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SEMI AUTOMATIC UREA FERTILIZER SPREADER

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Abstract:

India is agriculture-based country. This project is based on automatic fertilization process. Our aim was to improve the performance of fertilizer distribution in sustainable fertilizer spreader. The project design divided into three stages. First stage consist hopper. Middle stage consist impeller. Last stage consist motor. The whole design is supported by frame. For small-scale uses, it not possible to use costly tractor mounted spreaders. This project solves the problem of manually spreading of fertilizer. It also reduces waste of fertilizer due to overlapping.

Keywords: *Agriculture; Fertilizer spreader machine; Design and Fabrication.*

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1. 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. farming process includes many stages, out of which fertilization is one of the important stages and which is not exploded up to the mark up till now. now-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 labor. also, some tractor operated machines for spreading of fertilizer are available. so, what we need is an alternative to the traditional as well as tractor operated fertilizer spreading machine which will fulfill all the requirements. so, we are going to design a manually operated machine for fertilizer spreading by taking into consideration the user group and their needs which helps to them to work easy and functional.

2. PROBLEM STATEMENT

Some issues exist when manually distributing fertilizers in the field, such as uneven fertilizer spreading (wrong material and wrong quantity), which may result in harvest damage. The old-fashioned method of distributing fertilizer by hand on a farm takes more time and demands more human energy. As a result, a fertilizer spreader machine is far more ideal for agricultural labour because it increases harvest productivity quickly and with no effort. Manual fertilizer spreading, which involves using hand-held tools to distribute fertilizer, also faces a few challenges and problems. One of the main issues with manual fertilizer spreading is the potential for uneven application. If the person spreading the fertilizer is skilled or experienced, they may apply less fertilizer, resulting in uneven crop growth and yield. Additionally, manual fertilizer spreading is typically less precise than using a machine, which can result in wasted fertilizer and environmental damage.

Another problem associated with manual

fertilizer spreading is its physical strain on the person doing the work. Carrying heavy bags of fertilizer and repeatedly bending down to spread it can lead to back pain, fatigue, and other physical ailments. This can make finding workers willing to do the job difficult, especially in areas where labour is scarce or expensive. Moreover, manual fertilizer spreading can be time-consuming and inefficient, especially for large fields. It may require multiple passes over the same area to ensure even coverage, which can be tedious and costly. Finally, manual fertilizer spreading also poses risks to the health and safety of the person doing the work. Fertilizer dust can irritate the eyes and respiratory system, and exposure to certain chemicals in fertilizers can be toxic. Therefore, the problem statement for manual fertilizer spreading is to find ways to ensure the even distribution of fertilizer while minimizing physical strain and health risks for workers, reducing waste, increasing efficiency, and improving the overall productivity and sustainability of agriculture.

3. LITERATURE REVIEW

There are different researchers who invented different types of fertilizer spreading machines. They publish their papers and the papers published are given below:

• Arun Abraham studied that, Conventional spreading of fertilizers for small-scale farming are by hand. The farmers have to carry heavy bags throughout the spreading process. Therefore, it is necessary to develop a fertilizer spreader for small-scale farming. The proposed fertilizer spreader uses a trolley type of mechanism. The main part is spreader disk, which helps for uniform spreading. The feed for the disk is from the wheels of the trolley using gear transmission. By using this spreader, a lot of time can be saved, human effort used for carrying heavy bags of fertilizer is reduced and wastage of fertilizer can also be avoided. Joao P.A.R. Cunha studied that; the quality of fertilizer distribution process is important to the success of agriculture. This research aimed to study the distribution uniformity of fertilizers with spreaders capable of performing variable rate. Evaluations were carried out in different farms, in the Southwest region of the State of Goias, Brazil.

Narode R. R. studied that; He has generated a method to spread the fertilizer uniformly over a fallow land by dropping the fertilizer over the impeller disc. The system consist s of 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. This condition is satisfied by Spring Mechanism.

• Vignesh B. studied that; A method was generated to spread the fertilizer automatically over the agricultural land by dropping the fertilizer over the impeller disc. A 25cc engine is used to rotate impeller disc in which the fertilizer drains and spreads from hopper where it is introduced. In tractor mounted or manual system they carry four and three wheels respectively. But here two wheels are used in which the bigger front wheel is connected to engine through supporting wheel can be adjustable.

Bhojane et al. [1] designed a manually operated fertilizer-spreading machine while considering the user group and their demands. The project design is separated into three levels: top, middle, and bottom. The top level is made up of a hopper. The intermediate level comprises the gear arrangement, chain drive, and spreader disc. A wheel can be seen on the bottom level. They have used this to learn how mechanization can help solve the problem and what else can be done to make it more accessible to all farmers.

Laghari et al. [2] aim for valuable fertilizer uses in agriculture. Soil contains various micro and

macronutrients vital for plant growth and yield. It is necessary to save essential nutrient constituents like nitrogen, phosphorus, and potassium by applying chemical nourishments. For constructive situations, broadcast applications can be inefficient because there is a much greater soil-to-fertilizer connection in more fixation or tie-up of nutrients.

Shailesh Chaudhari et al. [3] have studied sugar plantations in Indian agriculture and what is the need for an alternative to the traditional tractor-operating fertilizer sprayer machine. The countries which are based on their agriculture, like India, have near about 71% farmers. Because of these reasons, the author has proposed to develop a machine that will have the least cost compared to traditional fertilizer requirements.

Kishore et al. [4] described various types of machinery present in sugarcane farming, such as Mechanized land preparation in which animals, automobiles, or tractors are used.

Narode and Sonawane [5] have studied a procedure to spread the fertilizer homogeneously over land, creating uniform distribution by dropping the fertilizer over the impeller disc. In this type of mechanical system, the mechanism consists of three wheels, of which two are mounted at the front and one at the back. The fronting two wheels are used to drive out the fertilizer. Here, two hoppers are used to store the fertilizer. These hoppers are placed at some height from the wheel axle so the fertilizer drops over the impeller. The hopper is based on a flow control mechanism. In fertilization, always flow maintenance is necessary.

Vignesh et al. [6] have tried to focus on incredible changes in the best traditional methods of agriculture, like seed plantation, irrigation systems, pesticides, and spray. To evolve our monetary condition, increasing our agricultural production and superiority is obligatory.

4. OBJECTIVES

The objective of this invention is to provide a simple and inexpensive fertilizer spreader, in a form of a two – wheeled ‗walk-behind‘device which may be easily and quickly pushed by the farmers for spreading solid fertilizers like urea.

Problems: generally, in the manually spreading of the fertilizers in the farm, some of the problems are occurring like uneven spreading of the fertilizers (wrong stuff and wrong amount) which may result in the crop damage. Moreover, the conventional spreading of fertilizers by hand in a farm is more time-consuming method and require more human effort.

Project discussion: this is a type of spreader which can be operated manually for spreading granular materials in farms especially for solid fertilizers like urea. the spreader has hopper with at least one orifice in it. at the bottom of hopper, a rotating disc is provided for spreading granular materials. as the device gets pushed manually the rotation of the wheels get converted in to vertical rotation of spreading disc by the set of bevel gears. the spreading device normally has a bladed centrifugal spreader comprising disc which is rotated about vertical axes and onto which the product to be spread on the ground is dropped in a suitable manner. Each disk also has a plurality of substantially radial spreader blades for directing the product to be spread by the centrifugal effect induced by the rotation and for projecting it onto the ground from the ends of the blades farthest from the axis of rotation.

Results: present invention results in increase in uniformity of fertilizer spreading, good crop yield, and reduction in time required to spread, less human fatigue, prejudiced use of fertilizers and less waste.

Conclusion: author in this paper has taken up design related project to understand and overcome various problems occurring in conventional fertilizer spreading. Uneven spreading, reduce human efforts and reduce time of spreading have been highlighted as key factor for this paper.

- Precision farming with lower fertilizing
- Reduce physical strength of farmer

5. WORKING PRINCIPLE

- It is based on motion of ground wheel using gear arrangement. The flow of

fertilizer is maintained by using spring mechanism.

- It is a machine for spreading the fertilizer in continuous and controlled flow at uniform rate. It can cover an acre of farm within half an hour

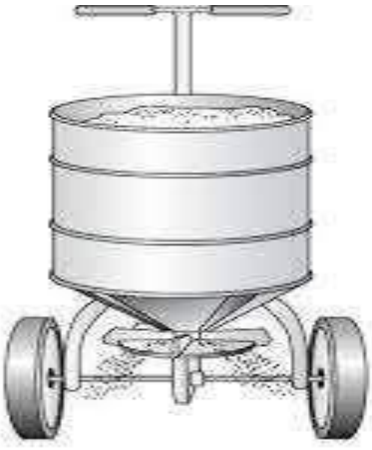
- Three wheels are used in this machine. In front axle two wheels are located to carry the load of the machine in proper way and last wheel is used to balance overall load of the machine.

- First two ground wheels transmit the input power by the operator to the rotor by gearing arrangement.

- On rotor, Hooper is located to reservoir of fertilizer, of which flow is controlled by spring mechanism. The control of spring mechanism is under control of operator.

- This machine is operated is operated using a motion of ground wheel through gear transmission arrangement.

- The flow of fertilizer is controlled by spring mechanism.



- Fig 6: Urea Spreader Machine Modelcontrol

6. ADVANTAGES

- Fertilizer spreader machines can cover large land areas quickly and efficiently, saving time and labor compared to manual methods.
- This allows farmers to apply fertilizer to their fields more quickly and accurately, reducing the risk of crop failure due to nutrient deficiencies.
- They can help to reduce labour costs and fertilizer waste, and the improved crop yields they promote can lead to higher profits for farmers.
- Fertilizer spreader machines can be used to apply a wide range of fertilizers, including organic and inorganic fertilizers, as well as herbicides and pesticides.
- Fertilizer spreader machines are a cost-effective solution for applying fertilizer to large areas of land
- This makes them a versatile tool for maintaining soil health and promoting plant growth.
- With the help of the machine operator, fatigue reduces during the operation.
- An adjustable nozzle helps to control the flow of fertilizer.
- Cost-effective as compared to tractor-operated spreaders.

7. APPLICATIONS

- Its major use in agriculture is to spread fertilizer.
- It is helpful in cases where the crops are in a row.
- It is useful for long farms as well as small farms.
- Use full in sugarcane crops and vegetable crops.
- For the herbicide's application, to kill the weeds.

  It can be used for spraying germicide

8. LIMITATIONS

- Fertilizer spreader machines may not be effective in windy or rainy conditions, as these conditions can cause the fertilizer to drift or wash away before it can be distributed appropriately.
- Fertilizer spreader machines may not be effective on uneven or steep terrain, as they require a flat surface to distribute fertilizer evenly.
- Fertilizer spreader machines may not be effective in compacted or poorly drained soils, as the fertilizer may not penetrate the soil surface and reach the plant roots.
- Fertilizer spreader machines can be expensive to purchase and maintain, especially for small-scale farmers who may not have the resources to invest in this technology.

9. CONCLUSION

The main objective of our project was to fulfil the need of farmers suffering from the problems of fertilizing timing is more, high physical strength of farmer is required, manually spreading of fertilizer, precisely spreading of fertilizer is not possible, carrying of heavy bags. Also, this fertilizer spreader provides convenient technique to fertilize the whole farm with uniform spreading of fertilizers and eliminate the wasting of fertilizers. The drawbacks in the existing spreader model are reduced in this system. In addition, this machine is easy to operate with low capital cost and less troubleshoots

10. REFERENCES

1. S.C. Jain, ―Farm Machinery-An Approach‖, PP-5,36,45

2. D.S. Sharma and Mukesh Sharma, ―Farm Machinery Design Principles and problems‖, PP-225-245.

3. Article for Experimental Study of Disc Fertilizer Spreader Performance by ArturPrzywara& Team.

4. ―Urea Spreader Machine‖ International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056

5. ―Solar Fertilizer Spreading Machine‖ International Journal for Scientific Research &

Development/Vol.6, Issue 01, 2018/ISSN (online): 2321-0613

6. ―Design of Manure Spreader Machine for Agricultural Farm Field‖ International Journal for

Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-1 November 2019

7. XT SERIES Fertilizer Spreader by Teagle.

8. ―Design and Fabrication of Trolley Mounted Fertilizer Spreader‖ IJIRST – International Journal for

Innovative Research in Science & Technology| Volume 3 | Issue 11 | April 2017 | ISSN (online):2349-6010

9. ―Design and Fabrication of Fertilizer Spreading Machine‖ International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887, Volume 6 Issue VII, July 2018

10. ―Fertilizer Spreading Machine‖ International Journal of Advance Engineering and Research Development, ISSN: 2348-4470, Impact Factor: 5.71, Volume 5, Special Issue 04, Feb.-2018

11. ―Design and fabrication of portable granular fertilizer spreader‖ K.Navanitha Krishnan, K.Velmurugan, S.Arul Pradeep, G.Gouber Raja, M.thoufiqueAhamed, ISSN NO: 0005-0601, Volume XI, Issue XII, December/2020, pp. 328-334.

12. ―Design and fabrication of multipurpose agricultural equipment‖ Kiran B, Pramodh H N, Manoj Kumar K V, Karthik S, Sampath H P,City Engineering College, Doddakallasandra, Kanaka pura, Bangalore.

13. ―Design and fabrication of multipurpose agricultural equipment‖ Vignesh B., Sethuraman N., Navaneethakrishnan M., IJSRD, Volume 5. ISSN: 2321-061

14. ―Design and Development of Fertilizer Spreader Machine‖ ShaileshChaudhari*, MansuriNaeem, PrajapatiJigar, PrajapatiPreyash IJESRT, **ISSN: 2277-9655, Impact Factor: 4.116, April 2017**