

# Design and development of a manual groundnut planter for smallholder farmers

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**Abstract:** This article presents the design and development of a manual groundnut planter, specifically tailored for smallholder farmers cultivating less than two hectares of land. The planter serves as an intermediate technology between hand tools and tractor-drawn multi-row planters, addressing the financial constraints faced by a significant portion of the farming population. The planter's design focuses on minimizing drudgery by eliminating continuous bending and standing up, ultimately improving efficiency and reducing time wastage. Key considerations during the design phase include affordability, ease of construction using locally available materials, and low technological complexity, requiring minimal training for operation and maintenance. Operational functionality involves a single-row tiller drawn type planter, utilizing a feed-in disc roller principle. Seeds are poured into the hopper, picked up by the metering plate, and introduced into the chute. The furrow opener continuously opens the soil, and the seeds fall into the furrow, simultaneously closed by the leveller. The planter achieves a continuous planting at a 30 cm intra-row spacing. The article further details the description of the groundnut planter, highlighting its components such as the handle, seed hopper, furrow opener, seed discharge tube, main body (frame), and metering roller housing. The planter's power is derived from the rotation of the wheel, and motion is transmitted through the shaft to the metering unit. The methodology is outlined, including a flowchart illustrating the design process and the use of AutoCAD software for the 2D design. Mechanical factors considered for the planter design include uniformity of seed depth placement, distribution along rows, transverse displacement, and soil cover. Design considerations prioritize the ease of fabrication, operator safety, simplicity for small-scale farmers, and the use of locally available materials. The viability and nature of the seed, including orientation and moisture content, are also taken into account. The article concludes with a discussion on the collection of required materials, including the seed box, seed metering disc, seed transmission hose, and main frame. The presented manual groundnut planter aims to enhance the planting process for

smallholder farmers, offering an affordable and efficient solution to improve agricultural practices.

**Keywords:** Advantage, Seeder, Economical, Adjustable spacing, Uniform seeding, Seed damage, Monitoring, Disadvantage, Loose soil, Speed, Marginal farmers

## 1.Introduction:

In the ever-evolving landscape of agriculture, the role of technology in enhancing productivity and sustainability cannot be overstated. Smallholder farmers, constituting a significant portion of the global farming community, often face financial constraints that limit their access to advanced agricultural machinery. This article introduces a ground-breaking initiative in the form of the "Design and Development of a Manual Groundnut Planter," tailored explicitly for smallholder farmers cultivating less than two hectares of land. As we delve into the intricacies of this manual groundnut planter, the primary focus is on bridging the technological gap between traditional hand tools and large-scale tractor-drawn multi-row planters. This innovative solution aims to alleviate the challenges faced by smallholder farmers, addressing concerns such as labour-intensive processes, financial limitations, and the need for efficient planting methods. The design philosophy behind this manual groundnut planter centres on minimizing labour drudgery by eliminating continuous bending and standing up during the planting process. The ultimate goal is to enhance efficiency, reduce time wastage, and empower small-scale farmers with a tool that strikes a balance between affordability and functionality. The planter's design is characterized by simplicity, utilizing locally available materials and requiring minimal training for operation and maintenance. The operational functionality of the planter involves a single-row tiller drawn type, incorporating a feed-in disc roller principle. Seeds are seamlessly fed into the furrow, ensuring a continuous planting process at a 30 cm intra-row spacing. Key components such as the handle, seed hopper, furrow opener, seed discharge tube, main body (frame), and metering roller housing are meticulously designed to optimize performance and durability.

This article provides a comprehensive overview of the groundnut planter, detailing its construction, operational principles, and the mechanical factors considered during the design phase. The methodology, illustrated through a flowchart and the utilization of AutoCAD software for 2D design, underscores the systematic approach taken to ensure precision and functionality. Crucial aspects such as uniform seed depth placement, distribution along rows, transverse displacement, and soil cover are thoroughly examined to guarantee the planter's effectiveness. Emphasizing the importance of accessibility, the design considerations prioritize ease of fabrication, operator safety, and the utilization of locally available materials. Furthermore, the article delves into the viability and nature of the seed, taking into account factors such as orientation and moisture content. The conclusion discusses the practical aspects, including the collection of required materials, such as the seed box, seed metering disc, seed transmission hose, and main frame. In summary, the presented manual groundnut planter represents a significant leap towards empowering smallholder farmers with an affordable and efficient solution to enhance their planting processes. By amalgamating innovation with simplicity, this initiative strives to contribute to the improvement of agricultural practices, ensuring sustainability and productivity for the backbone of our global food production system.

## 2.Objectives:

1. Develop a manual groundnut planter specifically designed for smallholder farmers, aiming to bridge the technological gap between traditional hand tools and larger, more expensive machinery.
2. Enhance planting efficiency and reduce labour drudgery by introducing an affordable and locally sourced manual groundnut planter, addressing financial constraints and empowering small-scale farmers with a practical and accessible agricultural tool.

## 3.Materials and Methodology:

The successful design and development of the manual groundnut planter involved a meticulous approach, encompassing the selection of appropriate materials and a systematic methodology. This section outlines the key components utilized in the planter's construction and provides a detailed overview of the step-by-step process employed during its development. From the seed box to the main frame, each material's role and the precise steps followed in the design process are elucidated, ensuring a comprehensive understanding of the innovative agricultural tool's creation.

### 3.1.Analysis:

The Materials and Methodology section provides a detailed insight into the development of the manual groundnut planter, emphasizing its design principles, components, and the systematic approach employed in its creation.



Fig. 1 SEED BOX



Fig. 2 SEED DISC

The design principle revolves around addressing the specific needs of smallholder farmers with limited resources and land area. The planter serves as an intermediate technology, offering an affordable alternative to tractor-drawn planters, considering the financial constraints faced by a significant portion of the farming population. The focus on minimizing drudgery through the elimination of continuous bending and standing up reflects a commitment to improving efficiency and reducing time wastage.

The description of the groundnut planter outlines its key components, such as the handle, seed hopper (fig.2), furrow opener, seed discharge tube, main body (frame)(fig.3), and metering roller housing. The utilization of locally available materials and the consideration of low technological complexity ensure ease of construction and affordability for the target end users.

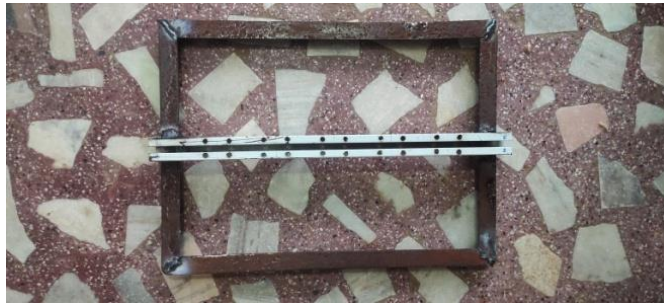


Fig. 3 MAIN FRAME



Fig. 4 TYNE

The operational functionality, utilizing a single-row tiller drawn type with a feed-in disc roller principle, is detailed, highlighting the seamless process of planting at a 30 cm intra-row spacing. The power derived from the rotation of the wheel and its transmission through the shaft to the metering unit underscores the simplicity and practicality of the design.

The inclusion of a flowchart illustrating the methodology and the use of AutoCAD software for the 2D design showcase a systematic and technologically advanced approach to the planter's development. The emphasis on mechanical factors, such as seed depth placement, distribution, transverse displacement, and soil cover, demonstrates a comprehensive consideration of planting variables for optimal results.

#### **4.Design considerations:**

Design considerations, including ease of fabrication, operator safety, simplicity for small-scale farmers, and the use of locally available materials, align with the overarching goal of accessibility. The mention of CAD tools and their role in optimizing the design process further emphasizes the integration of technology to enhance efficiency.

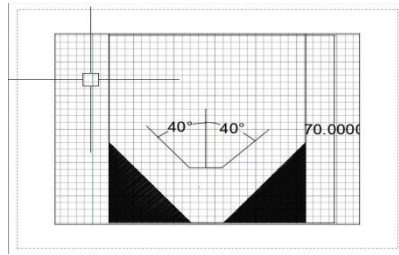


Fig.5. TYNE EDGE

Length-70mm, Breadth-63mm, Degree-40mm

The section concludes with a detailed list of required materials, each with its specific function in the planter's construction. The mention of altering materials through cutting, grinding, drilling, and welding (fig.4) followed by the assembly process, provides insight into the fabrication and manufacturing aspects of the planter.

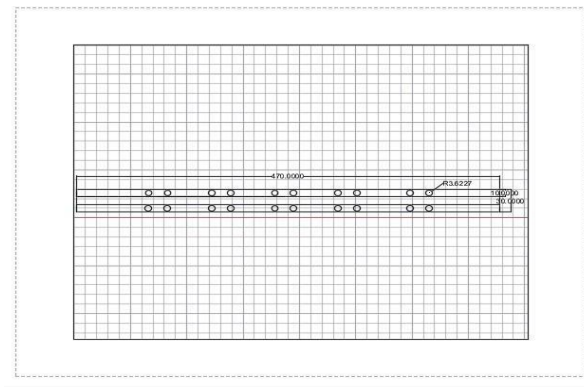


Fig.6. ADJUSTABLE FRAME

Length-470, Breadth-30, Radius-3.6(in mm)

Overall, the Materials and Methodology section not only outlines the technical aspects of the manual groundnut planter but also emphasizes the practicality, affordability, and accessibility that are crucial for its successful implementation among smallholder farmers.

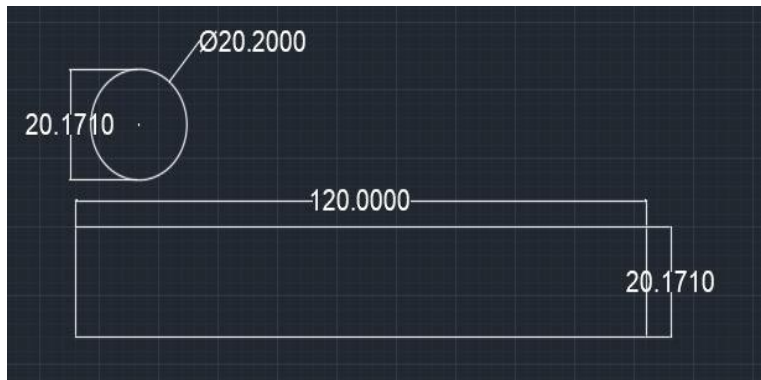


Fig.7. SEED TRANSMISSION HOSE

Radius-20mm, Length-120mm

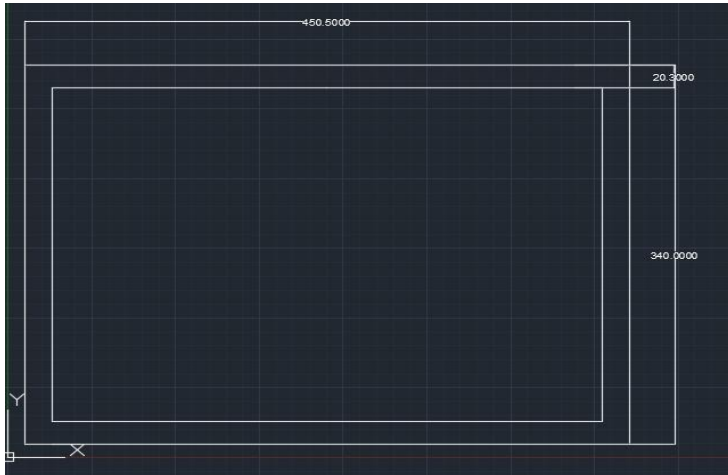


Fig.8. OUTER COVER OF MAIN FRAME

Length-450 and Breadth-340 (in mm)

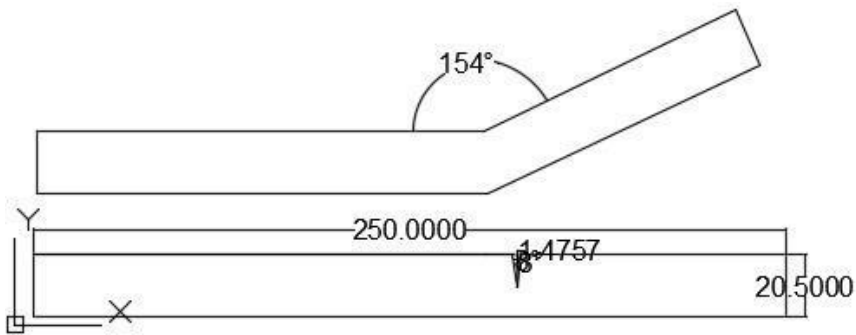


Fig.9. TYNE FRAME

Length-250(in mm) Breadth-20.5(in mm) Degree=8,154

## 5. Conclusion:

The seeder designed in this project presents several notable advantages that cater to the needs of marginal farmers and those unable to afford rented groundnut seeders. The device offers an economically viable solution with its adjustable and accurate spacing, promoting uniform seeding while minimizing seed damage. Additionally, the ease of monitoring seed deposition enhances overall efficiency. However, it is important to acknowledge that the seeder has limitations, particularly in its applicability restricted to loose soil. While it achieves uniform seeding, this is limited to an average speed, which may pose challenges in certain contexts. Nevertheless, the significance of the seeder lies in its potential to address the needs of farmers facing resource constraints. Its enhanced seeding efficiency, compared to conventional cup feed seed metering mechanisms, makes it a valuable tool for multipurpose seeding. The adaptability to various crop types and adjustable depth through hydraulic action further underscores its practicality. Furthermore, the choice of locally available and affordable materials not only makes the seeder accessible but also contributes

to its cost-effectiveness. Overall, this seeder stands as a commendable innovation, bridging gaps in agricultural practices and providing a sustainable solution for small-scale and resource-limited farmers.

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