

Design, Testing and Fabrication of Electric Power Solid Fertilizer Spreading Machine

Keshav Mot¹, Kuldeep Singh Rathor¹, Chandan Kumar^{2*}

¹Students, ²Assistant Professor, Department of mechanical engineering, Swami Keshvand Institute of Technology Management and Gramothan, Jaipur, India.

*Corresponding author email- chandanpink1988@gmail.com

Abstract: - Farmers still use traditional methods to spread the solid fertilizers, which is time consuming and affects human health and comfort. Compared to traditional methods, Fertilizer spreading machine help farmers to fertilize comfortably in the shortest possible time. The machine also provides precise and uniform fertilizer distribution at a controlled variable rate. This machine is suitable for the spread of urea, sulfur, DAP and other solid fertilizers, and is evenly distributed in various fields such as side hills. This machine allows variable rate or segmentation control of the fertilizer equipment. It is designed to provide users with maximum flexibility and ease of operation.

Keyword: - Solid fertilizer, farmers, uniform distribution, fertilizer spreading machine

I. INTRODUCTION

India is an agricultural country. About 71% of India's population is farmers. The economy also depends on agricultural products and services. Today, traditional agricultural methods have undergone tremendous changes, such as seed planting, irrigation systems, pesticides and spraying. In order to develop economic conditions, it is necessary to improve our agricultural productivity and quality. The agricultural production process involves many stages, of which fertilization is one of the important stages and has not yet erupted. We used to spread fertilizer in a traditional way, which is time consuming and expensive, and did not provide comfort for the workforce. In addition, there are tractor operating machines for spreading fertilizer. Therefore, what we need is a fertilizer spreader that replaces traditional and tractor operations and will meet all requirements. Therefore, we have designed a manually operated fertilizer machine that allows them to work easily and practically, taking into account the user base and its proliferation needs. There are signs that farmers are considering how to adjust fertilizer programs to improve crops.

The fertilizer market is roughly divided into 16% liquid and 84% solid fertilizer. Solid fertilizers are currently being hand-spread, which is time consuming and causes skin diseases. Therefore, a solid fertilizer spreader is required. Therefore, a solid fertilizer spreading system was developed to eliminate the possibility of human error, power and time consumption. The project concept of making a solid manure spreader is a viable idea because there are already several liquid fertilizer spread projects, but for solids, only artificial spread is currently being carried out. Manure spreaders also have long machine life

and high spreading capacity, helping to reduce agricultural input costs and increase overall productivity by ensuring efficient and effective spread of fertilizer. Therefore, our idea will definitely find an application suitable for farmers to promote the use of solid fertilizer. This project will help farmers improve productivity and reduce manpower. This is the bottleneck today.

II. LITERATURE REVIEW

The uneven spread of fertilizer affects the overall performance of the crop, reduces fertilizer use efficiency and profitability due to crop yield and quality loss, and increases the environmental damage of nutrients. Uneven or uneven spread of fertilizer can result in uneven spread of fertilizer, which requires determining and correctly determining the optimal rate (Richards & Hobson, 2013). Application system components with performance goals related to delivery rate and distribution uniformity including (after Miller, 1996):

- A. Machine design (Olieslagers et al., 1996), setup, calibration and maintenance (Bull and Crowe, 1985),
- B. Physical and chemical properties of Bay Fertilizer (Hofstee, 1993), and
- C. Weather conditions during the spread of fertilizers, especially wind speeds affecting particle trajectories, and relative air humidity affecting fertilizer behavior (Svenssen, 1994)

Fertilizers, as well as seeds and other inputs, are essential to increase productivity and production. Since independence, the de facto fertilizer has been driven by the whole (rural social economy)

Agricultural landscape in Malawi. Recently, in order to improve the agricultural productivity and profitability of small farmers, the Malawi Government (GOM) has issued a written policy on fertilizers, which has been incorporated into the National Fertilizer Strategy (NFS). The strategy supports the Agricultural Development Plan [ADP]. The strategy can also be used as an input to develop a regional fertilizer action plan to accelerate the supply of fertilizers and other free inputs to millions of poor farmers. The purpose of National Fertilizer Strategy is to address key issues affecting the adoption and use of fertilizer technology through short-term, medium-term and long-term actions to develop a private sector-led fertilizer market with a view to improving the agricultural productivity and profitability of small farmers. There are many types of fertilizer spreading methods on the market, such as manual manuals, and some fertilizer spreaders based on various working systems, such as centrifugal impellers, manual impellers with hand wheels, tractor-operated spreaders, etc., for fertilizer spreading. The cost is very high and the small farmers can't afford it, so we plan to use the fertilizer method to make a fertilizer spreader for fertilizer spreading. Which will cost less, so the idea of making fertilizer is feasible.

III. EXPERIMENTAL SETUP

The working method of the machine is shown in Figure 1. The main function of the machine is to distribute the fertilizer evenly on the fallow land by dropping the fertilizer on the high-speed air flowing in the pipe. The system consists of two blowers that blow compressed air in a common pipe. A hopper is used to store the fertilizer; the hopper is placed at a certain height from the pipe to allow the fertilizer to fall into the air stream. The hopper is provided with a flow control mechanism. Flow consistency is necessary in fertilization. Usually enough fertilizer is needed for each crop. The thread operation control mechanism satisfies this condition. When the operator rotates the lever, the control panel moves the air back in the common duct. A hopper is used to store the fertilizer, and the hopper and hopper are opened. Below the system there is a pipe in which the compressed air I follows. Hooper opens in the pipeline, and the fertilizer spreads on the farm due to the high air speed. Produce a large amount of air velocity by using a battery to supply power to the blower

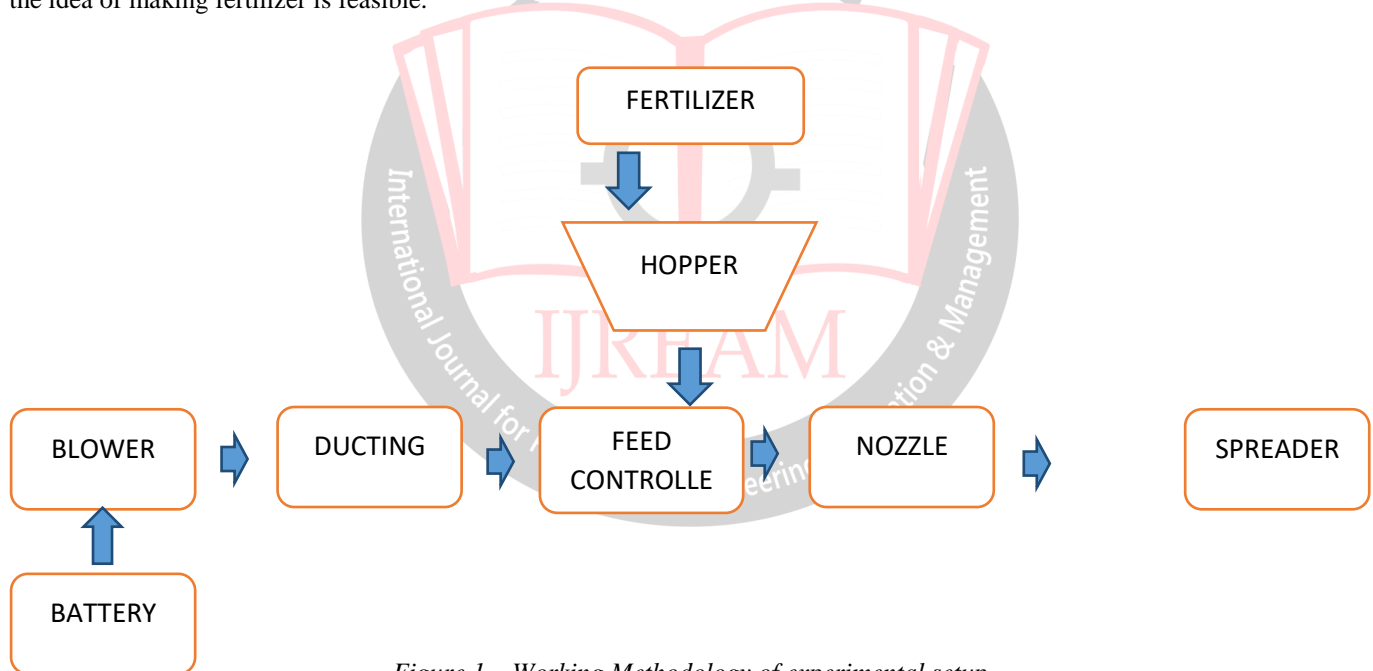


Figure 1 – Working Methodology of experimental setup

The blower is supplied with power through a battery, and the blower blows high-speed air in a pipe connected there to. In the piping arrangement, the hopper containing the fertilizer has been placed at a certain height such that the fertilizer falls due to gravity in the air flow, and the light weight fertilizer is dispersed as the air flows. The pipe consists of two parts, the first part connecting the hopper to a common pipe

The second part is to reduce the export area and increase the air flow rate.

3.1 METHODOLOGY

1. High-speed atmosphere air is used for communication purposes.
2. According to our requirements, the hopper is filled with fertilizer granules.
3. The amount of fertilizer to be dispersed is controlled by a control valve located at the lower end of the hopper
4. The blower is powered by the battery

5. Alternative sources of power to the blower can be generators, solar panels, and the like.
6. The blower draws in the atmosphere so that high speed air can be delivered at the exit
7. The air pressure is controlled by a pressure regulating valve, and the pressure regulating valve is located at the outlet of the blower.
8. Route the air through the pipe and then through the pipe. Fertilizer particles are made to enter the pipe in a controlled rate.
9. Allow the fertilizer granules to enter the pipeline at a controlled rate.
10. The fertilizer granules are in contact with the high pressure air delivered by the blower.
11. Light fertilizer pellets are blown with high pressure air and spread out in the projection area

3.2 COMPONENTS & ASSEMBLY

(Dimension in inches)

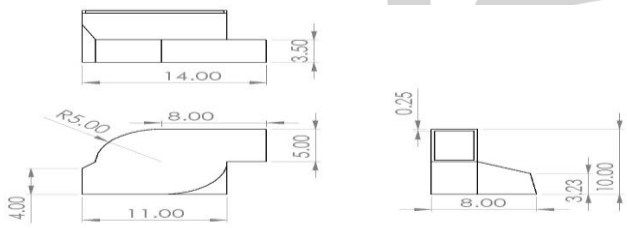


Fig1.1 – blower dimensions

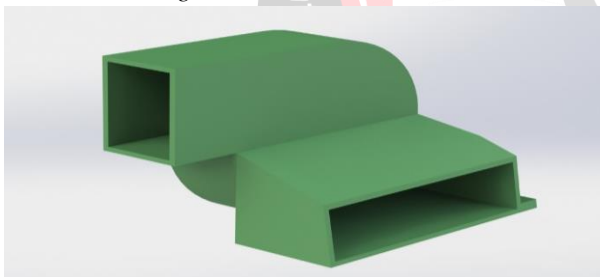


Fig1.2 – blower 3d model

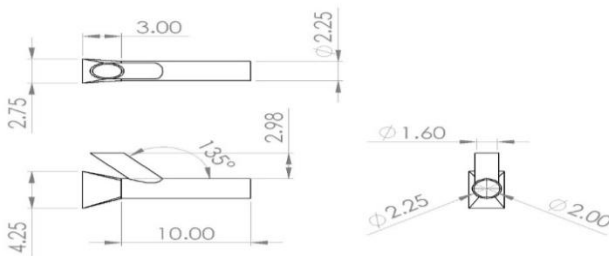


Fig2.1 – ducting dimension

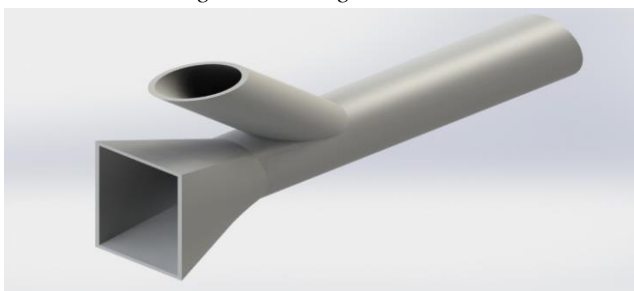


Fig2.2 – ducting 3d model

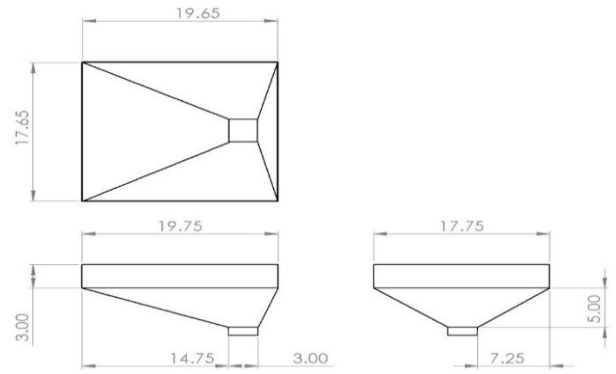


Fig3.1 – hopper dimensions

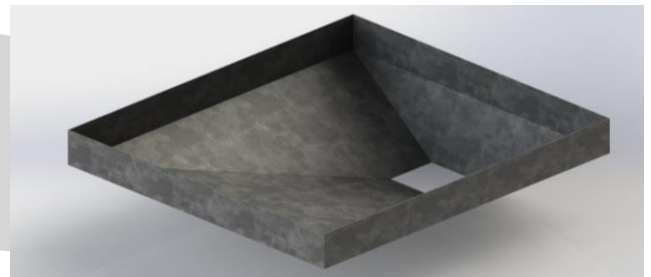


Fig3.2 – hopper 3d model

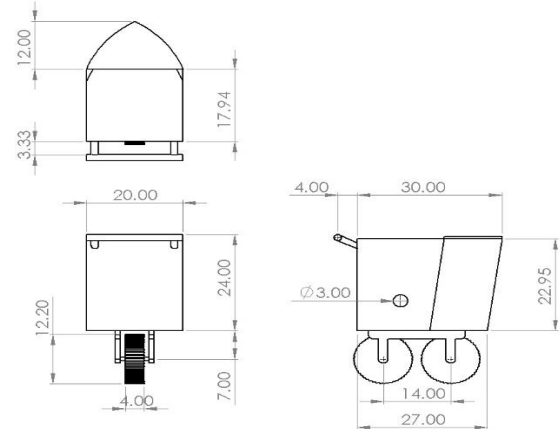


Fig4.1 – body with wheels

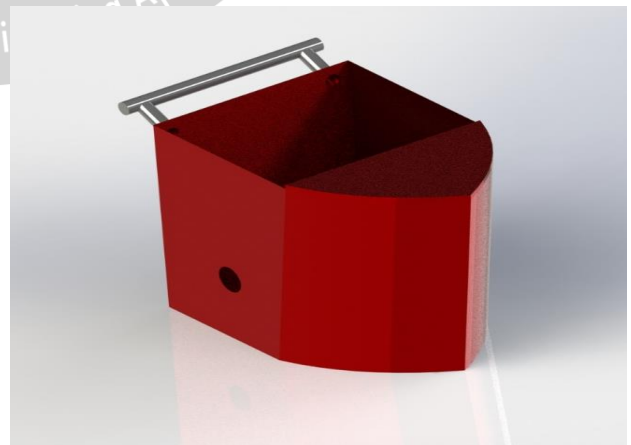


Fig4.2 – body 3d model

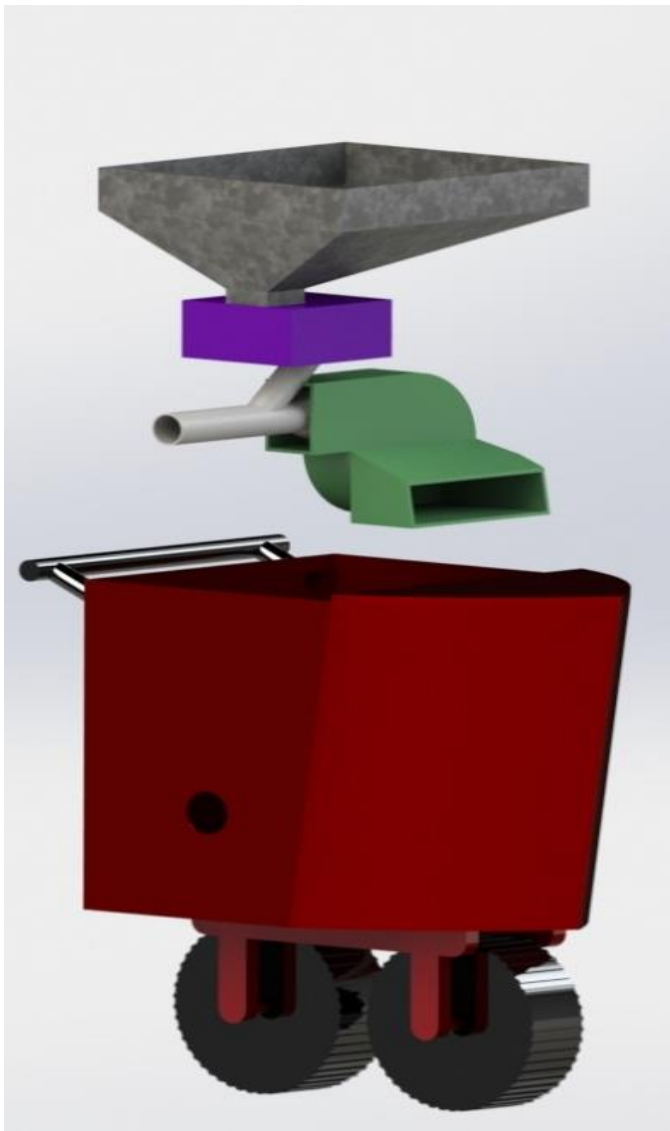


Fig5 – final assembly of machine

IV. RESULT AND DISCUSSION

By taking of our machine and gathering information it have shown result better than other possible traditional methods of spreading fertilizers in the field. This machine fertilizer the land comparatively faster, safer and uniformly than the traditional methods at low capital cost. With this machine, percentage reduction in time required for Fertilization was observed to be 1/3 and reduction in labor cost as compared to conventional method was 2/3.

The distance at which this machine can throw solid fertilizer is up to 26 ft. which is more than enough for fertilization of almost all types of crops.

It can throw up to 1000g/min of fertilizer.

The machine have variable feed control which can be used to regulate the flow of fertilizer form hopper to the ducting. Hence feed can be adjusted according to the need of the farmer.

V. CONCLUSION

It indicates that the project concept of making a fertilizer spreader is feasible. Through testing we found that the

results were probably the cheapest as expected and one of the best ways to overcome all the problems associated with traditional fertilizer delivery methods. It can avoid various hazards to the skin of fertilized people. It provides a uniform distribution of fertilizer, i.e. avoiding excessive fertilizer granules in specific areas, which can cause damage to crops. The main goal of our project is to meet the needs of farmers, as farmers are subject to single-person operations that increase the cost of fertilization, labor costs and availability. Using this machine, the percentage reduction in time required for fertilization was observed to be 1/3, and the labor cost reduction was 2/3 compared to the conventional method.

It solves the problem of traditional fertilization methods. Capital costs are a key factor in choosing the type of agricultural equipment. Compared to other types of machines, this machine has a very low capital cost and is environmentally friendly and has the main advantage of being easy to troubleshoot. Through all these discussions and experiencing all the factors related to fertilization, this machine will bring huge benefits to Indian agriculture.

REFERENCES

- [1] "Fertilizer particle Trajectory"
<https://www.irjet.net/archives/V2i13/Ariet-v21357.pdf>
<http://www.horiba.com/scientific/products/particle-characterization/applications/fertilizer>
<https://pubs.acs.org/doi/abs/10.1021/jf60127a018>
<https://www.maximumyield.com/definition/202/fertilizer>
- [2] "Fertilizer available in market"
http://www.ijetae.com/files/Volume5Issue2/IJETAE_0215_67.pdf
<http://www.fao.org/3/a0257e/A0257E03.htm>
<https://business.mapsofindia.com/national-fertilizers/>
- [3] "Application of fertilizer "Different methods of fertilizer application"
<http://agritech.tnau.ac.in/agriculture/agri-nutrientmgmtmethodsoffertilizerappin.htmlb>
<http://www.soilmanagementindia.com/fertilizers/application-of-fertilizers/1421>
- [4] "A comprehensive range of grassland and arable spreader"
<http://www.teagle.co.uk/fertilizerspreader.php>
- [5] FMA Guidance note 4, fan Efficiency Guidance, from the Fan Manufactures Association
<http://www.feta.co.uk/fima/index.htm>
- [6] FMA Guidance note 2, fan installation Effects- A Guide to install fan acoustics, from the Fan Manufactures Association (UK)
<http://www.feta.co.uk/fma/indes.htm>
https://www.mouser.in/ThermalManagement/Fans-Blowers/Blowers/_/Naxg8z?P=1z0xjmuZ1z0sdx2
- [7] "Fertilization recommendations for individual crops"
<http://www.kuhn.coukfertilizerspreaders.html>
<https://www.smartfertilizer.com/articles/fertilizer-recommendations>
- [8] "Product description and further information on our fertilizers"
<http://www.nauticexpo.com>
<https://www.campbellsci.com.au/ps12240>