seed sowing an attempt is made to design and fabricate such equipment which will able to perform both the operations more efficiently and also will result in low cost. Decrease the operational cost by using new mechanism.

•Work reliably under different working conditions.

• Decrease the cost of the machine.

• Decrease labor cost by advancing the spraying method.

• The machine can be operated in the small farming land (1 acre).

• Making such a machine which can be able to perform both the operation.

For seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital, the project has been made. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer seed sowing equipment in an agriculture field. A pesticide sprayer seed sowing

equipment has to be portable and with an increased tank capacity as well as should result in cost reduction, labour, seed sowing and spraying time. In order to reduce these problems, there are number of sprayer and seed sowing equipment introduced in the market but these devices do not meet the above problems or demands of the farmers. The conventional sprayer and seed sowing equipment having the difficulties such as it needs lot of effort to push the liver up and down in order to create the pressure to spray. Another difficulty of petrol sprayer is to need to purchase the fuel which increases the running cost of the sprayer and seed sowing equipment. In order to overcome these difficulties we have proposed a wheel driven sprayer and seed sowing equipment, it is a portable device and no need of any fuel to operate, which is easy to move and sprays the pesticide by moving the wheel. The mechanism involved in this sprayer is reciprocating pump, and nozzles which were connected at the front end of the spraying equipment. And for seed sowing equipment the mechanism is chain and sprocket.

2 DESIGN 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 is 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 works 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 depending on capacity of battery.

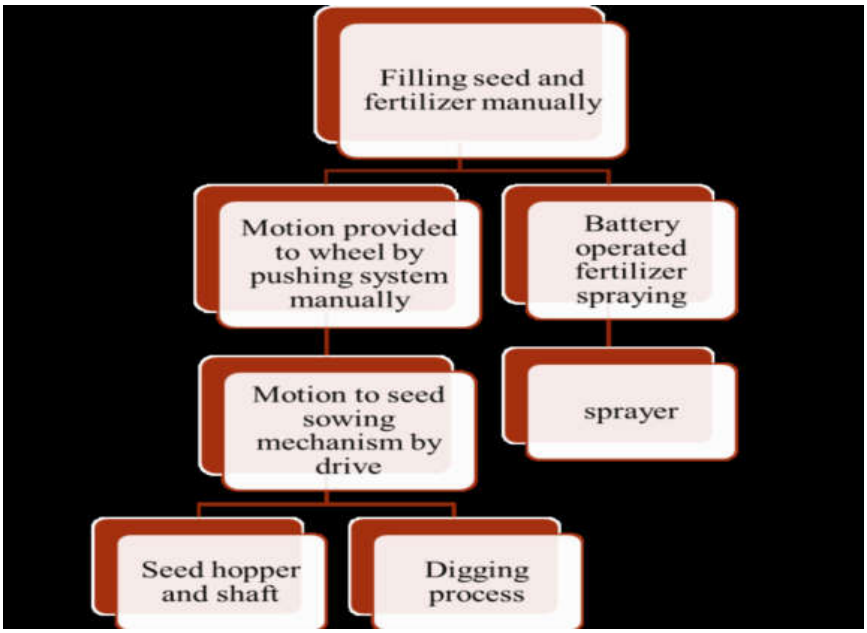

Fig 2.1 Working setup

2.1 Traditional Sowing Methods and Fertilizer Spraying Techniques

Traditional sowing methods include:

- Broadcasting manually, opening furrows by a country plough and dropping seeds by hand.
- Dropping seeds in the furrow through a bamboo/meta flannel attached to a country plough (Pora).
- For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand.

- Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers.
- In manual seeding, it is not possible to achieve uniformity in distribution of seeds. A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field.

The complete assembly is made using CATIA V5 R20 software with extra mixed cropping arrangement, row and seed spacing arrangement are as follows

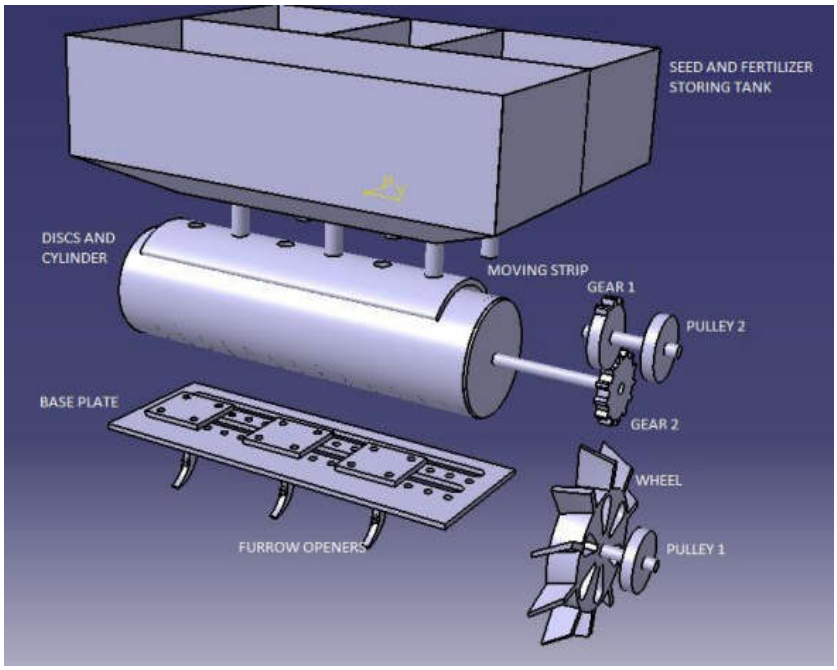

Fig 2.2 Proposed machine assembly

2.2 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.

2.3 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.

2.3 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.

A. 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.

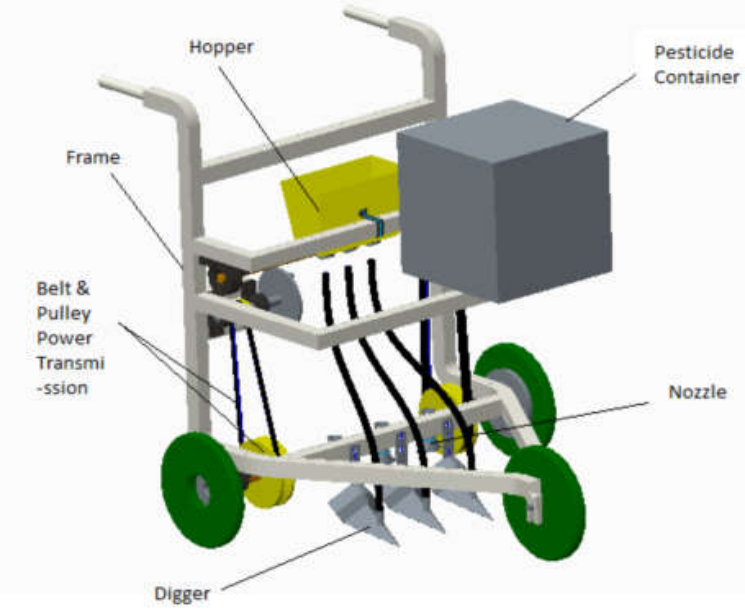

Fig 2.3 Seed sowing machine

3 WORKING OF SEED SOWING MACHINE AND SPRAYER

Consider the assembly attached to the tractor. During cotton planting the wheel of planter is placed on ground, as the tractor moves planter wheel also rotates. This motion of planter wheel is transferred to pulley1 which is attached on the same shaft. Motion of pulley1 is transferred to pulley2 by means of chain or belt drive. Owing to this arrangement gear1 rotates. When teeth on gear1 meshes with gear2, it rotates to some degree, then the holes on disc coincides with the holes of cylinder through moving strip so that seed from the tank get release as per requirement. When gear1 disengages with gear2, gear2 return to its original position by means of spring tension (spring is attached to the shaft of gear2). This cycle goes on repeating resulting into the required spacing in seed sowing. The required spacing can be adjusted by providing holes on disc at different angles such as 0, 45, and 90 (for example we can plant the seed at 1, 2, and 4 feet by closing and opening of holes on disc).Whenever seed spacing is not required, gear1 can slide on splined shaft so that gear2 does not mesh with gear1.Hence disc will not rotate and hole on disc coincides with the holes on cylinder ensuring continuous flow of seeds. For different size of seeds we can adjust the flow of seeds (from tank to disc) with the help of moving strip which can slide over the cylinder with the help of lever. Row spacing can be adjusted with help of the nut and bolt arrangement provided on the base plate. In case if tractor stops the seed flow from tank can be stopped by providing key to the inlet pipes. This key can be attached to the lifting lever provided near to the operator

a. DESIGNING OF VARIOUS COMPONENTS

Design 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

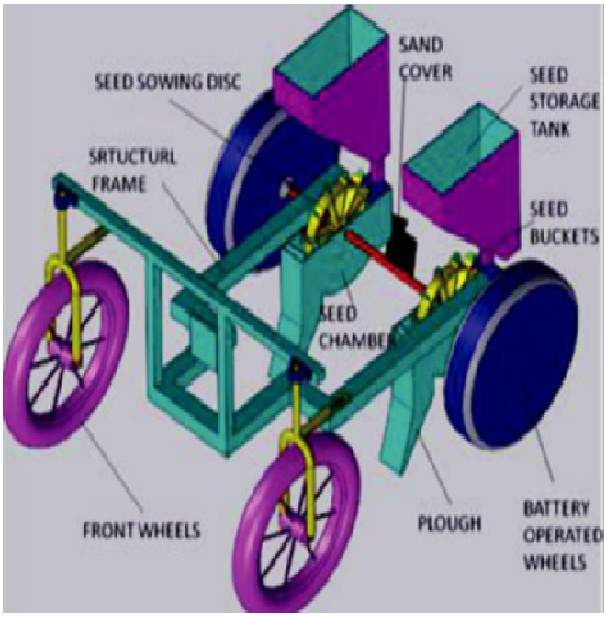

Fig 3.1.CATIA drawing of the project

Permissible stress is given by, Applying A.S.M.E code

Ultimate tensile stress = Sut = 770 N/mm^2 ; α = 0.18 × 0.75 × Sut; α = 103.95 N/mm^2

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

$(\pi /16) \times d3 \times \alpha = \sqrt{(KbM)^2 + (KtT)^2}$

Where, Shock Factor in bending = Kb= 1.5; Shock Factor in torsion = Kt= 1.2

$(\pi/16) \times d3 \times 103.95 = \sqrt{(1.5 \times 36885.6)^2 + (1.2 \times 2250)^2}$

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.

Checking Safety of Shaft:

Bending Stresses is given by, Bending moment = Moment of resistance; (M/ I)= (Binduced /y)

Where, Polar Moment of Inertia = π/ 32 × d^4 = 4970.097 mm^4; Distance from Natural Axis is given by,

y= d/ 2 = 7.5mm

Bending moment = Moment of resistance

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

B induced = 55.66 N/mm2

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.

Design of chain drive

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 the conventional pattern of seed sowing, assumption is taken that the distance between two consecutive seeds is approximately 110 mm. For every one revolution of wheels min 6 seeds must be sowen and the chain drive of ratio is taken as 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.

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. The discharge of the pump = 350/3 = 116.667 litre/hr = 1.944 litre/min.

The pump should deliver the discharge above 1.944 lpm. Selection 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 5 lpm. Pressure = 5-8 kg/cm^2; Operating RPM = 200 to 250

4 COMPARITIVE ANALYSIS

TESTING

Testing of seed sowing machine for continuous type for multiple type crops like soyabeen, maze, etc.

Table 4.1 Testing of seeds

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

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. The only specialized items required are the seed meters plunger which can be sourced at an inexpensive price from local promoter and plunger is easily manufactured. By using of this machine, achievement of flexibility of distance and depth variation for different seed plantation is possible.

Table 4.2 Comparison Table for various parameters

Sl.NO	Parameter	Manual	Tractor	Seed sowing machine
1	Man power	More	Moderate	Less
2	Time required	More	Less	Less
3	Sowing technique	Manually	Automatically	Automatically
4	Distance between seed	Not Fixed	Fixed	Fixed
5	Wastage of seed	Moderate	More	Less
6	Required Energy	High	Very high	Less
7	Pollution	NO	More	NO
8	Alarm and Display	NO	YES	NO
9	Cost of machine	Less	Very high	Very less

Hence after comparing the different the existing machine, it is concluded that the multi-purpose seed sowing machine can

1. It Maintain row spacing and controls seed and fertilizer rate.
2. It Control the seed and fertilizer depth and proper utilization of seeds and fertilizers can be done with less loss.
3. It perform the various simultaneous operations and hence saves labor requirement, labor cost, labor time, total cost of saving and can be affordable for the farmers.
4. It can be improve in planting efficiency and increase in crop yield and cropping reliability.

5 CONCLUSION

This seed plantation machine has great potential for increasing the productivity of the planting. Till now tractor was the main traction unit for nourishment in farming. With the adaptation of this seed planting machine its purpose will be done. Hence there is need to promote this technology with affordable prices. This machine can be made by raw materials also which saves the cost of whole project and is easily manufactured in available workshops. The only cost is of metering device and sensors. Hence by using this machine we can achieve flexibility of distance and control depth variation for different seeds hence usable to all seeds. Innovative Seed sowing equipments has remarkable influence in agriculture. By using this innovative project of seed sowing equipment we can save more time required for sowing process and also it reduces lot of laborer cost. After comparing the different method of seed sowing and limitations of the existing machine, it is concluded that the this solar powered seed sowing machine can

1) Maintain row spacing and controls seed rate.

2) Control the seed depth and proper utilization of seeds can be done with less loss. Perform the various simultaneous operations and hence saves labour requirement

So as labour cost, labour time and also save lots of energy.

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