

# Electric Power Weeder Innovation and Improvement

Mr. Arvind Kumar  
SOMC, Sanskriti University, Mathura,  
Uttar Pradesh, India  
Email Id- arvind.me@sanskriti.edu.in

## ABSTRACT

This article shows the design, production, analysis, control, and experimental activities in which is considered to be a suitable engineering education. The design for a motor-powered weeder is performed for home gardening labour has been detailed. In India over the last 20 years, labour saving and efficiency have been required since the involvement in agricultural industry was reduced to 50 percent. An electric powered weeder design is developed because this is concerned with environment, agriculture, and engineering. Design and manufacturing is the core to engineering, education for mechanical engineering requires the concept of practical design and manufacturing. The initial aim is the development and manufacturing of a weeder via a rotating body and the mechanical component that nails up and down. The second is stress analysis and control experimental validation of the weeder.

## Keywords

Agriculture, Blades, Engineering, Production, Weeding.

## 1. INTRODUCTION

The weeding technique requires huge human effort and increases crop returns, reduces farm expenses and competes with crop plants over a wide variety of resources, including water, nutrients and sunlight. The land structure is dependent on soil, atmosphere, crop and management variables. Infertile soil is harmful to plants. It is a plant which emulates plants using water, nutrients and light. This will reduce agricultural output. Weeding is the agricultural system's main work-intensive task.

Agriculture now needs free chemicals to guarantee food stability. High quality food and food safety need consumers to pay special attention. Weeding is as old as agriculture itself, but through the years we have developed methods and concepts that further enhance soil production. In India, the methods of general weeding are mechanical. Mechanical procedures differentiate the extensive use of manual work and animal strength. Both are short in supply and are increasingly non-economic. Not only is manual disposal difficult, expensive and not usually feasible due to unfavourable soil conditions.

The seedlings are more competitive in the early stages of their development (2-6 weeks after planting). In order to obtain optimal crop production, it is extremely important to regulate soil fertility throughout this time. Mechanical weeding is more productive since it helps to reduce manual weeding work. Consumers want high-quality nutritious products and focus on food safety. More significantly, for crops such as soybeans, maize, gram, no electrically powered mechanical weeding method is available. For small and medium-sized producers, a low-cost power weeder is also needed. In light of the foregoing, this study proposes the design and development of a power-operated rotating weeder for all crops[1].

Weeding takes enormous human efforts and is the main reason for improving crop production efficiency. The terrestrial composition depends on soil, climate, cultivation and management variables. This may decrease yield of crops. Weeding is a major occupational activity in the agricultural system. The agricultural industry now requires free medicines based on chemical composition to guarantee food safety. Consumers require high-quality food and special attention for food safety.

Weeding is as ancient as agriculture itself, yet throughout the years the techniques and ideas for improving soil fertility have evolved. The general methods of weeding are mechanical in India. Mechanical techniques include a strong use of human labour and animal power. Both are in limited supply and are getting increasingly economic. Not only is manual disposal difficult, inefficient and not usually feasible because of unfavourable soil conditions.

The saplings are more competitive throughout their early growth phases (2-6 weeks after planting). The control of soil fertility at this period is extremely important for optimum crop production. Mechanical weeding is more effective since it helps minimise manual weeding efforts. Consumer demands are excellent quality foodstuffs and pay particular attention to food safety. More precisely, in crops such as soya, maize and gram there is no mechanical weeding technique powered by electricity. Therefore, small and medium-sized farmers require a low-cost power weeder. With regard to this research, the design and development of an electrical power rotary weeder for all crops is suggested[2].

Indian agriculture has consistently supplied the economy with structural support since independence. Agriculture is the largest sector in the Indian economy, giving jobs and livelihoods to over 115.5 million people. Despite substantial increases in crop production, the agricultural yields for most crops are shown to be lower per unit area. Weeds remain a major restriction in agricultural productivity. Weeds have the ability to grab the resources available to feed crops. This also impacts plant growth and agricultural output.

Weed control has always been a difficult and demanding task. Methods for weed management vary with agricultural scale, laboratory access, weeds and crop type. Weed control methods have always been improved with advances in technology, which typically seek to decrease drudgery during machine operation and production costs. The engine is powered by power weeders that are widely used nowadays and relies on fossil fuel for its functioning. Fossil fuel emits greenhouse gases that are detrimental to health and the environment when burned [3].

On the other hand, the price of petrol raises daily, eventually raising machine running costs which seem to be unbearable for small farmers. It has always been necessary to move over to alternative fossil fuel solutions in the near future to prevent an energy catastrophe. And as we all know, air pollution is also an important factor in the environmental and climate change dangers. That is why looking for an alternative that is

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environmental friendly and cost-effective has become extremely essential. Using renewable energy, the usage of fossil fuels may decrease emissions of carbon dioxide. Electricity generates wind, solar, and hydro systems with no related air pollution emissions. Due to its abundant availability, solar energy is more practical and comes straight from the sun. The renewable energy is essential, pure, inexpensive, and abundantly accessible, unfinished in nature and available freely in sufficient amounts in almost every region of the globe.

Over the years, traditional agricultural methods have developed for different procedures. Agricultural growth has historically played a key role as a motivator to reduce rural poverty. Nevertheless, recent trends indicate that agricultural productivity increases and the marginalisation of poor farmers are slowing down. Rs. 4,800 million crops in India are wasted annually owing to weeds. The cost of weeding is on average Rs. 945 per ha, out of the overall cultivation costs for agricultural crops of Rs. 3 000 per ha. Weed management in agricultural production is becoming a costly business. Most Indian farmers use hand-hoe for weeding, and 40-60 workers need a hectare of land for weeding.

The impacts on operational depth, weeding efficiency and crop production of the different blades of bullock-drawn blade harrow were investigated. Six alternative blade shapes were tested with straight blades - convex, concave, 1200 V shape, 1600 V shape, tightened edge, and tyne cum blade. The maximum draw was 286 N, with a width of 450 mm. The blade harrows demand was 0.20-0.27 kW. Human energy mostly utilised one another for nearly all Indian agricultural operations. Even in specialised operations such as rice transplantation, crop planting, hoeing and weeding, cotton picking, human force is still a source of energy alone [4].

Mechanical weeding is preferable over chemical weeding since the application of weedicides is usually costly, dangerous and targeted. Moreover, mechanical weeding loosens the surface of the soil, which leads to improved ventilation and humidity conservation. Considering the aforementioned factors, a weeder driven by the engine was conceived, built and tested in the field.

CAD technology has been extensively used to many areas in general in the equipment / machinery manufacturing industry. But farm equipment remains the major stage, relying on handwork such items, models and drawings and samples, which completes the whole Farm machinery design procedure without utilising current CAD design software tools. At now, CAD contemporary technology is already being used by overseas farmer equipment businesses, but issues like insufficient accuracy, lengthy design cycles remain in the domestic agricultural machinery companies.

### 1.1 Technique of Work

The blade is the component of the dirt power weeder. In general, five types of blades are utilised in a rotary weeder. These include L-shaped, C-shaped, J-shaped, pick type and straight type for various working conditions. L-shaped blades are regarded superior for absorbing the least demand in all kinds of blades. The suggested model comprises of two basic mechanical components, namely the weeder, for the primary purpose of removing the weeds from croplands and gardens. The second objective is to distribute the seed across the cultivated area. L-shape rotary blades, i.e. for weed cuts, were employed to achieve the necessary objective, because L-shape blades are as strong as other blade shapes [5].

The blades needed rotational power to cut the weeds, since weeding efficiency would be increased by the circular motion. The spinning power is obtained from the electric motor. The power is then transmitted to the rotary unit via the belt-pulley

transmission system. A seeding mechanism that is motorised when the vehicle pushes ahead with the help of a servo engine will also be required in addition to the rotary unit and the power transfer system. The manual control of the vehicle in its handle is given for pressing the traction wheel or ground wheel.

The multifunctional electric power supply system is used to enhance soil fertility by attaching a grip to the handle to reduce the vibration impact while the weeder is moving. A mechanism used to sustain the mechanical components of the electric weeder. The electrical weeder frame has at least two weeder wheels and a support wheel. To decrease the friction in the weeder wheel, the weeder wheel has several ball bearings. A motor switch is linked to control the electric motor. The electric motor is connected to the driving shaft to transmit power. A 'V' pulley belt assembly connected to the pulley drive motor shaft. A shaft is linked with a pulley to spin a rotating shaft. A chain interwoven between the shaft and rotating shaft is used to transfer rotational motion from the shaft to the rotary shaft. The rotating shaft is mounted on the rotating blade chain. The concept of a motor-powered weeder was described for home gardens. Work savings and productivity have been required in India in the last 20 years because participation in the agriculture sector fell to 50%. Since ecology, agriculture and engineering are involved, an electric powered weeder design has been developed [6].

The core to engineering is design and production; mechanical engineering education requires the idea of practical design and production. A systemic method for this assembly is known as morphological analysis or diagramming and the creation of ideas. It is a tool which provides a thorough search for and synthesis of product design concepts. The highest soil resistance for determining the weeder's power demand was = 0.0686 N mm<sup>-2</sup>.

The operating speed of the weeder is assumed to be 0.4 m/s and the entire coverage breadth of the cutting blade = 300mm. The operating depth was also deemed to be = 50mm. The transmission efficiency is also 70%.

$$Power = \frac{Work}{Time}$$

$$P_b = \frac{Draft\ Force \times Distance}{Time}$$

$$P_b = SR \times d \times w \times v$$

Where

$P_b$  = power required by the electric motor for the blade, SR = soil resistance,  $N\ mm^{-2}$ , d = depth of cut, mm, w = effective width of cut, mm, v = speed of operation,  $m\ s^{-1}$

The torque obtained at the main shaft was calculated by using following formula:

$$T = \frac{P \times 60}{2\pi N}$$

$$T = \frac{1118.55 \times 60}{2\pi \times 1400} = 7.62\ Nm = 7629.54\ N\ mm$$

The rotative unit consists of rotary blades, blade flanges and the rotativetine shaft. The rotary shaft diameter must be constructively designed. After the diameter is established the blade geometry and forces operating on the blade continue. The energy is transmitted from the electric motor to the rotating unit. The control is sent from the engine pulley to the 1st intermediate shaft, and then from the 1st intermediate shaft to the rotor shaft, through the V and pulley mechanism. The belt and pulley drive are selected to transfer the power from the electric motor to the belt. V- Frequently utilizing a belt and a timing belt, the two poultry were extremely near and there was a lot of power to transmit. The drive in the V-belt was quite smooth, since these belts were endless and no junction was problematic. It provides positive thrust; it was minimal in this belt slip. It has an extended life of 3 to 5 years. V-belt was employed when the speed of the belt was less than 30 m/s. For power transmission via belt drive, the V-grooved pulley and A-type belt have been selected and timing belt drive has been chosen [7].

The length of the handle and angle of tilt of the horizontal surface rely on each other. The angle of operation was dependent on the setup and geometry of the tool. The ideal handle grip diameter is 30 to 35 mm. Duration of the handle, based on the average elbow height of the male and female worker. The average height of the male and female employees is 1027 mm and 960 mm respectively. The suggested model comprises two basic mechanical components, i.e. weeder, for the aim of eliminating farmland and gardens weeds. The second objective is to distribute the seed across the cultivated area. L-shape rotary blades, i.e. for weed cuts, were employed to achieve the necessary objective, because L-shape blades are as strong as other blade shapes.

## 2. DISCUSSION

Agriculture has always been and will be the backbone of the Indian economy. Agriculture is an applied science and agricultural industry which includes soil cultivation, crop production and increasing animals. Little farmers farming between 2 and 3 hectares have, throughout the years, done agricultural operations utilizing human labor and traditional equipment, such as wood plough, yoga, leveler, harrow, hammer, spade and big sickles, etc. Land planning, seed planting, weeding and harvesting are all carried out using these techniques.

Small landowners utilize modern agricultural techniques and equipment since they are too expensive and hard to get. Using contemporary agriculture techniques, maximum yield and high quality crops may be obtained that can rescue a farmer from bankruptcy. But, because of the lack of knowledge or investment in new technology, the bulk of farmers still practice primitive farming. Because tractors need resources that are not easily accessible to many Indian farmers, handhold tools are still extensively utilized in Indian land cultivation.

The necessity for agricultural mechanization in India must thus be assessed in the light of a greater knowledge of the small-scale farmers' operations. There is a substantial gap in technology acceptance and implementation for small and marginal farmers. The implementation of better resource conservation methods is essential for improving impoverished farmers' lives in emerging nations. While the bulk of the necessary components are already in place, there is a lack of information on equipment availability and efficiency and no efficient communication between farmers and agricultural research and development departments[8]. Weed is any plant that grows at the wrong time in an uncomfortable or

unsuitable place, producing more harm than benefit. It is a plant competing in water, nutrients and light with crops. This may decrease agricultural yield and land value and increase cleaning expenses. Weed management is one of the most intimidating tasks in agriculture and represents a substantial part of the production costs. Weeding is the procedure through which undesirable plants are removed from field crops. Mechanical weed management is highly efficient since it eliminates hand weeding labor, kills the weed, and keeps the soil surface loose to improve soil aeration and water intake.

Farmers have also indicated a general need for effective methods to prevent weed development and spread. Control of chemical weed is more frequent than control of manual and mechanical weeds. Due of the adverse impacts on the environment, however, farmers evaluate and adopt mechanical techniques for weed management. Engineering, technology, biological and physical sciences are extensively used in modern agriculture. The drainage, irrigation, restoration and channeling sectors, which are essential elements of agriculture, are engaged in agricultural engineering[9].

Weeds are plants that grow in areas where they are not necessary, the history of weeds is as ancient as when people began farming. Since the start of the crop production system, waste plant development among plant crops has always been the main problem faced by farmers. The non-growing plant and crops are competition for sunshine, soil water, space and soil nutrients, and non-growing plants/waste plants known to have weeds. Various species of weeds that are recognized are more than 3000, soil weeds compete directly for nutrients, light, soil water, air and soil space to lower yields.

Weed eradication is important for plant growth and production cycles, and equally a laborious process. Weed management is therefore important to minimize production cost losses and increase crop yield. Poor weed management may result in a decrease in agricultural yields of approximately 50-70 percent, and weed expenses are one third. Weed damage may be serious in the agriculture industry. The harm includes losses in crop quality, loss of agricultural production, protection for plant pests, diseases, and further reductions in land values.

In Africa, the typical weeding practices are mostly manual, with 75% of the population of Nigeria engaged in farming. Weeding accounts for more than 25 percent of overall work needs throughout the season. As agriculture is industrialized, riparian plants are widely spread to allow agricultural techniques that reduce inter-role weeds. Weeding is not successful in Nigeria because weeder row crop is not promoted. Mechanical techniques of weeding are extremely basic and straightforward for farmers to adopt and comprehend[10].

Traditionally, weeding is made using intercultural instruments like hand hoe and spade. New technologies constantly contribute to improving production in the field. Mechanical weeding would lead to increased crop production and a reduction of shortages if they were used in subsistence agriculture. Mechanical weeders may be categorized as manual weeding tools, animal pulled weeders and power or tractor driven weeders on the basis of power, design and mechanism.

## 3. CONCLUSION

The device is suitable for burrowing the soil like sowing seeds. The fundamental requirement is the customer's health. In this paper there was no kind of gasoline or diesel engine; it works completely with the help of a strong electric motor. The

portion should be utilized to plant a tiny amount of land. Anyone may be the customer of this item since the situation is favorable and no external source is necessary. It may also be utilized for multi-rational work, for example, water systems and dirt bed lifting. The portion is hard to utilize and may move from one place to the next without any effort. It has several reversible links. Due to its safety measures and its many reasons, it will provide the weeder inventiveness with an amazing boost.

Weed cutter equipment used for various agricultural tasks. Generally speaking, each such activity needs various types of equipment or an additional set of skilled handles that eventually cost the farmer a lot and reduce his monthly revenue. It has been determined that the weed cutters would save farmers a great deal of money and time which will have a direct impact on Indian economies as farmers' incomes increase. As a consequence of the study, it can be concluded that the work satisfies the requirements of small-scale farmers who cannot afford to buy costly agricultural equipment. It required less time and labor than conventional techniques, so when a farmer employs it on a big scale, his expenses are reduced by half.

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