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Evolution of Seed Sowing Machine

Shashikant Suresh Sawant¹, Harshad Sambhaji Patil², Chetan Balu Patil³, Aniket Narayan Patil⁴, Suraj V. Chougale⁵

Student, Department of Mechanical Engineering, Sant Gajanan Maharaj Rural Polytechnic, Mahagaon, Kolhapur, Maharashtra, India^{1 2 3 4}

Assistant Professor, Faculty, Department of Mechanical Engineering, Sant Gajanan Maharaj Rural Polytechnic, Mahagaon, Kolhapur, Maharashtra, India⁵

ABSTRACT: A Seed Sowing Machine is a pivotal agricultural innovation designed to automate the process of planting seeds, thereby improving the efficiency, accuracy, and speed of sowing operations on large-scale farms. The traditional method of manual sowing is time-consuming, labour-intensive, and prone to errors such as uneven seed distribution and improper seed depth, all of which can negatively affect crop yield. The seed sowing machine addresses these challenges by ensuring uniform seed placement, optimal seed depth, and proper spacing, which are critical factors in maximizing crop productivity and minimizing seed wastage. The machine typically consists of several key components, including a seed hopper for storing the seeds, a metering mechanism to regulate the flow and quantity of seeds being dispensed, a furrow opener (such as discs or drills) to create furrows in the soil, and a mechanism to cover the seeds once they are placed. In addition to these fundamental features, modern seed sowing machines are equipped with advanced technologies such as GPS, sensors, and automation systems, enabling precise control over the sowing process. These innovations ensure that the seeds are planted with optimal accuracy, adjusting for variations in soil conditions, seed type, and crop requirements. Furthermore, many contemporary machines are designed to handle a wide range of seed types, from small grains to large legumes, making them versatile tools for diverse agricultural operations. By reducing human labour, enhancing planting precision, and increasing operational speed, seed sowing machines contribute significantly to the advancement of modern agriculture, particularly in the realm of precision farming. The adoption of these machines not only boosts the productivity of large-scale farming but also helps in minimizing environmental impacts by reducing over-sowing, optimizing fertilizer use, and promoting sustainable agricultural practices.

KEYWORDS: Sowing machine, Hopper, Seed distribution mechanism, Ground wheel, Power transmission system.

I. INTRODUCTION

A Seed Sowing Machine is an essential agricultural innovation that has significantly transformed the traditional method of planting seeds. In conventional farming, manual sowing methods were labour-intensive, time-consuming, and often prone to inconsistencies, resulting in uneven seed distribution, improper depth placement, and wasted seeds. This affected overall crop yield and farming efficiency. The seed sowing machine addresses these issues by automating the sowing process, ensuring that seeds are planted at the correct depth, spacing, and in a uniform manner across the field. It is equipped with key components such as a seed hopper for storing and dispensing seeds, a metering mechanism to control the rate of seed flow, and a furrow opener (which can be a disc or drill) to create furrows in the soil for seed placement. Some modern machines also incorporate sophisticated features like GPS, sensors, and automation systems, allowing them to adjust sowing parameters based on real-time data such as soil conditions, seed type, and terrain variations. This results in more precise and efficient sowing, leading to higher crop yields, reduced seed wastage, and significant savings in labour costs.

Additionally, the versatility of modern seed sowing machines enables them to handle various types of seeds, from small grains to large legumes, making them suitable for a wide range of crops. By automating and optimizing the sowing process, these machines contribute to the overall advancement of precision farming, promoting sustainable agricultural practices, reducing environmental impact, and supporting the scalability of modern farming operations. The adoption of

seed sowing machines is increasingly seen as a critical step towards enhancing food production and improving agricultural productivity globally.

II. LITERATURE SURVEY

A literature survey on Seed Sowing Machines reveals the evolution and ongoing advancements in technology, design, and performance. Below are the key points discussed in the literature on this topic:

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.

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.

Early Developments in Seed Sowing Machines: The development of seed sowing machines can be traced back to the late 19th century when mechanical devices were first introduced to replace manual sowing methods. Early machines were basic and aimed primarily at simplifying the labor-intensive process, ensuring more uniform seed placement compared to manual sowing.

Types of Seed Sowing Machines:

Mechanical Seed Sowing Machines: These machines use mechanical mechanisms such as rotating discs or drums to meter and place seeds in the soil. They are most suitable for dry, loose soils and small-scale applications.

Machine Versatility: Modern seed sowing machines are now capable of handling a wide variety of seed types, including small seeds (like wheat and rice) and larger seeds (like beans or corn). Research has focused on making machines adaptable to different soil types, ensuring optimal performance in diverse farming conditions.

Environmental Impact and Sustainability: Several studies have examined the environmental benefits of seed sowing machines. By minimizing seed wastage and optimizing sowing depth, these machines contribute to more sustainable farming practices. They help reduce the overuse of fertilizers and water by planting seeds with better precision, leading to more efficient use of resources.

Improving Yield and Reducing Seed Wastage: One of the main benefits cited in recent research is the potential of seed sowing machines to reduce seed wastage. The precision with which seeds are placed in the soil minimizes the need for replanting and ensures that each seed has the best chance of germination, thus improving overall crop yield.

Economic Benefits: Literature also points to the significant economic advantages of using seed sowing machines. These include labor cost savings, faster planting times, and higher yields, which contribute to the profitability of large-scale farming operations. Furthermore, less seed wastage and reduced need for manual labor translate into lower operational costs.

Challenges and Future Directions: Despite these advancements, some studies have highlighted challenges such as the high initial cost of advanced machines and the need for proper training to use the technology effectively. Future research is focusing on making these machines more affordable and efficient, as well as exploring the use of renewable energy sources to power these machines.

III. METHODOLOGY

We started with the actual fabrication of project the material survey is to be made to select the appropriate materials for the entire project. The second step is to layout a proper plan for the project so that project can be carried out in stages. Based on the concept of the project the following material was needed to the completion of the project.

1. Selection of frame material:

Since the frame or chassis forms the integral part of the project on which all the other components can be mounted, care has to be taken while choosing the material for the frame of the project.

2. Machine Design and Components

Seed Hopper: The seed hopper is the main storage unit for seeds. It holds a large quantity of seeds, which are dispensed in a controlled manner. The hopper is typically equipped with a lid or cover to prevent seeds from spilling and to protect them from environmental factors.

3. Seed Delivery System: Once dispensed, the seeds are delivered into the furrow or seedbed. The system often uses tubes or solid circular wood device to guide the seeds to their final placement.

4. Furrow Opener/Seeder Discs: The furrow opener creates a small trench or groove in the soil, allowing the seeds to be planted at the correct depth. These components can vary based on the machine.

5. Operation Process

Movement and Ground Penetration: The seed sowing machine moves across the field, either pulled by a tractor or operated autonomously. The wheels or tracks of the machine ensure stability and facilitate proper soil penetration, creating furrows for the seeds.

Seed Dispensation: As the machine moves forward, the metering mechanism releases seeds at a constant rate, which are then directed into the furrow or trench formed by the opener.

Seed Placement: The seeds are placed at the ideal depth and spacing according to the preset parameters. Advanced machines can adjust the depth.

6. The drive system in a seed sowing machine is essential for controlling its movement, seed distribution, and operational functions. Depending on the type of seed sowing machine and its design, different types of drive systems are used to power various components. Here are the main drive systems employed in seed sowing machines:

7. Mechanical Drive System

Description: A mechanical drive uses gears, shafts, chain and crank to transmit power from a prime mover to the machine's various components. It is the simplest and most common drive system in older and more traditional seed sowing machines.

IV. DESIGN OF SEED SOWING MACHINE



Fig.1. Proposed design for seed sowing machine

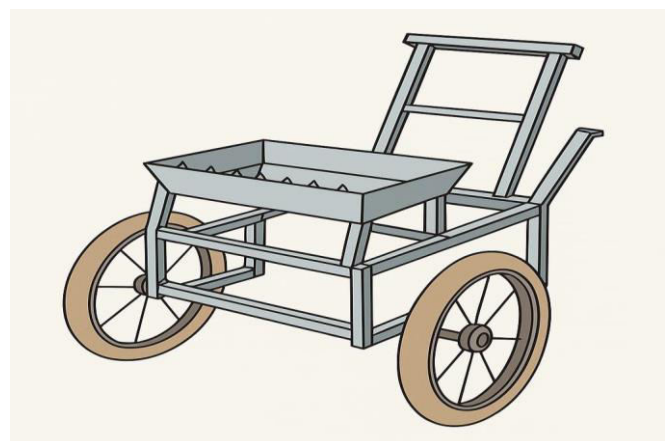


Fig.2. 3D model of seed sowing machine

Construction-

1. Frame:

Made of welded metal pipes (possibly mild steel or aluminum) to provide structural support.
It consists of a rectangular base frame with vertical handles for pushing the machine.

2. Wheels:

Three wheels: two rear wheels and one front support wheel.
The rear wheels are connected with a chain and sprocket mechanism.
The wheels seem to have rubber or plastic tires suitable for movement over soil.

3. Seed Hopper:

A metallic container (hopper) mounted centrally on top.
Divided into sections to hold different types of seeds.
Seeds fall through small outlets to the tubes below.

4. Bottles & Tubing Mechanism:

Recycled plastic bottles are used as part of the seed metering or fertilizer liquid system.
Connected via flexible plastic tubing (orange pipes)
These likely help in controlling the flow of seeds or liquids.

5. Chain and Sprocket Mechanism:

A chain drive connects the rear wheel axle to a shaft under the hopper.
When the machine moves, the rotation of wheels drives the metering mechanism.

6. Handle:

Long vertical handlebar with a horizontal grip for pushing the machine.
Attached firmly to the frame to provide control and manoeuvrability.

V. SPECIFICATIONS OF COMPONENTS

SR.NO	COMPONENTS	SPECIFICATIO N	QUANTITY	PRICE
1.	Steel Pipe	1×1	1	500
2.	Steel Plate	16 gauge	1	300
3.	L angle	1 Inch	1	400
4.	Plastic coated rims	14 Inches in dia.	2	300
5.	Steel Bar	6 mm	2	150
6.	Chain	-	1	50
7.	Crank	-	1	200
8.	Bearing	-	1	70
9.	freewheel	-	1	100
10.	Plastic bottles	-	4	20
11.	Rubber pipe	½ Inch	4	130
12.	Mechanical row material	-	-	1000
13.	Wood matering component	10 mm Dia.	2	200
TOTAL				3420

Working-

A manually operated seed sowing machine is designed to automate the labor-intensive task of planting seeds, making the process more efficient while reducing the physical strain on the operator. The working mechanism of such a machine is straightforward but relies on a series of interrelated components that work in unison to plant seeds with

precision. The process begins when the operator fills the seed hopper—a compartment that stores the seeds—at the top of the machine. This hopper is designed to hold a sufficient amount of seeds to minimize the need for frequent refills during planting. The operator then adjusts the settings on the machine, which may include modifying the depth at which seeds will be planted, adjusting the spacing between seeds, and determining the row width depending on the type of crop being sowed and the condition of the soil. With the machine set and ready, the operator begins the process by manually pushing or pulling the machine forward across the field.

As the machine moves, it activates the seed dispensing mechanism, typically a rotating seed plate or drum located just below the seed hopper. This mechanism is responsible for feeding the seeds from the hopper and placing them at precise intervals on the ground. As the seed plate rotates, it picks up seeds from the hopper and drops them through small openings onto the soil below. In simpler designs, gravity may also assist in feeding the seeds, where the hopper tilts slightly forward to allow seeds to flow down a chute. The rotating seed plate or drum controls the spacing and even distribution of the seeds as it moves across the field, ensuring that the seeds are dispensed consistently. The design of the dispensing system can be adjusted to control the flow rate, which is important for different types of seeds, from large beans to small grains, ensuring they are dispensed in appropriate quantities.

Before the seeds are dropped into the soil, the machine creates a furrow using a furrow opener mechanism, which is often a blade or set of discs at the front of the machine. These discs or blades dig into the soil as the machine moves forward, creating a shallow trench where the seeds will be placed. The depth of the furrow can be adjusted to accommodate various seed types, as different crops require different planting depths to thrive. Once the furrow is made, the seeds are deposited in it as the machine continues to move forward.

After the seeds are dropped into the furrow, the soil is then pressed back over them by press wheels or rollers located at the back of the machine. These press wheels ensure that the seeds are properly covered with soil, which helps maintain good soil-to-seed contact, essential for effective germination. The pressure applied by the press wheels can often be adjusted depending on soil conditions—loose soil may require less pressure, while denser, compact soil may require more force to ensure the seeds are firmly covered.

The operator continues to push or pull the machine along the field, repeating the process across multiple rows if the machine is designed for multi-row sowing. Depending on the design, the machine can sow several rows at once, with separate dispensing mechanisms for each row. This reduces the time and effort needed for planting over larger areas. The process ensures that the seeds are spaced evenly, placed at a uniform depth, and covered with soil in a consistent manner, all of which are important for optimal crop growth. Throughout this process, the operator may adjust certain settings of the machine, such as seed flow or row width, based on the field's specific needs or the type of crop being planted. Once the sowing operation is complete, the machine may require minimal maintenance, such as cleaning the seed hopper and checking for wear and tear on moving parts. The design of the machine is typically lightweight yet durable, with parts that can be easily serviced or replaced as necessary, ensuring longevity and reliable operation. By streamlining the planting process, a manually operated seed sowing machine not only reduces the labor and time required for sowing but also helps to improve the precision and efficiency of seed placement, ultimately leading to better crop yields.

VI. CONCLUSION

In conclusion, the literature on seed sowing machines illustrates the significant progress in agricultural mechanization, with ongoing efforts to improve efficiency, reduce costs, and increase sustainability in farming practices. Researchers continue to focus on integrating new technologies such as AI, machine learning, and robotics to further optimize the sowing process and meet the growing demand for food production.

Moreover, by minimizing seed wastage and enabling precision sowing, the manual seed sowing machine supports sustainable farming practices and promotes increased yields with lower input costs. Overall, its implementation can lead to better resource management, improved working conditions for farmers, and enhanced food security in developing agricultural sectors.

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