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Innovative Seed Sowing Machine for Improved Agricultural Productivity and Efficiency

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Abstract- This research focuses on the design and development of an innovative seed sowing machine aimed at improving agricultural productivity through precision and efficiency. Traditional sowing methods, which are either manual or use basic machinery, face challenges like inconsistent seed spacing, high labor requirements, and frequent blockages in seed dispensing tubes. These issues lead to reduced crop yields, increased operational costs, and significant seed wastage.The proposed seed sowing machine addresses these limitations by integrating automated seed dispensing, consistent depth control, and a blockage detection system using sensors. This machine is designed to place seeds uniformly at a specific depth and spacing, enhancing germination rates and ensuring even crop growth. Testing results demonstrate improved accuracy in seed placement and reduced downtime, showing a potential to save up to 40% of labor compared to traditional methods.Overall, this seed sowing machine offers a cost-effective and efficient solution for small to medium-scale farmers, enabling more sustainable and productive farming. This research lays the groundwork for future advancements in automated agricultural machinery, contributing to the broader goal of technological innovation in agriculture.

Index Terms- Seed, Sowing, planting, agriculture, efficiency, productivity.

I. INTRODUCTION

In agriculture, seed sowing is one of the critical steps for ensuring good crop yields. Traditional sowing methods are labor-intensive and lack precision, which can lead to uneven crop growth. This research focuses on developing a seed sowing machine that not only automates the sowing process but also ensures accurate seed placement, depth, and spacing.
growth and their distribution per unit area. However, the space requirement of a plant is so adjusted between the rows that the subsequent use of interculturing implements is made possible for the crops. In general the larger seeds are sown at comparatively greater depth and the plants need wider spacings.

The amount of seed to be sown per unit area depends upon the size of seed, germination percentage, extent of cover at the maturity and expected use of the plant either as fodder or for grain. Most of the crops under optimum rainfall conditions are sown on a flat surface. Under too low or too high rainfall condition, the sowing is done in furrows or on ridges. In regions where human labour and draft animals are the main sources of farm power, timeliness of field operations including seeding operation has been identified as a major factor in increasing the intensity of cropping. Hence, there is necessary to mechanize not only tillage but also the seeding operation. Full advantage of residual moisture can be derived by completing the tillage and seeding after the harvest of previous crops with minimum time loss.

1. Objectives Of Project Work

The main objective of "Design and Manufacturing of seed sowing machine" is to reduce serious back ache problem in hand sowing for the farmer which limits the size of field that can be planted as well as manpower required for planting. This project will be very useful for peasant farmers.
In this machine we are going to use two seed sowing wheels along with seed metering mechanism which sows the seeds at equal distance and which are mounted on axle. Hopper is used for storing seeds. This machine can be operated manually or it can be towing.

- Study of different research papers
- Study of different seed sowing methods
- Study of different wheel mechanisms
- Framing of project setup and design of hopper Dimensioning of frame, specification of components for setting of machine
- Assembling of different components

II. PROBLEM IDENTIFICATION

To meet future food demands, farmers need to adopt new techniques that increase crop production without compromising seed distribution or soil quality. Current seed

sowing machines are expensive, not widely available in India, and have complex designs. Many machines include separate storage compartments for each seed distributor, which increases the machine's cost. Additionally, they are often bulky and heavy, making transportation difficult.

III. THEORY AND DESIGN

In this chapter, we have explained the methods of sowing, seed drill and its types and the seed metering mechanism and determination of planter capacity. We have also explained a detail design of our project seed sowing machine.

Methods of Sowing
Seeding or sowing is an art of placing seeds in the soil to have good germination in the field. A perfect seeding gives

- Correct amount of seed per unit area.
- Correct depth at which seed is placed in the soil.
- Correct spacing between row-to-row and plant-to-plant.

Broadcasting
Broadcasting is a seed planting method where seeds are scattered evenly across the soil surface by hand or machine. It is a simple and quick method used for sowing small-seeded crops like wheat, rice, and grass.It's a common method for seeding smaller plots, and is often used in areas with low soil fertility, low rainfall, or heavy slopes.
Broadcasting is a faster and easier way to sow seeds than older methods. It's often used for lawns and cover crops, and for plants that can be thinned later. However, broadcasting has some drawbacks

Dibbling
Dibbling is the process of placing and seeds in holes made in seedbed and covering them. In this method, seeds are placed in holes make at definite depth at fixed spacing. The equipment used for dibbling is called dibbler. It is a conical instrument used to make proper holes in the field. Small hand dibblers are made with several conical projections made in a frame. This is very time consuming process, so it is not suitable for small seeds. Mostly vegetables are
sown in this way.

Drilling
Drilling is a method where seeds are dropped in furrow lines in a continuous flow and then covered with soil. Seed distribution can be done manually or mechanically, and one or more rows can be planted at a time. This technique is effective in ensuring proper depth, spacing, and the right amount of seed is sown in the field. Drilling can be performed using the following methods:

- Sowing behind the plough
- Bullock drawn seed drills
- Tractor drawn seed drills.

Transplanting
Transplanting is the process of growing seedlings in a controlled environment, such as a nursery, and then relocating them to the main field when they reach a certain growth stage. This technique is commonly used for crops like rice, tomatoes, and onions, where initial growth is more successful in a nurse

Hill Dropping
In this method, seeds are dropped at fixed spacing and not in a continuous stream. Thus the spacing between plant to plant in a row is constant. In case of drills, the seeds are dropped in continuous stream and the spacing between plant to plant in a row is not constant.

Check Row Planting
Check Row Planting is a method where seeds are planted in uniform rows with equal spacing between plants and rows. The rows are arranged in two perpendicular directions. This method ensures even growth and easy management of resources like water and nutrients. A check row planter is used for this method, which helps in precise seed placement.

Fig. 1 Methods of sowing

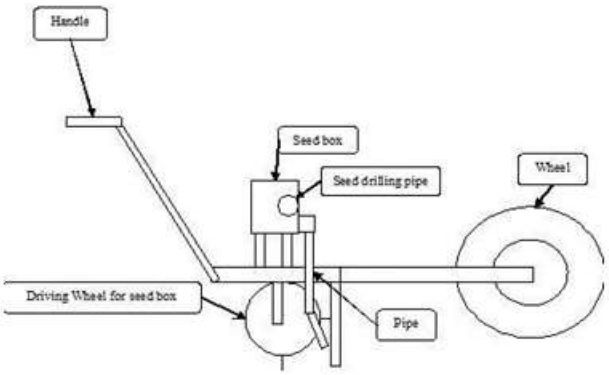

Fig:2 seed sowing machine

An attempt has been made to design and fabricate equipment for spraying and seed sowing, which will perform both tasks more efficiently and at a lower cost. This project primarily focuses on designing an appropriate operating system Locally fabricated components have been used to maintain simplicity and cost-effectiveness in the design. This project provides several benefits, such as enhanced safety, saving manual labor, increasing efficiency, reducing workload, lessening worker fatigue, and lowering maintenance costs.

Components Used Are

- Two octagonal plates
- Centre plate
- Links
- Seed metering mechanism
- Shaft
- Frame
- Tyres

Selection of Components

Selection of Material

Selection of proper material is one of the most important step in process of designing. The factors which should be consider while selection of material are as follows:

- **Availability--**The material should be readily available in market in large quantity to meet the requirements.
- **Cost—**For any application, a designer must adhere to a cost limit. Cost analysis involves two main factors: material cost and the cost of processing that material into a finished product. Sometimes, while material cost may be low, the manufacturing process can be expensive.
- **Mechanical Properties--**Mechanical properties are the most important technical factor governing the selection of material. They include strength under static and fluctuating loads, elasticity, plasticity, stiffness, toughness, ductility and hardness.
- **Manufacturing Considerations--**In some application, machinability of material is an important consideration in the selection. Sometimes an expensive material is more economical than a low priced one. Past experience is a good guide for selection of material.

Materials

For Shaft - Mild Steel
For Wheel - Mild Steel
For Seed Cylinder- Poly Vinyl Chloride (PVC)
For Hopper- Sheet metal

Selection of Bearing

The most frequently used bearing is the deep groove ball bearing. It is found in almost all kinds of production general mechanical engineering. In this radius of ball is slightly less than the radii of curvature of the grooves in the races. This gives a point contact between the balls and the races may roll freely without any sliding.

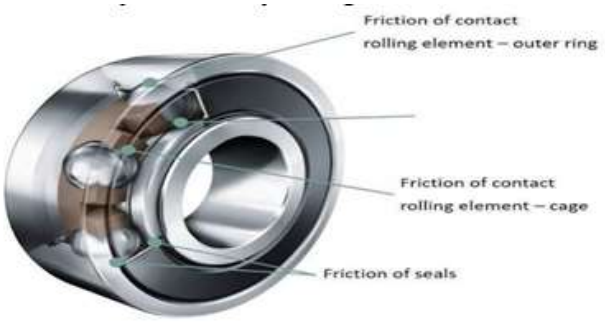

Fig. 2 Deep groove ball bearing

Specification Deep Groove Ball Bearings

- **Load Capacities:** These bearings can handle both radial and axial loads.
- **Speed:** Higher speeds can be achieved with proper lubrication and clearance.
- **Lubrication:** Typically grease or oil lubrication is used for smoother operation and longevity.
- **Materials:** Usually made of high-carbon chrome steel or stainless steel for durability and corrosion resistance.
- **Application:** Commonly used in electric motors, pumps, automotive components, and various machinery.
- **Purpose of Seed Holder:** The seed holder is a critical component in a seed sowing machine, responsible for storing and feeding seeds to the dispensing mechanism. Its design ensures uniform and efficient seed distribution to maximize crop yield.

Types of Seed Holders

Single Seed Holder: Dispenses one seed at a time, ideal for precision planting.

Multiple Seed Holders: Allows for the simultaneous sowing of multiple seeds, suitable for larger-scale agriculture.

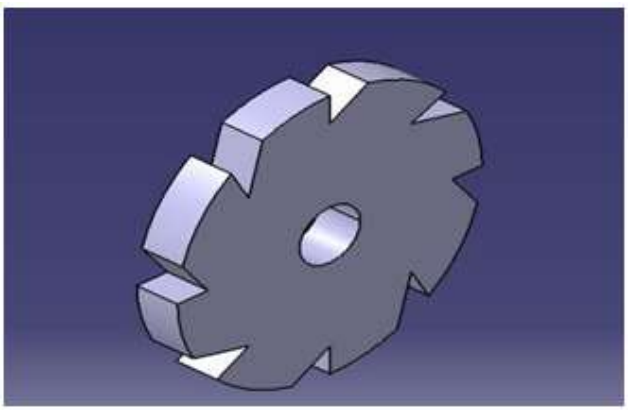

Fig. 3 Seed holder

Centre Plate

A center plate seed sowing machine is a type of agricultural equipment designed to improve seed distribution in the soil. This type of machine typically uses a rotating center plate mechanism to distribute seeds evenly in rows. Here's how it generally works and some benefits it offers:

- **Seed Metering:** The machine has a center plate (or disc) with holes of specific diameters matching the seed size. This plate rotates as the machine moves, allowing seeds to drop through the holes and fall at consistent interval
- **Seed Delivery:** The seeds that fall through the plate are guided into a dispensing tube, where they are dropped into the soil. The spacing between seeds is controlled by adjusting the speed of the plate rotation or the number of holes on the plate.
- **Soil Coverage:** Some machines also have mechanisms to cover the seeds with soil after they're dropped, ensuring they're properly planted.

Links

In a seed sowing machine, links are essential components that control movement and positioning. There are typically two main types of links: the fixed link and the movable link. These links work together to ensure that the machine can precisely plant seeds at specific depths and distances.
Link 1: 12.5 * 2.5 * 0.6 cm
Link 2: 16 * 2.5 * 0.6 cm
Link 3: 5 * 7.5 * 0.3 cm

Frame

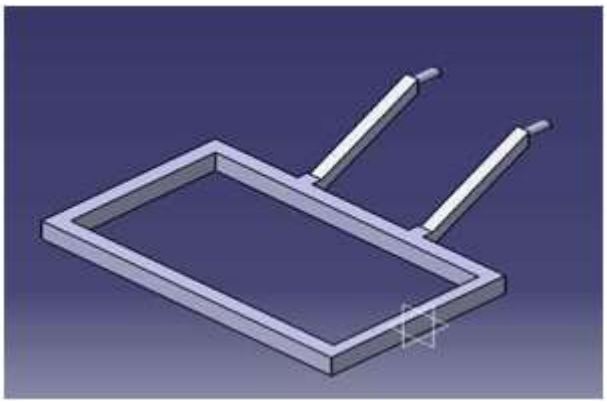

Fig. 4 Frame

Main Frame Structure: The main frame is the core structure of the seed planter. It holds and supports the seed storage containers, ensuring stability.2.Material Selection: For the frame material, two main factor are considered. Weight: It should be light enough for easy movement. Strength: It needs to be strong enough to support all components without bending or breaking.3Material Used: In this project, we used a mild steel angle bar with dimensions of 38mm x 38mm and a thickness of 6mm. This provides the required strength and durability.

Assembly

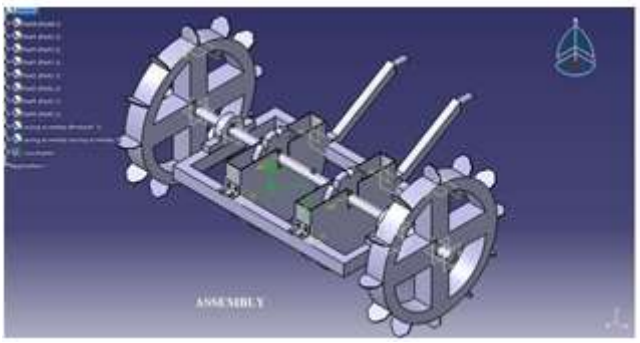

Fig. 5 Assembly

IV. RESULTS

Objective: This chapter focuses on calculating the time required to feed seeds into the hopper.
Human Walking Speed: The average speed of a person walking is taken as 2.5 km/hr
Machine Speed: Based on this, the speed of the seed sowing machine is also set to 2.5 km/hr, which is equivalent to 0.7 m/s.

In this chapter we have to take the reading that is how much time is to be required to feed seeds in hopper.

The normal speed of human beings is 2.5km/hr. Therefore Speed of machine = 2.5 km/hr =0.7 m/s. No. of revolutions per minute,Nw = Speed (m/s) * 1000N * 60Nw = 3.71 rpm Nw ≈ 4 rpm

V. CONCLUSION

The manual seed sowing machine effectively addresses the needs of small and marginal farmers by providing an affordable and efficient solution for planting seeds. This machine offers several key benefits: it improves productivity by ensuring uniform seed placement, enhances planting efficiency, and significantly reduces the physical effort required from the farmer. Additionally, the machine saves time during the seed-sowing process, making it a valuable tool for those with limited resources.

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