

# Fabrication of Electric Agriculture Cultivator

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## ABSTRACT

Agriculture has been an integral part of the human ecosystem. However, traditional farming methods require a lot of human effort and are very time-consuming. Farm tilling is one of the most labor intensive operations in agriculture. Manual tiling of fields is very strenuous task while tractors incur high capital along with heavy fuel consumption costs. This low-cost portable battery charged electric power tiller machine is a one-stop modern solution to enhance the conventional agriculture methods of farming, as it reduces the human effort, at a very negligible price using motorized tilling mechanism. The electric power tiller helps reduce the time and cost involved in tilling using a smart portable design thereby increasing the productivity and efficiency in agriculture.

**Keywords:** Efficiency, Machinery equipment, motor, No fuel consumption, Eco-Friendly, etc.

## I. INTRODUCTION

Agriculture has always been an important aspect of the human ecology. Traditional agricultural methods, on the other hand, need a lot of human labour and take a long time. Even in 2020, the majority of Indian farmers still utilise conventional farming implements like the plough and sickle. As a result, there is a waste of energy and personnel, as well as a lower yield per capita labour force. Farm tilling is one of the most labour-intensive agricultural procedures. Field tiling by hand is a difficult work, and tractors require a large investment as well as a lot of gasoline. Despite

the massive mechanisation of agriculture in some regions of the nation, the majority of agricultural activities in the country's bigger areas are carried out by hand utilising rudimentary and traditional equipment and implements such as a wooden plough, sickle, and so on. This low-cost portable battery-powered electric power tiller machine is a one-stop contemporary solution to improve traditional farming practises by reducing human labour at a very cheap cost through the use of a motorised tilling mechanism. Because design and manufacture are the keys of engineering, mechanical engineering education requires real design and production. Using a clever

portable design, the electric power tiller helps minimise the time and expense required in tilling, consequently enhancing agricultural output and efficiency. Power tiller equipment is two-wheeled agricultural equipment outfitted with a rotary tiller that conducts all farm activities effortlessly. It prepares the soil, plants, and sows seeds, as well as sprays fertiliser.

Electric agriculture cultivator is a farm machine that is primarily used for land cultivation. It is effective because it can reverse and cut dirt at the same time. A power tiller that runs on batteries is a kind of wheeled farm equipment. This Power Tiller is suitable for home gardens, small and big farms, but it is especially recommended for paddy farmers with tiny plots of land. The earth is just smoothed and loosened to the desired depth. The underlying concept of soil scratching for weed control is millennia old, and it was done using hoes before cultivators were invented. Herbicides have considerably decreased the amount of cultivating that is done for weed control in modern commercial agriculture.

A developing country like India is expected to continue to rely more on hand tools for the foreseeable future for cultivation. The use of hand tools for land cultivation is still predominant in India because draft animals and tractors require resources that many Indian farmers do not have easy access to. The need for agricultural mechanization in India must therefore be assessed with a deeper understanding of the small holder farmer's activities and what values farm power generated for them.

As our population continues to increase, it is necessary that we must produce more food, but this can only be achieved through some level of mechanization. Manual method of seed planting, results in low seed placement, spacing efficiencies and serious back ache for the farmer which limits the size of field that can be planted. However, planting machine or planter that is normally required to produce more food is beyond the buying capacity of small holder farmers. These small holder farmers still

continue to plant manually, the result of which is low productivity of the crops. It is therefore necessary to develop a low-cost planter that will reduce tedium and drudgery and enable small holder farmer to produce more foods and also environmental friendly.

## II. LITERATURE REVIEW

This project entails the design and development of chain and sprockets, shafts, bearings, transmission cases, among other components, in order to convert motor speed to Power Tiller tilting speed. This power tiller is designed for weeding in sugarcane plantations with a minimum inter row spacing of 1.2 meters, as shown in this report. Owing to a goal to decrease chemical use and production costs, farmers want weed management options. There are no selective herbicides available for particular crop situations. Because human weeding is expensive, an automated system may be possible, and mechanical weed control systems can decrease or eliminate the need of herbicides. According to the study, the reaper's performance on the farm was good, and its capacity was 93 percent higher than hand harvesting, saving 35 percent in operation costs and two times the labour. Small and irregularly shaped plots of less than 150 m<sup>2</sup> were determined to be unsuitable for the machine. However, as a power tiller attachment for hilly regions, a reaper with a smaller coverage width and lighter weight will be more beneficial for smaller and irregularly shaped fields.

A seeding attachment for riding type power tillers was created and developed at the Faculty of Agriculture Engineering, IGKV, Raipur, India, to reduce soil moisture loss, turnaround time, and energy loss during seed bed preparation and seed operations. The primary design concerns were to put seed and fertilizer with tractive tines during rototilling and field preparation using a rotary tiller. The rototiller did not need to be removed because it created back propulsion and boosted the power tiller's pulling capability, as evidenced by the work done and

fuel consumption of the power tiller with and without the produced machine connection. As a result, sowing and tilling may be completed in a single pass, saving energy and preserving in-situ soil moisture.

### III. WORKING PRINCIPLE

It consist of chain sprocket, battery operated electric motor, mounts and joints, etc. the machine is driven by electric motor which uses a sprocket chain arrangement to drive the pulling wheel. A battery is used to power motor with a forks through soil. The cultivator forks allow for easy and narrow tilling exactly as needed for farming. The machine is light in weight and portable. Due to easy construction of machine the maintenance is very low. The cost of machine is very low as the farmers can purchase the machine easily.

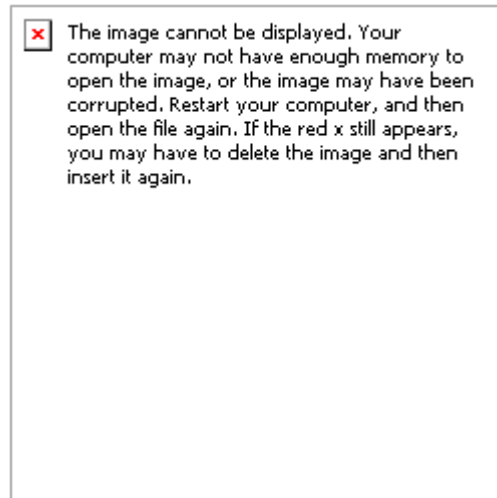
### IV. BLDC MOTOR

A brushed DC electric motor is an internally commutated electric. Motor designed to be run from a direct current power source and utilizing an electric brush for contact.

Brushed motors were the first commercially important application of electric power to driving mechanical energy, and DC distribution systems were used for more than 100 years to operate motors in commercial and industrial buildings. Brushed DC motors can be varied in speed by changing the operating voltage or the strength of the magnetic field. Depending on the connections of the field to the power supply, the speed and torque characteristics of a brushed motor can be altered to provide steady speed or speed inversely proportional to the mechanical load. Brushed motors continue to be used for electrical propulsion, cranes, paper machines and steel rolling mills. Since the brushes wear down and require replacement, brushlesDCmotors using

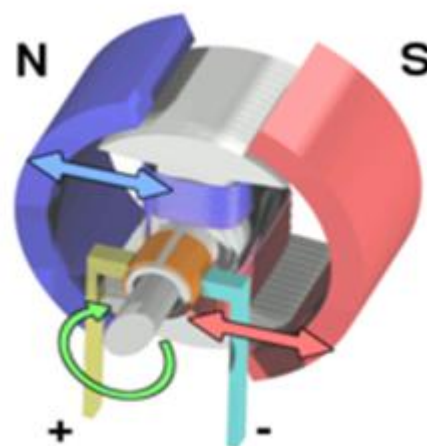
power electronic devices have displaced brushed motors from many applications.

When a current passes through the coil wound around a soft iron core situated inside an external magnetic field, the side of the positive pole is acted upon by an upwards force, while the other side is acted upon by a downward force. According to Fleming's lefthand rule, the forces cause a turning effect on the coil, making it rotate. To make the motor rotate in a constant direction, "direct current" commutators make the current reverse in direction every half a cycle (in a two-pole motor) thus causing the motor to continue to rotate in the same direction.



Principle:

It is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's Left-hand rule



Features:

Speed: 350-5000 rpm

Rated Torque: 1.1-12.0 in-lbs

Output Power: .01-.21 hp

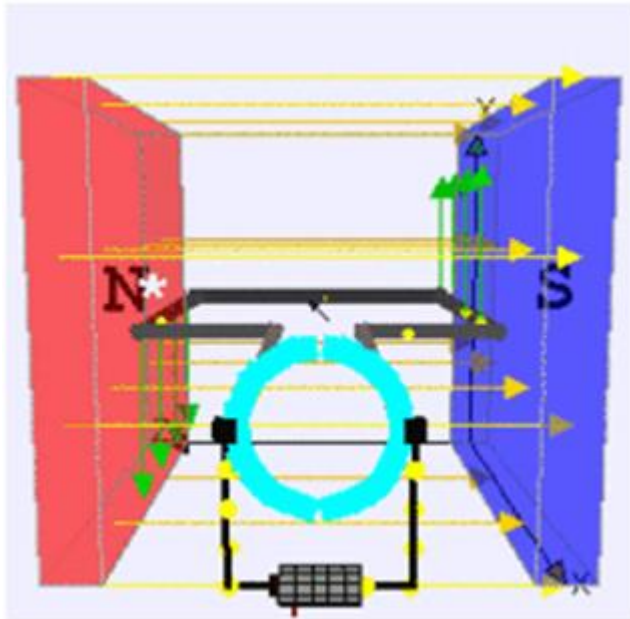
Frame Sizes: 60, 80, 108 mm

Brush card or replaceable brushes

Standard brush life of 2000+ hours

#### 4.1 4.1 BRUSHED

The brushed DC electric motor generates torque directly from DC power supplied to the motor by using internal commutation, stationary magnets (permanent or electromagnets), and rotating electromagnets. Advantages of a brushed DC motor include low initial cost, high reliability, and simple control of motor speed. Disadvantages are high maintenance and low life-span for high intensity uses.



Maintenance involves regularly replacing the carbon brushes and springs which carry the electric current, as well as cleaning or replacing the commutator. These components are necessary for transferring electrical power from outside the motor to the spinning wire winding of the rotor inside the motor. Brushes are usually made of graphite or carbon, sometimes with added dispersed copper to improve conductivity. In use, the soft brush material wears to fit the diameter of the commutator, and continues to wear. A brush holder has a spring to maintain pressure on the brush as it shortens. For brushes

intended to carry more than an ampere or two, a flying lead will be molded into the brush and connected to the motor terminals. Very small brushes may rely on sliding contact with a metal brush holder to carry current into the brush, or may rely on a contact spring pressing on the end of the brush. The brushes in very small, short-lived motors, such as are used in toys, may be made of a folded strip of metal that contacts the commutator.

#### 4.2 BRUSH LESS

Typical brush less DC motors use one or more permanent magnets in the rotor and electromagnets on the motor housing for the stator. A motor controller converts DC to AC. This design is mechanically simpler than that of brushed motors because it eliminates the complication of transferring power from outside the motor to the spinning rotor. The motor controller can sense the rotor's position via Hall effect sensors or similar devices and can precisely control the timing, phase, etc., of the current in the rotor coils to optimize torque, conserve power, regulate speed, and even apply some braking. Advantages of brush less motors include long life span, little or no maintenance, and high efficiency. Disadvantages include high initial cost, and more complicated motor speed controllers. Some such brush less motors are sometimes referred to as "synchronous motors" although they have no external power supply to be synchronized with, as would be the case with normal AC synchronous motors.

### V. AUTOMOBILE RIM

The rim is commonly a metal extrusion that is butted into itself to form a hoop, though may also be a structure of carbon fiber composite, and was historically made of wood. Some wheels use both an aerodynamic carbon hoop bonded to an aluminum rim on which to mount conventional bicycle tires. Metallic bicyclerims are now normally made of aluminium alloy, although until the 1980s most

## VI. BATTERY

bicycle rims - with the exception of those used on racing bicycles - were made of steel and thermoplastic. Rims designed for use with rim brakes provide a smooth parallel braking surface, while rims meant for use with disc brakes or hub brakes sometimes lack this surface. The Westwood pattern rim was one of the first rim designs, and rod-actuated brakes, which press against the inside surface of the rim were designed for this rim. These rims cannot be used with caliper rim brakes.

The cross-section of a rim can have a wide range of geometry, each optimized for particular performance goals. Aerodynamics, mass and inertia, stiffness, durability, tubeless tire compatibility, brake compatibility, and cost are all considerations. If the part of the cross-section of the rim is hollow where the spokes attached, as in the Sprint rim pictured, it is described as box-section or double-wall to distinguish it from single-wall rims such as the Westwood rim pictured. The double wall can make the rim stiffer. Triple-wall rims have additional reinforcement inside the box-section



The lead-acid battery is a type of rechargeable battery first invented in 1859 by French physicist Gaston Planté. It is the first type of rechargeable battery ever created. Compared to modern rechargeable batteries, lead-acid batteries have relatively low energy density. Despite this, their ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors.

As they are inexpensive compared to newer technologies, lead-acid batteries are widely used even when surge current is not important and other designs could provide higher energy densities. In 1999 lead-acid battery sales accounted for 40–50% of the value from batteries sold worldwide (excluding China and Russia), equivalent to a manufacturing market value of about \$15 billion. Large-format lead-acid designs are widely used for storage in backup power supplies in cellphonetowers, high-availability settings like hospitals, and stand-alone powersystems. For these roles, modified versions of the standard cell may be used to improve storage times and reduce maintenance requirements. Gel-cells and absorbed glass-mat batteries are common in these roles, collectively known as VRLA (valve-regulated lead-acid) batteries.



## VII. FINAL PRODUCT



## VIII. CONCLUSION

The machine is simple in construction as there is not much complication in design. Based on the overall performance of the cultivator we can definitely say that the project will satisfy the need of smallscale farmer, because they are not able to purchase costly agricultural equipment. The simultaneous working of seed plantation and watering of field makes farming more efficient and easy. The cultivator requires less time compared to manual agriculture cultivators, so if we use it on a large scale the agricultural costs will be reduced and we hope this will satisfy the partial thrust of Indian agriculture. So in this way we make farming more efficient and economical thereby reducing the farming expenditures in India. The electric agriculture cultivator is most suited for usage in hilly locations, moist conditions, and on small farms because it can do both primary and secondary tillage operations. The power tiller, with the correct set of tools and attachments, can handle most of the field operations in intensive cultivation. The power tiller's small weight makes it ideal for

working in both wet and dry situations. Depending on the type of work, external attachments can be added to the tiller. As a result, the tiller can be utilised for a variety of tasks.

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