

DESIGN AND FABRICATION OF MULTIPURPOSE AGRICULTURE MACHINE

Prof. Pramod Jadhao, Vinit Patil, Shubhankar Shirsat, Ashutosh Pandey, Vinayak Pandey

Department Of Mechanical Engineering

Smt. Indira Gandhi College Of Engineering, Navi Mumbai, Maharashtra

*** Abstract - This report outlines the development of a multipurpose agricultural machine designed to alleviate labor demands and boost productivity in farming. Extensive research and careful design were conducted to create a versatile solution that incorporates features such as a flexible power source, sturdy mobility, and modular attachments for various tasks. The fabrication process involved precise machining and thorough testing to ensure reliability and optimal performance in real-world conditions. Initial findings indicate promising reductions in labor requirements and enhancements in productivity. However, challenges persist in areas such as advanced controls and scaling production. Nevertheless, our project represents a significant advancement in the agricultural sector, offering a cost-effective and user-friendly solution to support farmers worldwide.

Key Words: Multipurpose agricultural machine, Labor reduction, Robust mobility, Cost-effectiveness, Userfriendly solution, research, calculations, fabrication, costeffective, ergonomic

INTRODUCTION

In the heart of global agriculture, where nature and innovation converge, lies a sector grappling with challenges from climate change to poverty. Our project pioneers multipurpose agricultural machinery to revolutionize farming, blending modern engineering with traditional wisdom for sustainability. From design to field testing, we navigate a journey of innovation, listening to farmers' insights to cultivate resilience and progress. This endeavor stitches together a narrative of creativity and collaboration, forging a path towards a brighter agricultural future nurtured by our collective imagination. In our quest for agricultural transformation, we strive to cultivate a future where ingenuity meets necessity, where each innovation sows the seeds of possibility. Together, let's embark on this journey towards a harvest of prosperity, redefining the landscape of agriculture for generations to come.

PROBLEM STATEMENT

The agriculture sector grapples with labor shortages, high operational expenses, and resource limitations, necessitating a versatile solution: the multipurpose agricultural machine. This innovation aims to

streamline operations, cut costs, optimize resources, and foster sustainability by consolidating multiple functions into one platform.

 \triangleright By integrating various functionalities, such a machine enhances efficiency, adaptability, and competitiveness in farming, serving as a crucial tool for modernizing agriculture and empowering farmers to effectively tackle prevailing challenges.

OBJECTIVE

- Comprehensive research
- Multipurpose machine design
- Advanced technology integration
- Prototype fabrication
- Usability and compatibility
- ➢ Real-world testing
- \succ Performance evaluation
- Stakeholder feedback gathering
- Cost-effectiveness analysis
- Economic viability assessment
- \triangleright Socio-economic impact evaluation

LITERATURE SURVEY

The literature review for the Multipurpose agriculture machine encompasses a diverse range of studies that delve into the innovative intersection of exercise and transportation.

Dr. C.N. Sakhale^[1] and colleagues from Priyadarshini College of Engineering, India, present a comprehensive study on a multipurpose farm machine tailored for smallscale farmers in India. They emphasize the need for agricultural mechanization to address resource constraints and rising productivity demands. Drawing from previous research, they propose a machine integrating various components to streamline farming tasks and minimize manual labor. This cost-effective solution holds promise for enhancing productivity and alleviating labor challenges in Indian agriculture, with potential for future advancements. Similarly, Om Khadke[3] and his team from NIT Polytechnic Nagpur develop a solar-operated multipurpose agricultural machine to aid small-scale Indian farmers. Their research underscores the significance agricultural of mechanization, leveraging previous studies. The machine, performing tasks like seed sowing, pesticide spraying, and grass cutting, offers a cost-effective solution. The methodology includes literature review,



market survey, fabrication, and testing, resulting in various assembly components powered by an engine. This innovation contributes to heightened productivity and decreased labor reliance in Indian agriculture. Furthermore, Asit Dhawale [3] and colleagues delve into the development of multipurpose agricultural machinery in India in their research published in the International Journal of Research in Engineering, Science, and Management. They stress the transition from traditional to modern farming methods, advocating for affordable equipment to aid small-scale farmers. The study explores innovations in agricultural machinery, highlighting benefits such as increased efficiency and reduced labor. It outlines constructional features, including components like the engine, differential, and steering mechanism, and discusses functions of essential components like cultivators, seed drills, and sprayers. The research concludes by underscoring the advantages of the multipurpose agriculture machine in efficiently covering large field areas, reducing labor, and offering costeffective farming solutions. In addition, Goraksh Choughule [4] underscores the importance of mechanization in agriculture through multipurpose agricultural machines, aiming to ease the burden on especially smallholders, farmers, by boosting productivity and reducing labor. Traditional methods are deemed inefficient and labor-intensive, necessitating cost-effective solutions. These machines offer a single, integrated platform for various tasks, enhancing overall efficiency. Accessible designs tailored to smallholder needs are essential for widespread adoption. While technological advancements hold promise for further improvement, inclusive development policies are crucial to ensure equitable benefits for rural communities.

METHODOLOGY

- Problem Identification
- Literature Review
- Design Calculations
- CAD Modeling
- Material Selection
- Precision Manufacturing
- Assembly Instructions
- Documentation
- Validation

LIST OF PARTS AND MATERIALS

1) FRAME (1 Qty):

The frame serves as the structural backbone of the treadmill tricycle, providing support and stability to the entire assembly. Fabricated from mild steel (M.S), the frame is designed to withstand the rigors of daily use while maintaining structural integrity. Its sturdy construction ensures durability and reliability throughout

the tricycle's lifespan.

2) WHEELS (4 nos.):

Wheels in a multipurpose agriculture machine serve to provide mobility and stability, enabling efficient navigation across diverse terrains. They support the machine's weight and facilitate the uniform distribution of agricultural inputs like seeds, fertilizers, and pesticides, ensuring consistent coverage for optimal crop growth.

3) SEED FEEDER (MADE UP OF ALUMNIUM):

The purpose of the seed feeder in a multipurpose agriculture machine is to facilitate precise and uniform seed distribution during the planting process. By controlling the rate and spacing of seed dispersal, the seed feeder ensures optimal seed placement, which is essential for promoting uniform crop growth and maximizing yield. Additionally, the seed feeder helps to streamline planting operations, reducing manual effort and labor costs for farmers.

4) SERVO MOTORS:

A servo motor in a multipurpose agriculture machine is utilized to precisely control various mechanical components, enhancing operational accuracy and efficiency.

5) ARDUINO:

Arduino plays a crucial role in a multipurpose agriculture machine by serving as the central control unit for coordinating different functions and components. It facilitates automation and customization of operations such as seed sowing, fertilizer spreading, and pesticide spraying. Additionally, it enables integration with sensors and actuators, enabling real-time monitoring and adjustment based on environmental conditions, ultimately contributing to improved crop management and productivity.

6) DC BATTERY:

The DC battery serves as the power source for a multipurpose agriculture machine, providing the necessary electrical energy to operate various components such as motors, pumps, and controllers. It ensures the machine's mobility and functionality,

I



enabling tasks such as seed sowing, fertilizer spreading, and pesticide spraying to be performed efficiently and

independently, even in remote agricultural areas without access to grid power. Additionally, the battery's portability and rechargeability allow for flexibility in deployment and prolonged operation, contributing to increased productivity and reduced reliance on conventional energy sources.

DESIGN CALCULATION

Calculations for seeding :-

Speed = 30 rpm,

Row spacing= 25 cm

Seed sowing time= 2 seed/ sec

Opening no.= 5 Seed

Dropping per minute = $5 \times 30 \times (1/2) = 75$ seeds

Hence, if the speed of the wheel is 28 m/min, then for 28 meter 75 seeds will be dropped.

For ploughing tool :-

Depth of cut = 5cm

Considering Speed of the tool as 2.5 km/hr = 41.64 m/min

No. of tool= 4

Feed rate can be calculated as, (Speed of tool x depth of cut x Number of tool) = $41.64 \times 4 \times 0.05$

= 8.328

Calculation of torque transmitted on the wheel :-Calculation of torque transmitted on the wheel,

Tw = Kw x Wt x Rw

Where, Kw = Coefficient of the rolling resistance (0.3 for metallic wheel)

Wt = weight of the machine (8kg approx.)

Rw = Radius of the ground wheel

We have Kw = 0.3,

 $Wt = 8kg \times 9.81$

= 490.5N

Tw = Kw x Wt x Rw = 0.3 x 8 x 9.81 x 0.05 = 1.1772 Nm

 $P = (2 \ x \ \pi \ x \ N \ x \ T)/60$

 $= (2 \times 3.14 \times 30 \times 1.1772)/60 = = 4.11$ (watts)

ASSEMBLY CAD MODEL



RESULT AND DISCUSSION

The integration of seed sowing, fertilizer spreading, and pesticide spraying into a single machine has transformed agricultural efficiency, enabling multitasking and larger area coverage, thus boosting productivity. Utilizing solar power and efficient motor mechanisms, it offers a sustainable, cost-effective solution, reducing reliance on non-renewable resources and enhancing environmental benefits. Advanced metering ensures precise input distribution, optimizing crop yields and quality. Its modular design allows easy adaptation to diverse agricultural needs, though challenges like seed spacing uniformity component durability and persist. Nonetheless, its scalability and efficiency hold promise revolutionizing practices for farming globally, contributing to sustainable agriculture and improving food security.

CONCLUSIONS

The multipurpose agricultural robot gives an advance method to sow, plow and spray water with minimum man power and labour making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop.

I



REFERENCE

1.Asit Dhawale "Multipurpose Agriculture Machine" IJRESM February 2019, Volume 2, Issue 02, ISSN (Online): 2581-5792

- 1. Om Khadke "Fabrication of Multipurpose Agriculture Machine" IJIRT July 2021, Volume 8 Issue 2, ISSN: 2349-6002
- Dr. C.N. Sakhale "MULTIPURPOSE FARM MACHINE" IRJET Sep-2016, Volume: 03, Issue: 09, ISSN: 2395 -0056
- Someshwar "Fabrication of Multipurpose Agro Machine" IJCESR March 2020, VOLUME-7, ISSUE-3, ISSN (PRINT): 2393-8374
- 4. Goraksh Choughule "Multipurpose Agriculture Machine" IRJET May 2021, Volume: 08 Issue: 05, ISSN: 2395-0056