Design and Fabrication of a Ploughing and Seeding Machine and Its Applications

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Abstract: Agriculture being one of the major livelihoods in India, it is very indispensable to discover and implement new idea in this field though lot of work has been done in this area. It is unfortunate that, these ideas are not been implemented properly in actual field. This is due to high cost and is complicated for rural people. Agro-technology is the technology of agriculture, as the methods or machinery needed for efficient production. Agriculture sector need an improvement in the efficiency of the crop produced and also to develop a better mechanical machine to help the agriculture field which reduces the amount and time of work spent on one crop. Ploughing and seeding processes are fundamental stages in agricultural field, they can impact crop yield and overall farm productivity. Nowadays farmers using bulls for ploughing a crop, it takes lot of time if it is done by farmer and animals. There is another way to plough a field that is by using tractors, but the tractors are very expensive. A farmer cannot effort that much of money. In order to rectify this problem, a power tiller machine has been designed which is capable of doing ploughing and seeding operations simultaneously. This is fabricated with less capital. The electric power tiller machine helps to reduce the time and cost involved in tilling. The development of this ploughing and seeding machine represents a significant step towards a more sustainable and technologically advanced agricultural sector.

Keywords: Ploughing and Seeding Machine, Agriculture, Crop yield.

1. INTRODUCTION

Agriculture is backbone of human civilization. It has undergone remarkable transformations over the centuries. From the fundamental tools of our ancestors to the advanced machinery of the modern era. Farming practices have continuously evolved to meet the ever-growing demands of a promising global population. Nowadays farmers using bulls for ploughing a crop, it takes lot of time if it is done by farmer and animals.

There is another way to plough a field that is by using tractors, but the tractors are very expensive. A farmer cannot effort that much of money. For this concern “Ploughing and seeding machine” is fabricated with cheaper cost.

The ploughing and seeding machine is a fundamental agricultural machine used for land preparation and seed placement. This machine simplifies the process by combining the tasks of ploughing the soil and sowing seeds into a single operation. By ploughing the soil and accurately placing seeds, it helps farmers save time, labour, and resources. This machine plays a crucial role in modern farming, helping farmers to achieve greater productivity.

An automobile rear wheel with gear arrangement is used. L shaped bars are welded to the periphery of the automobile wheel to offer a tight grip on the soil during the tilling process. Five forks are fastened to the base of the machine for tilling the soil. An electric motor is used to drive the wheel. The motor is powered by a battery and has enough force to draw the forks through the soil. The five cultivator forks allow for precise and easy tilling. A solar panel is placed over the machine to charge the battery. Thus, the battery does not require to charge frequently. For avoiding over charging of the battery, a charge controller is used to control the charge. The battery of machine will be charged automatically while it is in use or idle. As a result, the electric power ploughing and seeding machine offers fuel-free mechanism for farming.

2. OBJECTIVES

- To develop a machine that efficiently performs both ploughing and seeding operations, reducing the time and labour required for these tasks.
- To design the machine to minimize soil disturbance during ploughing to preserve soil structure, reduce erosion, and improve soil health.
- Develop a machine that is cost-effective to produce and operate, making it accessible to both small-scale and large-scale farmers.
- Develop a machine that can be easily manufactured at scale to meet the demand of the agricultural market.

3. LITERATURE REVIEW

Sandesh Sawant et al [1]**,** in this paper researcher studied the portable battery charged electric power tiller machine. To provide maximum soil grip, the machine uses a wheel with welded angles. The machine is powered by an electric motor that drives the pulling wheel using a sprocket chain configuration. By adopting a motorized tilling system, it minimizes human effort at a very low cost. Using a unique portable design, the electric power tiller reduces the time and cost of tilling, enhancing agricultural output and efficiency. As a result, the electric power tiller offers a smart, fuel-free mechanism for farm and garden tilling.

Sonu Yadav et al [2], in this paper researcher studied the portable electric tiller machine. Power Tiller is mainly design for tilling of small farms and in hill farming. The adoption of Power tiller by the farmers for carrying out farming operation is low cost as compared to the tractors. The working capacity of power tiller presented here is 8 to 10 hours and weighting up to 30 to 40 kg. This machine is easy to operate cheap portable and simple in construction and maintenance available space. Power tiller is designed mainly for tilling of seedbed in small farms and in hill farming and also for carrying out spraying operations in horticultural crops and food crops.

Shailendra Zaveri et al [3], In this paper researcher studied about the design and fabrication of portable electric tiller and cutter machine. The machine makes use of a bike wheel rim with welded angles to provide efficient gripping on agriculture soil. A lithium-ion battery is used to power the hub motor with a force, capable of pulling the tiller blade through agriculture soil. In the fabrication process several operations have been performed such as cutting, drilling, welding and shaping operations.

Hemadri Chadalavada et al [4], In this paper researcher studied about solar powered semi - automated multipurpose agriculture machine. The main aim of project is to convert the solar energy into electrical energy and that energy is used to drive machine. The sun rays coming from the sun is absorbed by solar panel and that absorbed radiation is converted into electric energy by solar controller this energy is stored in batteries and used to drive vehicle and to rotate grass cutter motor on one side the water is sprayed through the sprayers via storage tank.

S. A. Bobade et al [5], presented about the design and fabrication of multipurpose agricultural solar operated seed sowing machine.

Dinesh Parve et al [6], presented about development solar powered multipurpose agriculture machine. The whole machine is drive with handle system through manual pressure. Two big wheels is arranged, so that whole machine can run efficiently. There is pesticide spraying, seeder roller and water arrangement etc. is attached to frame. The power source use here is solar energy. Solar panel (12v 10w) collect the solar energy and convert into electrical energy. This electrical energy is stored in battery. The stored energy in battery (12v 2Amp) is used for various other function like, seed spreading, watering and pesticide spraying function.

D. B. Dukale et al [7], discussed about the design and development of multipurpose agriculture solar machine. This project has designed a machine which can be a semi-automatic or fully automatic which can run on solar system to perform ploughing, digging, seeding and mulching in the field or greenhouse. The development and the fabrication of this machine which can dig the soil, put the seeds, leveler to close the mud and these whole systems of the machine work with the battery and the solar power. As a result, this solar powered seed sowing machine can maintain row spacing and controls seed rate, control the seed depth and proper utilization of seeds can be done with less loss.

Sanjay Patel et al [8], presented about the production of multipurpose agriculture machine. The multipurpose agricultural vehicle (MAV). This is an Automobile which is capable of grass cutting/ trimming, surface levelling and small load (80-100kg) towing. The concept used in working of this vehicle is quite similar to that of a tractor. The grass cutter, levelling roller and trolley are all designed and fabricated with a provision that they can be detached and attached to the main vehicle assembly easily and according to the requirement of the user. The use of this vehicle results in saving time.

Shiva Gorjian et al [9] studied the advent of modern solar-powered electric agricultural machinery. A solution for sustainable farm operations. This study promoted the combination of PV technology with modern electric agricultural machinery and to encourage farmers to employ this technique in mechanized agriculture by giving them an insight into the latest advances along with major challenges.

Anola Ku Panda et al [10] discussed the multipurpose agriculture machine its applications and uses. This work has developed a machine which satisfied all the needs and solved the problems of the labour. In this equipment a 24cc engine is used for digging operation and for spraying used motor with 12V battery. Next two operations are manual base which is cultivation and sowing. This machine performs four farming operation (digging, sowing, cultivation, spraying) which is used small scale farming. By using above attachments, one may perform various farming operations in less time and economically.

Vineet Pandey et al [11] presented the design and fabrication of seed sowing along with automatic irrigation system using robotic vehicle & solar panel. This project focuses on farming work like automatic irrigation system, and seed sowing. An automated irrigation system is successfully designed and assembled by using solar energy which is an best alternative of electrical energy and also not affect the environment as it is a clean energy.

Prasad Reddy et al [12], presented the development of multipurpose agriculture vehicle by using solar power. The function of this agricultural vehicle depends on the amount of solar energy that the solar panel receives and this solar energy is used to drive the different parts of the vehicle. The power transmission is done by using various gear mechanisms such as simple spur gear and worm and spur gear mechanisms along with chain and sprocket mechanism. This vehicle reduces the human effort in the field of agriculture and finds a solution to increase the mechanization in the fields. This vehicle is mainly useful for small size farms in order to increase the productivity.

Dilip Radkar et al [13] presented about the multipurpose agriculture machine. In this paper Unique machine is designed carry out the task of spraying the fertilizers and sowing of seeds is developed. The vehicle power is provided by two stroke petrol engines, and controls are given at handles. The control switch is provided for spraying operations. Based on the overall performance of the machine, this paper says that the project will meet the need by small farmers because they cannot buy expensive agricultural machinery.

Mahesh Balpande et al [14] presented about the design and fabrication of motorized multipurpose agriculture machine. In this paper several operations are combined such as sowing, leveling, land preparation and weed removal process and to provide a multipurpose equipment. In this work a 250watt oculomotor is used for running this motor and a 12v battery is used for land preparation, leveling and sowing. The working of the machine will be based on Chain Drive Mechanism. There will be 2 gears; one gear will be on the wheel and other on motor shaft drive, which will be attached together by Chain Drive.

Chandana R et al [15] presented about multipurpose agricultural robot for automatic ploughing, seeding and plant health monitoring. The proposed system is battery operated and controlled by Bluetooth device. The proposed work focuses on implementing all the farming process especially in the field of ploughing and seeding by using micro controller, HC-05 and H- 06 Bluetooth models, various sensors etc. The robot detects the planning area by using sensors and seeds need to be planted in the corresponding field using gripper arrangement of the robot. As the robot is controlled by using Bluetooth the individual operations can be performed separately.

Ramachandran et al [16], studied about the development and conception of versatile agriculture machine. In this project the multi-purpose agricultural equipment can also be used for fertilizer, sowing, leveraging and weed removal purposes. All parts are connected in such a way that the equipment can be rearranged at each stage of agriculture. In this work four different farming processes are carried out by the multipurpose agricultural machinery. All processes

are driven by tractor and gear box. Chain and sprocket mechanism and belt drive are used for power and torque transmission.

Arun Kumar et al [17] proposed about the review on multipurpose agriculture robot. The present paper gives the overall review of planning, development and thus fabrication of the multipurpose agriculture robot which is able to dig the soil, leveler to shut the mud, sprayer to spray water and fertilizer separately, these whole systems of the robot work with the battery has been designed. The machine has achieved all the five applications of ploughing, sowing, irrigation, fertilization and solar power in one robot has drastically reduced the negative aspects in viewing agricultural efforts.

Sakhale et al [18] presented a review paper on “Multipurpose Farm Machine”. In this equipment a used 24cc engine for digging operation. And for spraying used motor with 12V battery. Next two operations are manual base which is cultivation and sowing. This machine performs four farming operation i.e., digging, sowing, cultivation, spraying which is used for small scale farming. By using above attachments, one may perform various farming operations in less time and economically.

Akash et al [19], presented the universal multipurpose cultivator. In this paper the field analysis is to done for various agricultural operations, the design and development of MPC is done by using the analysis tool. The main objective of the multipurpose cultivator is to put the seed in the desired depth and provides particular spacing between the seeds and further it covers the seeds with soil by the help plougher. This paper provides an alternative method to the existing farming system on agricultural field at effective cost.

P. V. Bute et al [20] discussed about the design and fabrication of multipurpose agro system. Then main part here is that the micro-controller that supervises the whole method.

4. CALCULATIONS

- Total weight of the Machine = 22 kg

  W=mg

  W=22*10=220 N

- Forces acting on the jaw while ploughing:

  Forces acting on the jaw is depend upon three factors such as:

  - Soil strength
  - Depth
  - Speed

Soil strength:

For weak soil – 0.1 to 0.5 kg/cm^2

For hard soil - 0.5 to 5 kg/cm^2

  - Depth= 10 cm
  - Speed= 0.5 kmph

- Total draft:

  Area= no. of jaws*width*depth

  = 5*5*10

  = 250 cm^2

  Draft = soil resistance * area= 0.5*250

  = 125 kg = 125*10 N

  = 1250 N

- Total load on jaw = 1250 + 220 = 1470 N
- Power required = Force * speed

  P= 1470*0.5*1000/60*60 = 205 W (approx.)

Design of Ploughing and Seeding Machine:

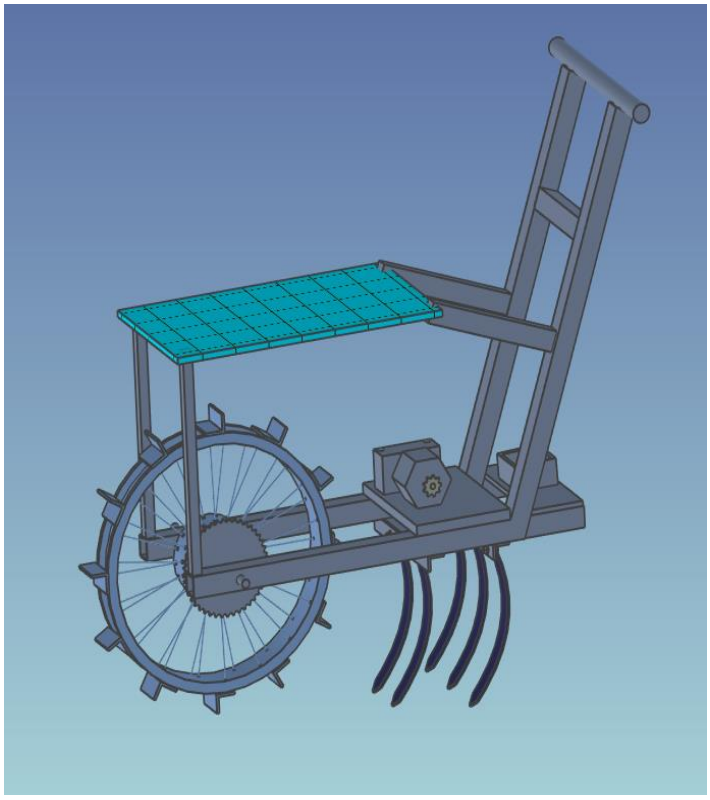

Figure 1: Isometric view

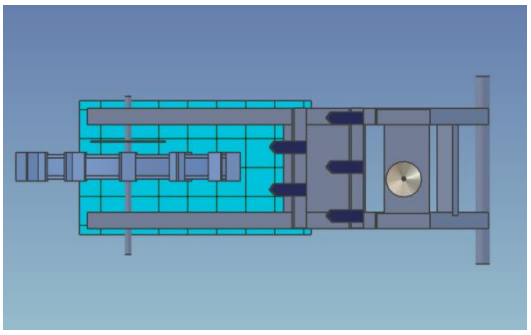

Figure 1A: Bottom view

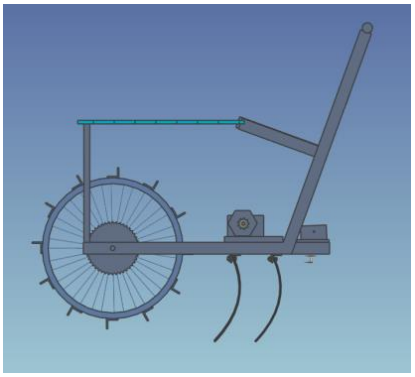

Figure 1B: Top view

Prototype:

Figure 2: Prototype

5. RESULTS AND DISCUSSION

The development of ploughing and seeding machines is crucial for modern agriculture to increase efficiency, reduce labor costs, and improve crop yields. The development of ploughing and seeding machines has significantly improved the efficiency of farming operations. These machines can cover large areas quickly, reducing the time and labor required for planting and preparing fields. There are a variety of different types of ploughing and seeding machines available, each with its own advantages and disadvantages. The type of machine that is best suited for a particular farm will depend on the size of the farm, the type of soil, and the types of crops that are grown. For making farmers life comfortable during farming operations such as ploughing and seeding, a machine is designed to reduce man power. With the help of this machine a crop can be easily cultivated by providing the higher productivity in the agriculture field. Generally, there are variety of ploughing and seeding machines are available in the market which are operated on the internal combustion engine. As these machines run on a petrol or diesel engines it creates a problem i.e., pollution in the environment and it is dangerous for human health. In order to solve this problem a battery-operated pollution free machine is developed which reduces the use of fossil fuels and improves the productivity in agriculture. For charging the portable battery a solar panel is placed over the machine. The solar panel will charge the battery continuously while the machine is in idle or working condition. Solar energy is a renewable energy and it is freely available in the atmosphere. For avoiding over charging of the battery a charge controller is used. Thus, the battery does not require to charge frequently. In this study the battery with high voltage output is used to run the motor with required power for driving the wheels of the machine which provide the best soil gripping for the agriculture land. The overall machine is driven by chain sprocket mechanism by using two sprockets in the machine.

Therefore, this low-cost portable battery charged electric power ploughing and seeding machine is a one-step new solution to develop the conventional agriculture methods of farming, as it reduces the human effort, and cost of this machine is very less.

6. CONCLUSION

- This ploughing and seeding machine will help the farmers to cultivate a farm with less capital. For farmers the main risk in farming is their initial investment on the crop. For cultivating a farm effectively to obtain better production, the farm should be tilled well and also seeding should be done properly to avoid resources wastage.
- This machine can plough the field very effectively and also seeds are sowed in optimal manner. It requires less manpower and less time. The dependency upon the tractors and bulls is avoided.
- This machine will reduce the initial investment on the farm and reduce the risk for every farmer. If the initial investment is less than the profit obtained is more.

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