

Fabrication of a Low-Cost Mechanical Seed Planter

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Abstract - Agricultural productivity in India is limited due to the dependence of small-scale farmers on traditional, labor-intensive methods. Modern machinery is often too expensive or too bulky for marginal farmers who own less than one hectare of land. This research focuses on the fabrication of a low-cost mechanical seed planter aimed at improving sowing performance, reducing labor, and ensuring uniform seed placement. The use of locally available materials and simple fabrication methods helps reduce the overall cost, making the machine more accessible to small farmers. The design, which integrates a seed hopper, metering mechanism, furrow opener, and covering device, ensures both precision and efficiency in sowing. Field testing is conducted to validate performance parameters such as seed spacing, depth accuracy, and time savings.

Key Words: Seed Planter, Agricultural Mechanization, Seed Sowing machine

1. INTRODUCTION

The demand for food is expected to exceed production capabilities due to the increasing population and rising per capita food consumption. Mere expansion of farmland is not sufficient; higher yields from the existing agricultural land must be ensured. India has made some progress in this direction, yet many small-scale and low-income farmers continue to rely on out dated and time-consuming methods because they cannot afford expensive modern machinery. These farmers typically own less than 1 hector of land and depend on manual labour or cattle for ploughing and sowing. In contrast, farmers in developed countries can cultivate hundreds of acres using advanced machinery. Because farming is labour-intensive and plays a vital role in national growth and development, engineers have attempted to reduce human effort by mechanizing farm operations. Researchers have explored several innovative approaches, including mechanical and solar-powered systems, seed-metering technologies, and Adriano-based automated sensor systems. India, being predominantly an agricultural nation with nearly 75% of its population dependent on farming, still practices largely out dated techniques. Poor mechanization and low power availability are key reasons for low agricultural productivity. Therefore, there is an urgent need to develop efficient, modern machinery for operations such as sowing, spraying, weeding, and similar tasks to enhance productivity and support multiple cropping cycles. To achieve this goal, agricultural machines must be properly designed and adapted to suit specific crop requirements.

With India's large and rapidly growing population, agriculture continues to be crucial for sustainable development. Conventional manual practices are still widely used, but they are time-consuming, costly, and result in significant seed wastage, especially on larger farms. Hence, there is an urgent need for mechanization to reduce labour involvement, increase productivity, and ensure timely completion of farm operations. This Work addresses the needs of small-scale farmers and focuses on developing a low-cost, automated machine for optimizing ploughing and seed-sowing operations. Although it may not be as versatile as tractors, it is significantly more affordable and can save valuable time, allowing farmers to pursue other income-generating activities without compromising agricultural productivity. Several researchers have contributed to the advancement of seed-sowing technologies aimed at improving efficiency, precision, and productivity. Manually operated and automated machines—such as okra planters, paddy seeders, and jab planters—have shown moderate improvements in field capacity, reduced seed damage, and lower labour requirements. Innovations such as disc-type and pneumatic seeders have improved user comfort and operational efficiency, while robotic systems equipped with sensors monitor soil conditions to optimize seed placement and resource utilization. Traditional sowing methods, such as manually dropping seeds into furrows created by ploughs, often result in poor control over seed depth, inconsistent spacing, and considerable seed wastage. Many seeds remain uncovered or are lost due to erosion, animals, or weather conditions, leading to low germination rates and over-seeding issues, which negatively affect crop yield due to competition for resources. The invention of the seed drill marked a major technological breakthrough by enabling uniform seed depth and proper soil coverage, significantly improving germination and overall yield [1]. Multiple researchers have developed innovative seed-sowing machines to enhance planting efficiency, minimize seed loss, and reduce labour costs. These include autonomous and manually operated devices, solar-powered systems, and robots controlled by microcontrollers or smartphones. Key advancements include the use of sensors, adjustable seed-metering mechanisms, and integration with fertilizer and pesticide dispensing systems. The materials used are cost-effective and suitable for small-scale farming. Overall, these innovations emphasize precision sowing, affordability, ease of use, and adaptability to various seed types and farming conditions [2]. Several studies underline the importance of technological innovations in seed-sowing equipment to improve agricultural productivity. Researchers highlight that

advancements in sowing technology significantly influence crop cost and yield, stressing the need for mechanization to meet future food demands, improve accuracy, and reduce input costs [3]. Proper seed placement and spacing are essential for achieving optimal yields. Adoption of modern sowing methods enhances crop production without degrading soil quality. Collectively, these studies emphasize the crucial role of efficient sowing techniques in modern agriculture [4].

2. PROBLEM IDENTIFICATION

- Seeds do not fall at the proper distance or depth.
- Many seeds are wasted due to poor control of seed flow.
- Sowing is time-consuming and reduces work efficiency.
- The operator becomes tired because of the high physical effort required.
- The machine cannot handle seeds of different sizes.
- It is not suitable for uneven or rough field conditions.
- Germination becomes poor due to inadequate soil-seed contact.
- Farmers experience non-uniform plant growth and lower yields.

3. OBJECTIVES

- To manufacture a seed-sowing machine that can be operated by a single operator.
- To dispense fertilizer along with the sowed seeds.
- To level the ground to a small extent.
- To enable the machine to sow various types of seeds such as maize, wheat, etc.
- To maintain a uniform distance between two seeds during the sowing process.

4. METHODOLOGY

- Literature Review: Studied existing seed-sowing tools to understand their limitations.
- Problem Identification: Identified issues related to uneven sowing, high labour requirements, and low efficiency.
- Design & Calculations: Prepared design sketches, selected the best concept, and performed basic calculations for seed spacing, wheel size, and frame dimensions.
- Material Selection: Chose low-cost, lightweight, and easily available materials such as mild steel and PVC.
- Fabrication: Included cutting, welding, drilling, and assembling components such as the frame, seed

box, furrow opener, metering mechanism, and wheels.

- Testing: Conducted field trials to check seed spacing, sowing depth, and ease of operation.
- Modification: Made necessary changes based on test results to improve performance.
- Final Testing: Confirmed that the modified machine provides uniform sowing with reduced effort and time.

5. WORKING PRINCIPLE

In our country, farming is still carried out using traditional methods. Meanwhile, there has been significant development in the industrial and service sectors compared to agriculture. Spraying is traditionally done by labour using a backpack-type sprayer, which requires considerable human effort. Weeding is generally done with the help of bulls, which becomes costly for farmers with small land holdings. To overcome these problems, we designed equipment that benefits farmers by performing both spraying and weeding operations efficiently. The seed-metering mechanism operates through the rotation of the wheels when pushed manually. It picks seeds from the hopper and drops them through a seed tube into the furrow created by the opener. The seeds are then covered with soil and lightly pressed by a roller or wheel to ensure proper germination. This seeding technique provides uniform seed spacing, accurate depth placement, and reduced human labour. Figure 1 shows the multi-purpose seed-sowing machine, and Table 1 presents the comparison between manual, tractor-operated, and multi-purpose seed machines.



Fig.1: Mlti-purpose seed sowing machine

Table 1: Comparison between manual, tractor-operated, and multi-purpose seed machines

Sr. No.	Parameters	Manual seed sowing	Tractor operated seed sowing	Multi- purpose Seed Sowing machine
1	Sowing technique	Manually	Automatically	Automatically
2	Distance Between the Seed	Not Fixed	Fixed	Fixed But Changeable
3	Pollution	No	More	No
4	Cost	Less	Very High	Very Less
5	Required Energy	High	Very High	High
6	Man Power	More	Moderate	High

6. CONCLUSION

These low-cost mechanical seed planters successfully overcome the drawbacks of traditional sowing methods because they are portable, inexpensive, and highly effective. The prototype provides proper row spacing, uniform seed placement, reduced labor, and the potential for higher yields. In the future, this machine can incorporate fertilizer dispensing, and a solar-powered mechanism will further enhance its usability and sustainability.

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