Electrically Operated Granulated Fertiliser Spreader with Variable Range

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Abstract— A method was generated to spread the fertilizer uniformly over a fallow land by dropping the fertilizer over the impeller disc. The system consists of a three wheels, two at the front and one at the back. These two wheels at the front are used to impel the fertilizer. The two hoppers are used to store the fertilizer; these hoppers are placed at some height from the wheel axle so that the fertilizer falls on to the impeller. The hopper is provided with flow control mechanism. In fertilization, the flow maintenance is necessary. Generally every crop should get sufficient amount of fertilizer. The fertilizer is spread using the centrifugal force. This high value of centrifugal force is generated with the help of proper gear reduction ratio and electric motor. The gears are coupled to the shaft of wheel and motor is connected to the battery. With this machine, possible percentage reduction in time required for Fertilization is 50% and reduction in labour cost as compared to conventional method is 80%. It has solved the problem of traditional way of Fertilization.

Keywords: Fertiliser, Fertilisation, Farming, Spreading, Manual, Electrical

I. INTRODUCTION

India is agriculture based country. Near about 70% people of our country are farmers. Our economy also depends on agricultural products. Nowadays tremendous changes have occurred in conventional methods of agriculture like seed plantation, irrigation system, pesticides and spray used. For developing our economic condition, it is necessary to increase our agricultural productivity and quality also.

Indian agriculture is plagued by several problems; some of them are natural and some others are manmade. They are as follow-

1) Small and fragmented land-holdings
2) Seeds
3) Manures, Fertilizers and Biocides
4) Irrigation and fertilization
5) Lack of mechanisation
6) Soil erosion
7) Agricultural Marketing
8) Inadequate storage facilities

In foreign countries Today's agriculture routinely uses sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology, different types of drones. These advanced devices and precision agriculture and robotic systems allow businesses to be more profitable, efficient, safer, and more environmentally friendly. Present Status of Indian Agriculture sector is the mainstay of the Indian economy, contributing about 15 per cent of national Gross Domestic Product (GDP) and more importantly, about half of India's population is wholly or significantly dependent on agriculture and allied activities for their livelihood. But the way of farming we are using is not advanced.

So as compare to them, what we need is an alternative to the traditional as well as costly fertilizer spreading machine which will fulfil all the requirements‖.

Farming process includes many stages and problems related with those processes, out of which fertilization is one of the important stage and which is not exploded up to the mark up till now. Now-a-days, we are used to do spreading of fertilizer in traditional way which is time consuming, costlier as well as not provide comfort to the labour. Also, some tractor operated machines for spreading fertilizer are available which are costly and not so efficient.

II. PROBLEM STATEMENT

It is well known that by using farm equipment‘s yields more crop productions which ultimately have impact on national economy. Itself it gives prior need of agro equipment‘s in the field of agriculture. As we can see today, the major problem faced by the farmers is shortage of labours and also the time required for fertilisation is more. So in order to have solution to it, it was proposed to manufacture a fertiliser spreader machine. So, the farmers can work more easy and functional.

By using this kind of machines we are able to improve the work efficiency of the farmer. This also helps to reduce the timing required for fertilization and the cost as well as efforts required for the same. It also decrease dependency of farmer on labours.

So it‘s very necessary to reduce the time, increase the output and make the process economical‖.

III. TRACTOR OPERATED FERTILIZER SPREADER

Figure shows the Fertilizer Spreader which is pneumatically operated on tractor. It is most useful for plain ground method of Fertilization. As it is operated on pneumatics construction is complicated. It requires compressor and other accessories for its operation. Its maintenance cost is high as tubing‘s and compressor gets affected by soil particles.

Fig. 1: Tractor Operated Fertilizer Spreader

Fig. 2: Tractor Operated Fertilizer Spreader

IV. OBJECTIVES

According to the different problems and information we get during our visit, we should come to know about actual field requirements, the specifications or characteristics and some other different parameters which we have to consider during design and manufacturing of our project. On this basis we have selected our objectives to create a efficient machine in agricultural sector. The Fertiliser Spreader machine should satisfy the following objectives:

1) Manual setup is able to cover distance up to 2 feet on one side so our objective is to modify the range from 2 to 4 feet or more than that using new setup.
2) Small scale farmers can't afford big setups hence we can design small setup, so that farmer can afford it.
3) Manually fertilizer spreading is tedious task, hence our aim is to design such kind of machine which can reduce human efforts.
4) Equally fertilizer distribution is necessary for crop growth, but most of the time uneven fertilizer spread by labour

V. CONSTRUCTION AND WORKING

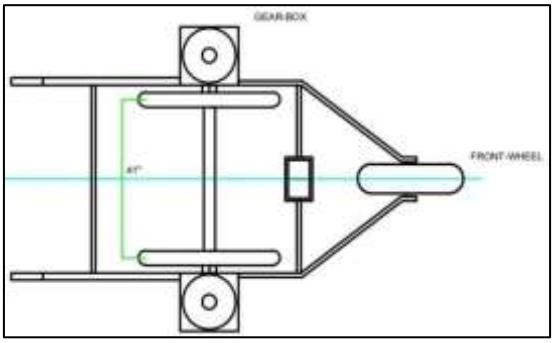

Fig. 3: General Layout (Top View)

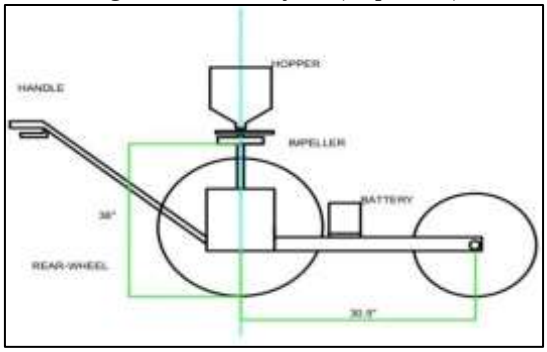

Fig. 4: General Layout (Side View)

A. Working:

The construction of ‗Granulated fertiliser spreader'is as shown in above fig. The setup runs on two powers manual as well as electric power. The gear box is design in such way that it generate 230 rpm at impeller which is require to spread the fertiliser up to 1 – 2 fits on manual setup.

The 12 volt electric motor is also connected with the impeller to rotate the impeller with more speed. The speed is require to increase the spreading distance of fertiliser. By using electric motor it is possible to achieve the spreading distance of 3 – 4 fits on each sides. So at a time, the total distance cover by the machine is 7 – 8 fits. So by using electric motor it is easy to reduce the time required, improve the work efficiency as well as the constant volume of fertiliser.

To compensate the problem of battery discharging, the manual setup is provided. Also for shorter distance the manual setup is best which saves energy and improves the battery capacity.

VI. DESIGN OF SYSTEM

A. Design Considerations:

Design consists of application of scientific principles, technical information and for development of new or improved machine or mechanism to perform a specific function with maximum economy & efficiency. Hence a careful design approach has to be adopted. The total design work has been split up into part.

1) System design
2) Mechanical design

System design mainly concerns the various physical constrains and ergonomics, space requirement, arrangement of various components on main frame at system, man and machine interactions, no. of controls, working environment of machine chances of failure safety measures to be provided, servicing aid, ease of maintenance, scope of improvement, weight of machine from ground level, total weight of machine and a lots more.

In a system design we mainly concentrated on the following parameters, system selection based on physical constraints. While selecting any machine it is going to be used in large scale industry or small scale industry in our case it is to be used by small scale industries. So space is a major constrain.

The mechanical design has directly norms with the system design. Hence the foremost job is to control the physical parameter, so that the distinction obtained after mechanical design can be well fitted into that. In system design we mainly concentrated on the following parameters.

1) Arrangement of various component:

Keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangement

2) Component off system:

As already state the system should be compact enough so that it can be accommodated at a corner of room. All the moving parts should be well closed and compact. A compact system design is given a high weighted structure which is desired

man machine interaction. The friendliness of machine with the operator that is operating is an important criterion of design. It is the application of anatomical and psychological principles to solve problems arising from man- machine relationship.

3) Chance of Failure:

The losses occurred by owner in any failure is an important criteria of design. Factor of safety while doing mechanical design is kept high so that there are less chances of failure.

4) Servicing Facility:

The layout of component of component should be such that easy servicing is possible. Especially those component which require frequents can be easily disassembled.

5) Scope of Improvement:

Arrangement should be provided to expand the scope of work in future. Such as to convert the machine motor operated, the system can be easily configured to required one. The die & punch can be changed if required for other shapes of notches etc.

6) Weight of Machine:

The total weight depends upon the selection of material components as well as dimension of components.

B. Design Parameters:

Our machine is also manually operated. So we have to consider the velocity of normal human for manual setup design. Normal human velocity is 1.4 m/s but as our work is in the farm, we will take it as v=0.9 m/s. With this velocity we have to achieve the speed of 160 rpm. As to cover an acre within one hour. Right now we Trying to increase speed of impeller from 160rpm to 500rpm but this is not achievable by manual setup hence we are introducing electrical motor with speed regulator into setup due to which it is possible to cover maximum fertiliser spreading area.

Manual setup is able to cover distance up to 2 feet on one side so our objective is to modify the range from 2 to 4 feet or more than that using new setup.

C. Design Specifications:

Maximum width = 41 inch Maximum length =30.5 inch Maximum height = 38 inch

1) Big Wheels:-

Specifications:-

Designation: - 50.8 * 3.75 cm

2) Small Wheel:-

Specifications:-

Designation: - 40.64 * 3.75 cm

3) Flow Control Mechanism:-

In fertilization, the flow maintenance is necessary. Generally every crop should get sufficient amount of fertilizer. This condition is satisfied by Spring Mechanism.

Figure shows the flow control mechanism. In normal conditions spring is not in tension and Hooper is closed. As operator apply tension on the spring, controlling plate moves backward and Hooper is open.

Fig. 5:

D. Gear ratio calculations for manual setup:

From design parameters V= 0.9

N= 34.4 rpm

We required Gear Ratio $\frac{160}{34.4}$ = 4.7

To achieve gear ratio of 4.7 for the bevel gear in single stage we have to use very costly bevel gear pair, which is uneconomical for the medium farmers, so we instead of single stage gear box we will design two stage gear box consist of one pair of spur gear & another of bevel gear.

So we will design the bevel gear which is commonly available in the market .i.e. having gear ratio of 1.8

Gear ratio of spur gear will be = = 2.6

E. Motor Specifications:

Power- 300 w

Torque-5 Nm

Voltage- 12v

Speed- 1200 rpm

Fig 5.2: DC Motor

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