ICEST_ME_018

FABRICATION OF FERTILIZER MIXING AND DISPENSING MACHINE

Rakesh Khandare[1], Sidharth A B[1*], Pavan G Shetty[1], Manoj Poojary[1], Dr. Manujesh B J[2]

[1]Students, Department of Mechanical Engineering

[2]Head of Department, Department of Mechanical Engineering

Vivekananda College of Engineering and Technology, Nehru Nagar, Puttur, Karnataka, India.

*Corresponding Author Email: sidharthballal100@gmail.com

Abstract:

In recent years, labour scarcity has emerged as one of the foremost challenges in farming. One of the crops that has been most affected by this is the arecanut. It is important to provide a plant with necessary minerals/compost and labourers are required to carry out this process as the weight of the compost is heavy and the arecanut plots are usually large. This project is a combination of a handcart, compost blending machine and compost dispensing machine. The unit is powered by a 160cc Honda engine. The compost is poured inside the mixing chamber and mixing is done inside, blending of compost is carried out. The cart is portable and dispensing is achieved with the help of this setup.

Keywords: Farming, compost, handcart, minerals.

1. Introduction

Agriculture has been the backbone of the Indian economy and it will continue to remain so for a long time. It is the most important enterprise in the world. As India is a developing country about 70% population lies in rural region. These people in rural region are independent on agriculture as their main occupation. It is very essential to develop modern technologies to increase the productivity. While implementing modern technology some factors should also be considered such as – the agricultural equipment's should be provided to farmers at feasible rates, etc. The concept of this machine design is based on the current phenomenal of fertilization methods used in today's agricultural field. The amount of fertilizer required to fertilize the plants is the key element for the

ISBN-978-81-19905-39-3

plant to grow healthy. Our project is to design and manufacture a versatile composite mixer and dispenser that are designed to solve the traditional hand mixing of various fertilizers to prepare fertilizer and help farmers to reduce manual work. Fertilizer Mixing and Dispensing Machine is mainly made for arecanut plantation, since this type of plantation require large amount of fertilizer to be dispense onto the crops which is complicated for the farmers. Fertilizer Mixing and Dispensing Machine serves for various problems like moving from one place to another, requires less space and is less bulky. The working of Fertilizer Mixing and Dispensing Machine is to mix various fertilizers and dispense it accordingly to the plants in required. Blend the measured contents to prepare an accurate composite mixture. Once the fertilizer is ready, fertilizer is fed to the crops. This properly blended fertilizer mixer will increase the productivity and quality of crops. Fertilizer Mixing and Dispensing Machine is portable, power driven & fitted with wheels for ease of movement in the farm. It is low cost and durable fertilizer machine with minimal maintenance.

2. Literature Review

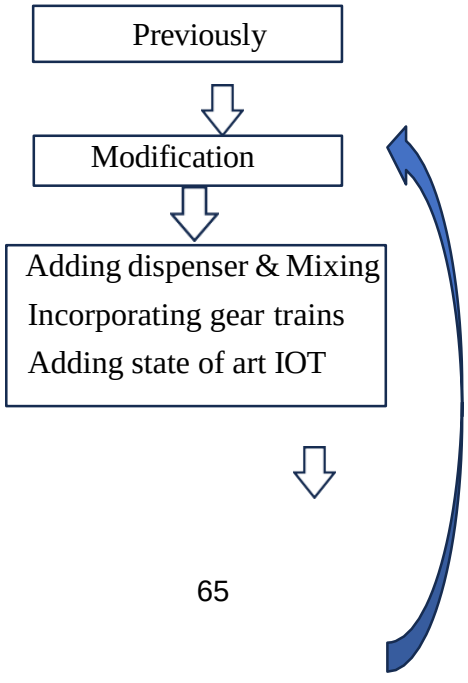
Ramappa et al. [1], has done a case study of Shivamogga district, to know the Economics of Areca nut cultivation in Karnataka and he concluded that Karnataka stands first both in terms of area and production of Areca nut, also the area under Areca nut cultivation has increased rapidly in Shivamogga district. Joshua et al. [2], have worked on solar operated pesticide sprayer. Most of the increase in the area of irrigated land in the world has been through the increasing use of engine-driven pumps. However, the increasing price of oil-based fuel has reduced the margin to be gained by farmers from irrigation, since food prices have generally been prevented from rising in line with energy costs. Bhojane et al. [3], have designed a manually operated machine for fertilizer spreading by taking into consideration the user group & their needs. The project design divided in to three level, top level, middle level, bottom level. Top level consists a hopper. Middle level consists a gear arrangement, chain drive and spreader disc. The bottom level consists wheel they have taken help of this to understand how mechanization can solve the problem and what can be done more so that mechanization is possible for every farmer. Adamade et al. [4], worked on mechanization is recognized as the necessary major means needed to accelerate agricultural production and create a period of surplus in Nigeria. Indeed, food sufficiency can only be attained in Nigeria by encouraging and promoting local designs and manufacture of implements and

ISBN-978-81-19905-39-3

equipment at low cost. We have taken the useful data from this research paper. Laghari et al. [5], focuses on beneficial uses of fertilizer in agriculture. Soil contains various micro and macro elements which are essential for plant growth and yield. It is necessary to save important nutrient elements like nitrogen, phosphorus and potassium by application of chemical fertilizers. For certain situations broadcast applications can be an inefficient method of application because there is much greater soil to fertilizer contact in more fixation or tie-up of nutrient. Narode R. R et al. [6], have generated a method to spread the fertilizer uniformly over a fallow land by dropping the fertilizer over the impeller disc. The system consists 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.

3. Methodology

With a due interest on helping society and farmers, we were exploring for project. In this regard we have come across previous literatures on “Fabrication of Fertilizer Mixing and Dispensing Machine”. We have thoroughly gone through literature and we could see the possibility of improving the performance and other related design criteria to optimize the submitted project. Following is the Methodology adopted to complete the project (Fig. 1).



ISBN-978-81-19905-39-3

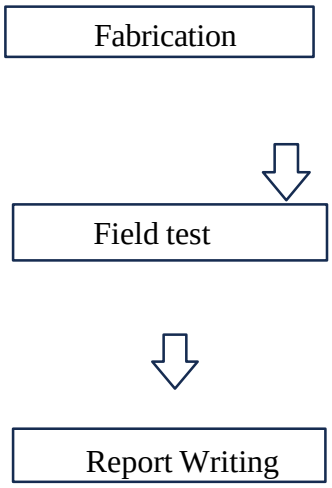


Fig. 1. Flow Chart of Methodology

4. Objectives and Design

Objectives of the project include design and fabrication of a portable, power driven, easily movable machine which facilitates fertilizer mixing and dispensing to the plants in required proportion, thus helping farmers to reduce manual work. 3D model of the fertilizer mixing and Dispensing machine is shown in the Fig. 2. It is a power-driven machine such that the power at the engine shaft has been transferred to the mixer inside the container through pulley belt arrangement. The shaft of the mixer is then coupled with another set of pulleys on the other side of the shaft that is then connected to the pulley at the rear wheel through belt. An intermediate pulley that act as an idler pulley to control acceleration of the machine**.**

Fig 2. 3D Model of the machine

4.1 RPM & Torque of Driven Pulley

ISBN-978-81-19905-39-3

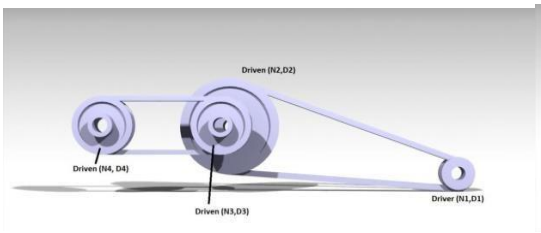


Fig 3. Compound Pulley arrangement

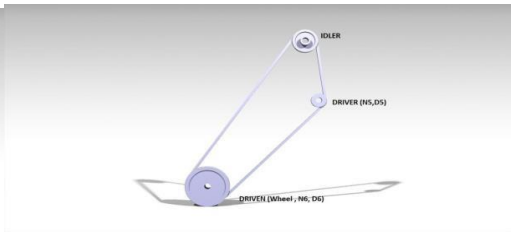


Fig 4. Belt Drive to the Wheel

Driver pulley RPM, N1 = 2000 rpm

Driver pulley Diameter, D1 = 2 inch

Driven pulley Diameter, D2 = 8 inch

Driven pulley Diameter, D3 & D4 = 4 inch

Velocity Ratio of Pulley 1 & 2, VR = N2/N1 = D2/D1 ---------- (1)

Velocity Ratio of Pulley 3 & 4, VR = N4/N3 = D3/D4 ---------- (2)

(N2/N1) *(N4/N3) = (D1/D2) *(D3/D4)

N2/N1=D1/D2 (N4=N3 because D3=D4)

N2 = (2/8) *2000

N2 = 500 rpm = N3 =N4

From Fig. 3,

T2/T1 = D2/D1

T2/8.92 = 8/2

T2 = 35.68 Nm = T3 = T4 (Because N2=N3=N4)

4.2 Speed of the Machine

Wheel RPM = 156.25 rpm

Speed = (π*D*N)/60

Speed = (π*0.254*156.25)/60 (Wheel dia = 10 inch = 25.4 cm = 0.254 m)

Speed = 2.07 m/s

Speed = 7.5 kmph

4.3. RPM & Torque of the Driven Pulley at the wheel

N5 = 500 rpm, T5 = 35.68 Nm (Pulley 2, 3 & 5 are mounted on the same shaft)

ISBN-978-81-19905-39-3

Diameter of Driver Pulley, D5 = 2.5 inch

Diameter of Driven Pulley, D6 = 8 inch

N6/N5 = D5/D6

N6/500 = 2.5/8

N6 = 156.25 rpm

Torque T6, T6/T5 = D6/D5

T6/35.68 = 8/2.5

T6 = 114.17 Nm

5. Results and Discussion

- Manual fertilizing method consumes more time and energy compared to the machine that does both the job of mixing and dispensing. In case of manual method manpower required to mix the fertilizer properly and also to carry the mixed fertilizer to the field where the crops are grown.
- The mixing capacity of the Fertilizer Mixing and Dispensing Machine is 10kg and dispenses 400g for each plant.
- 1 acre land can have approximate of 550 plants. Average grown Areca plant requires 100g of Urea, 150g of Potash, 150g of Rock Phosphate. Therefore, Total comes out to be 400g of blended mixture.
- At one time 10kg of fertilizer can be used to fertilize 10000g/400g = 25 plants.
- By the help of this machine, it requires 10 seconds to fertilize one plant. For 1 acre containing average 550 plants, to fertilize these plants using this machine requires 1hour 52 minutes.
- At single time of filling the 10kg of fertilizer covers 25 areca plants, therefore time required to fertilize 25 plants is 7 minutes (approx.).
- The amount of fertilizer needed in total, 10kg For 25 plants, 220 kg of fertilizer needed to cover 1 acre of plantation.

ISBN-978-81-19905-39-3

- The container should be refilled with fertilizers for 22 times to fertilize 1 acre of areca plants. Also refill time can reduced by increasing the container capacity with increasing the capacity of the engine as well.

6. Conclusion

The aim and vision of this project is to inculcate a holistic approach of fertilizer creation to the farmers which removes hardships that come across while fertilizing. With this project the farmers have to harvest high yield of crops with this precise mixing technique of raw materials, along with ease of movement of the machine in the land due to the wheel mechanism, and low investment and minimal maintenance machine which will not burden the farmer in long term. This strive to achieve growing non-pesticide and non-chemical food and staples, and encourage farmers to use organic fertilizer and leverage technology & knowledge which is modern yet simple.

ISBN-978-81-19905-39-3

References

[1] Dr. B. T. Ramappa, Dr. M. S. Manjunatha, "Cost Cultivation of Arecanut Nontraditional Region of Karnataka- An Analysis", International Journal of Pharmaceutical Science Invention, ISSN: 2319-6718, Volume 2, Issue 3, March 2013, pp. 25-31.

[2] R. Joshua, V. Vasu and P. Vincent. (2010) "Solar Sprayer - An Agriculture Implement", "International Journal of Sustainable Agriculture", 2 (1), 16-19.

[3] Bhojane Swapnil, Inamdar Arbaaz, Somoshi Sail, Yadav Suraj, Mr.Dighe.M.D.(2018) "International Journal of Advance Engineering and Research Development",5(04), 1-3.

[4] Admade C.A. and Jackson B.A. (2014) "Agricultural mechanization: A strategy for food sufficiency", Scholarly Journal of Agricultural Science, 4(3),152-156.

[5] Mahmood Laghari, Naimtullah Laghari, Ali Raza Shah and Farman Ali Chandio; (2014); "Calibration and Performance of Tractor Mounted Rotary FertilizerSpreader", International Journal of Advanced Research (IJAR)), 2(4),839-846.

[6] Narode R. R., Sonawane A. B., Mahale R. R., Nisal S. S., Chaudhari S. S. Bhane A B. (2015); "Manually Operated Fertilizer Spreader", International Journal of Emerging Technology and Advanced Engineering (IJETAE), 5(2),369-373.

[7] Giyoung Kweon, Tony E. Grift ;(2006); "Development of a Uniformity Controlled Granular Fertilizer Spreader", American Society of Biological and Agricultural Engineers (ASBAE), 2(4),1-14.

[8] Nitish Das, Namit Maske, Vinayak Khawas, Dr.S.K.Choudhary (2015) "Agricultural fertilizers spreaders and pesticides-A Review", "International Journal for Innovative Research in Science & Technology",1(11), 44-47.

ISBN-978-81-19905-39-3