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Development of Solar Powered Seed Sowing and Fertilizer Spraying Machine

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Abstract – In this research paper provides information about the various types of innovations done in seed sowing machine available for plantation and fertilizer sprayer. The seed sowing machine is a key component of agriculture field. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. This dissertation deals with the various sowing methods used in India for seed sowing and fertilizer spraying. The comparison between the traditional sowing method and fertilizer spraying and the new proposed machine which can perform a number of simultaneous operations and has number of advantages. As day by day the labor availability becomes the great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer spraying. In this dissertation we are development of solar powered seed sowing and fertilizer spraying machine.

Keywords—Seed Sowing; Spraying; Solar Power

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I. INTRODUCTION

A. Problem statement

Seed sowing machine is a device which helps in the sowing of seeds in a desired position hence assisting the farmers in saving time and money. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. The paper discusses different aspects of seed sowing machine which will be helpful for the agriculture industry to move towards mechanization. The agricultural industry has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for produce grows as well. Hence, there is a greater need for multiple cropping on the farms and this in turn requires efficient and high-capacity machines. Mechanization of the Agricultural industry in India is still in a stage of infancy due to the lack of knowledge and the unavailability of advanced tools and machinery. In traditional methods seed sowing is done by manually, opening furrows by a plough and dropping seeds by hand.

The agricultural has always been the backbone of India's sustained growth. As the population of India continues to grow, the demand for produce grows as well. Hence, there is a greater need for multiple cropping in the farms and this in turn requires efficient and time saving machines. In this paper discuss different types of seed sowing machine which will be helpful for the agriculture industry to move towards mechanization.

Traditional Sowing Methods: Traditional methods include broadcasting manually, opening furrows by a country plough and dropping seeds by hand and dropping seeds in the furrow through a bamboo/metal funnel attached to a country plough. For sowing in small areas dibbling i.e., making holes or slits by a stick or tool and dropping seeds by hand, is practiced. Multi row traditional seeding devices with manual metering of seeds are quite popular with experienced farmers. In manual seeding, it is not possible to achieve uniformity in distribution of seeds. A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field.

Traditional sowing methods have following limitations:

- In manual seeding, it is not possible to achieve uniformity in distribution of seeds.
- A farmer may sow at desired seed rate but inter-row and intra-row distribution of seeds is likely to be uneven resulting in bunching and gaps in field Poor control over depth of seed placement. Labor requirement is high

because two p ersons are required for dropping seed and fertilizer.

The effect of inaccuracies in seed placement on plant stand is greater in case of crops India is set to be an agricultural based country approximately 75% of population of India is dependent on farming directly or indirectly. Our farmers are using the same methods and equipment for the ages. e.g. seed sowing, spraying, weeding etc. There is need for development of effective spraying and weeding machine for increasing the productivity. Most of the developing countries of Asia have the problem of high population and low level of land productivity as compared to the developed nations. One of the main reasons for low productivity is insufficient power availability on the farms and low level of farm mechanization. This is especially true for India. It is now realized the world over that in order to meet the food requirements of the growing population and rapid industrialization, modernization of agriculture is inescapable. It is said that on many farms, production suffers because of improper seedbed preparation and delayed sowing, harvesting and threshing. Mechanization enables the conservation of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs applied. Mechanization reduces unit cost of production through higher productivity and input conservation.

Agricultural implement and machinery program of the government has been one of selective mechanization with a view to optimize the use of human, animal and other sources of power. In order to meet the requirements, steps were taken to increase availability of implements, irrigation pumps, tractors, power tillers, combine harvesters and other power operated machines and also to increase the production and availability of improved animal drawn implements. Special emphasis was laid on the later as more than 70% of the farmers fall in small and, marginal category. It is generally said that mechanization of small farms is difficult. But Japan having average land holding even smaller than ours, with proper mechanization has led agriculture to great heights. In order to minimize the drudgery of small farmers, to increase efficiency and save farmer's time for taking up additional /supplementary generating activities, the use of modern time saving machines/implements of appropriate size needed to be suitably promoted.

B. Objectives

Objective of the project can be stated as

1. Investigation of various types of seed sowing and fertilizer spraying machine
2. Development of solar powered seed sowing and fertilizer spraying machine.
3. Testing of development of solar powered seed sowing and fertilizer spraying machine in actual agricultural farm.

C. Scop

Seed sowing machine is a device which helps in the sowing of seeds in a desired position hence assisting the farmers in saving time and money. So considering these points related to spraying and seed sowing an attempt is made to design and fabricate such equipment which will able to perform both the operations more efficiently and also will results in low cost. Decrease the operational cost by using new mechanism.

- Work reliably under different working conditions.
- Decrease the cost of machine.
- Decrease labor cost by advancing the spraying method.
- Machine can be operated in small farming land (1 acre).
- Making such a machine which can be able to perform both the operation

II. LITERATURE REVIEW

Mahesh R. Pundkar and A. K. Mahalle are presented review provides brief information about the various types of innovations done in seed sowing machine available for plantation. The seed sowing machine is a key component of agriculture field. The performance of seed sowing device has a remarkable influence on the cost and yield of agriculture products. Presently there are many approaches to detect the performance of seed-sowing device. Depth of seeding has shown to be an important factor affecting seeding vigor and crop yield. Seed metering device is a heart of seed sowing machine which is evaluated for seed distance, seed size between seed varieties. High precision pneumatic planters have been developed for many varieties of crops, for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed spacing.

Laukik P. Raut and et. al., studied to meet the food requirements of the growing population and rapid industrialization, modernization of agriculture is inescapable. Mechanization enables the conservation of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs applied. Mechanization reduces unit cost of production through higher productivity and input conservation. Farmers are using the same methods and equipment for the ages. In our country farming is

done by traditional way, besides that there is large development of industrial and service sector as compared to that of agriculture. The spraying is traditionally done by labor carrying backpack type sprayer which requires more human effort. The weeding is the generally done with the help of Bulls which becomes costly for farmers having small farming land. So to overcome these above two problems a machine is developed which will be beneficial to the farmer for the spraying and weeding operations.

D. Ramesh and H. P. Girishkumar presented review provides brief information about the various types of innovations done in seed sowing equipments. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, cover the seeds with soil and provide proper compaction over the seed. The recommended row to row spacing, seed rate, seed to seed spacing and depth of seed placement vary from crop to crop and for different agro-climatic conditions to achieve optimum yields. Seed sowing devices plays a wide role in agriculture field.

Pranil V. Sawalakhe and et. al., are investigated the today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. This Paper deals with the various sowing methods used in India for seed sowing and fertilizer placement. The comparison between the traditional sowing methods and the new proposed machine which can perform a number of simultaneous operations and has number of advantages. As day by day the labor availability becomes the great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.

Sridhar H, studied the every year in INDIA, an average of 1980 Cr of rupees is wasted due to weeds. Our country faces the total loss of 33% of its economy from Weeds. The Losses are due to some of the following reasons, total loss of 26% from Crop Diseases, total loss of 20% from Insects and Worms, total loss of 6% from Rats has been surveyed. Shrinking farm lands, acute labour shortage, decreasing income per acre of cultivation, and economic frustration are some of the key factors hurting a farmer's confidence in continuing farming. Weeding control is done by: mechanical weeding, thermal weeding: flaming, biological control, chemical control, and by farming pattern. It has always been a problem to successfully and completely remove weeds and other innocuous plants. Invariably, weeds always grow where they are not wanted. This work involved the design and construction of mechanical weeder, after discovering that tools such as cutlass and hoes require high drudgery, time consuming and high labour force. As a solution to these problems, mechanical weeder was designed and constructed. The mechanical weeder was made of two implements attachment i.e. the primary cutting edge which is in front to loose soil above and the secondary cutting edge which is behind to do cutting and lifting of weeds. The overall machine field efficiency was 98.67%. The Single Wheel Weeder being manufactured is the equipment, which is used for very special purpose when the weeding is required at narrow places or between rows. The blade is thin but very sturdy and tough besides, it is very safe to use and offers zero threat of hurting to the user, Other than the wheel, there is nothing mechanical in this single wheel weeder but, it works wonderfully under the condition where it is put into. This hassle free equipment requires no special maintenance. It is necessary to design the weeder which minimize the human effort and provide efficient work output. The tool which is designed is able to fulfill the present requirement for the weed control. The present design is directed to an improved manual tilling, mulching and weeding tool.

D. Ramesh and H .P. Girishkumar discussed the information about the various types of innovations done in seed sowing machine available for plantation. The seed sowing machine is a key component of agriculture field. The performance of seed sowing device has a remarkable influence on the cost and yield of agriculture products. Presently there are many approaches to detect the performance of seed-sowing device. Depth of seeding has shown to be an important factor affecting seeding vigor and crop yield. Seed metering device is a heart of seed sowing machine which is evaluated for seed distance, seed size between seed varieties. for a wide range of seed sizes, resulting to uniform seeds distribution along the travel path, in seed.

Varikuti Vasantha Rao and et. al. are presented the design and implementation of multiple power supplied fertilizer sprayer has been presented. The proposed system is the modified model of the two stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. The two stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit. The battery can be charged by solar panel during the presence of sun. It could also be operated on direct current during rainy and cloudy weather conditions. This system can be used for spraying pesticides, fungicides, fertilizers and paints. The proposed system has been tested and compared with theoretical values of current and charging time. From the results it is found that the time taken to charge the full battery of capacity 12V, 7Ah has required 16.67 hours. The fully charged battery could be used to spray 575 liters pesticides. Which is approximately covers 5-6 acres of land. It is also found that, if we charge the battery for a day, then it covers approximately 200 liters of pesticides which in turn covers 2 to 2.5 acres of land. The developed systems initial cost is little more as

compared to conventional sprayer but the running cost of the system is all most zero in other words minimum.

Sankaranarayanan M and Nzamwitakuze A. studied the farmers in Rwanda perform agriculture mostly with manual operation. The pain involved in doing each and every operation has to be reduced by the way of introducing simple technology. The aim of the present study is to develop a seed drill to suit the varied topographic condition of Rwanda. The specific objective of the study is to develop a seed drill and test the performance of the seed drill. It is also compared with manual seeding for its benefit cost analysis. The study reveals the following vital points in the development and testing of seed drill.

1) A manually drawn single row seed drill is developed to sow the maize seeds at the spacing of 30 cm from plant to plant and 70 cm between row to row.

2) The seed drill is tested on 25 m2 area in concrete floor, actual field and it is compared with the manual sowing of same area. The sowing efficiency of seed drill in ideal concrete floor is 98% because the concrete floor does not have slippage for wheels.

3) Sowing efficiency of the seed drill on actual field condition evaluated by germination test is 88 %. Sowing efficiency of manual method on actual field condition is 96 %.

4) The actual field capacity of seed drill is found to be 60 hours / hectare whereas the field capacity by manual method is 247 hours / hectare.

5) The ergonomic study gives the conclusion that the human drudgery can be saved by 10 times by using seed drill than by working manually in sowing the seeds. It is found that ratio of body movement of using seed drill and manual method is estimated to be 1: 10.

6) The benefit cost study reveals the fact that the cost of sowing of land by seed drill is 3900 per hectare and the manual sowing gives 12350 per hectare. Hence, it is advantageous to go in for using seed drill for sowing. Sowing by seed drill gives 3 times saving in cost.

Ayesha Akhtar and et. al., studied the brief information about the various different types of innovations done in seed sowing machine available for plantation. The machine for seed sowing is a key component of agriculture field. Cotton is a significant beneficial harvest and extensively traded commodity across the world. This paper aims at promoting a new method of sowing cotton seeds through punching mechanism. The efficiency rate of the mechanism is higher than the usually undertaken manually operating methods. The basic objective of sowing operation is to put the seed and fertilizer in rows at desired depth and seed to seed spacing, covering of seeds with soil and to provide proper compaction over the seed.

Mohd Taufik Ahmad, are presented the weed management is one of the tedious operations in vegetable production. Because of labor costs, time and tedium, manual weeding is unfavorable. The introduction of chemical weed control methods has alleviated these undesirable factors. However, the emergence of herbicide-resistant weeds, environmental impact and increasing demand for chemical free foods has led to investigations of alternative methods of weed control. Most implements employing mechanical cultivation cannot perform weed control close to the crops, and existing intra-row weeders have limitations. A mechanical weeding actuation system was designed, and a prototype was constructed. This actuator was developed to mechanically control intra-row weed plants. The mechanical weeding actuator consisted of a belt drive system powered by an integrated servo motor and a rotating tine weeding mechanism powered by a brushless dc motor. One of the major challenges in this project was to properly design the actuator and its weeding mechanism for effective intra-row weed control. A prototype actuator was manufactured and a series of tests was conducted to determine actuator efficacy and the corresponding force and speed requirements of the actuator. The actuator would be combined with a machine vision system for detecting crop plant locations and guiding the weeding actuator to execute mechanical weeding operations without damaging crops. In the first field experiment, the performance of the first version of the intra-row weeder was investigated across three factors: working depth, travel speed and tine mechanism rotational speed.

R. Joshua, V. Vasu and P. Vincent are discussed the Energy - demand" is one the major thread for our country. Finding solutions, to meet the "Energy - demand" is the great challenge for Social Scientist, Engineers, Entrepreneurs and Industrialist of our Country. According to them, Applications of Non conventional energy is the only alternate solution for conventional energy demand. Now-a-days the Concept and Technology employing this Non-conventional energy becomes very popular for all kinds of development activities. One of the major area, which finds number applications are in Agriculture Sectors. Solar energy plays an important role in drying agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. This Technology on solar energy can be extended for spraying pesticides, Fungicides and Fertilizers etc., using Solar Sprayers. This paper deals how a 'Power Sprayer' which is already in use

and works with fossil fuel can be converted into solar sprayers works without any fossil fuel.

Kyada A. R and Patel D. B, have discussed basic requirements for small scale cropping machines are, they should be suitable for small farms, simple in design and technology and versatile for use in different farm operations. A manually operated template row planter was designed and developed to improve planting efficiency and reduce drudgery involved in manual planting method. Seed planting is also possible for different size of seed at variable depth and space between two seed. Also it increased seed planting, seed/fertilizer placement accuracies and it was made of durable and cheap material affordable for the small scale peasant farmers. The operating, adjusting and maintaining principles were made simple for effective handling by unskilled operators.

Ibukun B. Ikechukwu et al., focused on the design and fabrication of a manually operated single row maize planter capable of delivering seeds precisely in a straight line with uniform depth in the furrow, and with uniform spacing between the seeds. The work demonstrates the application of engineering techniques to reduce human labour specifically in the garden. The results obtained from the trial tests showed that the planter functioned properly as expected with a planting capacity of 0.0486 hectare/hr. Visual inspection of the seeds released from the planter's metering mechanism showed no visible signs of damage to the seeds.

Roshan V Marode et al., the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. Agriculture in India has a significant history. Today, India ranks second worldwide in farm output. Still, agriculture is demographically the broadest economic sector and plays a significant role in the overall socio-economic fabric of India. This paper deals with the various sowing methods used in India for seed sowing and fertilizer placement. The comparison between the traditional sowing method and the new proposed machine which can perform a number of simultaneous operations and has number of advantages. As day by day the labor availability becomes the great concern for the farmers and labor cost is more, this machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.

H. Navid, S. Ebrahimian et al., presented the Seed-metering system is an important component in row-crop planters in terms of uniform seed distribution. Numerous field and laboratory methods have been developed and used for evaluation of planter performance; each method having its own advantages and shortcomings. In the present study, a digital camera (Nikon, D70) was used for laboratory evaluation of vertical-rotor seed-metering device performance, indices such as multiple planting, feeding quality, miss planting and seed space uniformity being the major criteria. To validate the results from image processing method, the more conventional, grease-belt method, was used. The experiments were conducted on the basis of factorial randomized complete design with two types of seed-metering devices, with different numbers of cells and four levels of seed-metering speeds in three replications. Captured images were transferred to the computer via USB port and were processed by program written in MATLAB software environment. The results from two methods, namely, image processing and grease belt methods were in good agreement and analysis of variances showed that seed-metering device with 15 cells in 40 rpm performed better than seed-metering device with 21 cells and in other speeds. Comparison of the number of spaces that fell in normal domain in different seed-metering speeds showed that image processing method had higher value than grease-belt method. Since the initial falling velocity of seed and angle of its exit from metering device was unknown, thus the precision of space index was different in two methods.

III. METHODOLOGY

The section 3 discusses about the work like as:

- Introduction of the various parts used in the project like solar plate, battery, spray pump, seed drilling mechanism and tank.
- Design or selection of various parts used the project
- Fabrication model of the project

In our country farming is done by traditional way, be sides that there is large development of industrial and service sector as compared to that of agriculture. The spraying is traditionally done by labor carrying backpack type sprayer which requires more human effort. The weeding is generally done with the help of Bulls which becomes costly for farmers having small farming land. So to overcome these above two problems, we tried to eliminate these problems and designed the equipment which will be beneficial to the farmer for the spraying and weeding operations.

A. *Selection of Sowing and Planting Machines:*

Different designs of improved seed drills/planters have been developed for sowing of crops. Basic

difference in the design of these seed drills is mainly in the type of seed metering mechanism and furrow openers. Therefore, it is essential to select the machine with a metering unit and furrow opener suitable for the crop and soil conditions.

3.1 Design or selection of various parts used the project

1) Selection solar panel:

Solar panel Specification:

Pmax (Wp)	20
Vmax (V)	17.60
Imax (A)	1.14
Voc (V)	21.50
Isc (A)	1.23
Module Size (mm)	555x340x22
Weight (kg)	2.1

As per solar panel specification Imax is 1.14 (A)

Solar panels are a great way of cutting your electricity. We all want to live self-sustainably, or at least reduce the carbon footprint of our home, and solar panels make that dream possible. Solar panels are made of photovoltaic (PV) cells, which turn sunlight into electricity. This electricity can then be fed into your home's mains electricity supply. The technology behind solar is relatively old, despite their futuristic appeal, but while the basics are the same the efficiency of solar panels has improved greatly in recent years. Rated power 20W Frame Heavy duty aluminum Kind of connection waterproof junction box, can be customized Guarantee of power 90% within 10 years 80 within 25 years, Kind of glass and its thickness Low Iron, high transparency tempered glass of 3.2mm SLA Battery Voltage 12V size 555X340X22

2) Selection of Battery

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work**.**

Battery: 7.2 Amp Hour 12 Volts Sealed Lead Acid Battery

3) Selection of Motor as battery specification

Motor 12V DC 30 RPM

An electric motor is a machine which converts electric energy into mechanical energy. Its action is based on the principle that when a current carrying conductor is placed in magnetic field, it experiences a mechanical force whose direction is given Fleming's Left Hand Rule.

Design of the Motor

We know,

Specification of the DC motor,

Toque (T) = 5 N-m

Speed (N) = 30 rpm

We know,

Power (P) = 2πNT/60

= (2×3.14×30×5)/60

= 15.7 watt

Power of the motor (P) = 15.7 watt.

4) 3.5 Chassis:

A consists of an internal framework that supports a man-made object in its construction and use. It is analogous to an animal's skeleton. An example of a chassis is the under part of a motor vehicle, consisting of the frame (on which the body is mounted). If the running gear such as wheels is included then the assembly is described as a rolling chassis. Material Used In Chassis – Iron

Size of Chassis – 22 inch x 8 inch x 36 inches

5) 3.6 Battery Charging Design

Analytical calculation of current and charging time of the battery:

(i). The current produced by the solar panel (I) was calculated by knowing the maximum power (P) of the solar panel and the voltage rating (V) of the battery that is given by

I=P/V

Therefore, I=20/12 = 1.66 Amp

But actually given in the solar panel specification is 1.14 Ampere

(ii). Charging time (T) was computed by taking the ratio rating of battery in ampere hour (Ah) to the total current consumed by the solar panel.

T= (battery rating in ampere hour)/ (total current consumed by the solar panel)

Therefore, T=7.2/1.66 =4.33 hours

IV. CONCLUDING REMARKS AND SCOPE FOR THE FUTURE

Our project is successfully implemented for seed sowing and fertilizer spraying.

The equipment is purposely design for the farmers having small farming land say 5-6 acre. It is suitable for spraying as well as weeding at minimum cost for the farmer so that he can afford it. The equipment will results more beneficial when it is subjected to moist soil for weeding purpose, due to moist soil the weed cutter can easily penetrate and dig out the soil and hence will easily accomplished the weeding process The performance of the equipment will increase when it is operates on the smooth surface or less uneven surface and also it will be more effective when it is used on the crops having nearly similar height and having the less space between two crops

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