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Design of Manure Spreader Machine for agricultural farm field

Sengottaian K, Mohanrajhu N, Palani S, Jayabalan C

Abstract: ***The main aim of this project is to reduce the manual efforts of farmers in spreading manure or bio - fertilizers and provide the most convenient and cost-effective way of spreading manure on farm fields. Cow dung is vital for the fertilization of the farm land. So, to do all this there is a hectic process. Organic manure is an eco friendly bio fertilizer used for more polluted new era. The appropriate use of manure for landing is necessary for avoiding land pollution, the surface of the water as well as avoids the defeat of ammonia in addition to all another nutrients through manure. Organic farming methods are appropriate and adoptable for many types of land in several parts of India. Use of manpower for application of organic materials is uneconomical due to high labour cost. Thus, it attracts wide attention in various parts of world. This not only reduces the cost but also protects the environment and health of farmers.***

Keywords: Farm fields, Health of farmers, Land pollution, Spreading manure

I. INTRODUCTION

Manure is a natural fertilizer. To make manure, decomposition of plants and animal waste is done by farmers. The product of this decomposition is a material rich in organic matter which we call manure. Manure does not have a high content of nutrients. Instead, it gives fertility to the soil by adding humus (organic component of the soil). This improves the soil's physical properties, with better retention of moisture and more aeration. And since manure is made entirely of organic materials it does not contribute to any form of pollution. In fact, it reduces waste on the farm, by decomposing waste materials to make manure.

Fertilizers are natural or synthetic materials that we add to the soil to provide the plants with the nutrients they need. They can be organic or inorganic in nature. They work through creating plants as well as crops including nutrients and also they require for growing toward maximum further rate of quicker than attained via a usual process. The chemistry based fertilizers also act as an insecticide, protecting plants from pests and insects. Fertilizers are economically very beneficial to farmers. They expedite plant growth and are not very expensive to procure. Fertilizers also increase the yield from a farm. The plants also have a superior appearance i.e. they appear greener and healthier when we use fertilizers. However, fertilizers can also have a harmful effect on the environment. They contain synthetic chemicals which are not biodegradable. They can cause both soil and water pollution. Over time fertilizers also make the soil acidic in nature causing soil degradation. So between manure and fertilizers, fertilizers are a better source of nutrients for the plant, manure is a better alternative as far as the environment is concerned.

The danger of grievance associated for apply in the machines of agricultural is forever most important, as confirmation through the experience of work related mishap resultant through wrong method of utilizing the equipment as well as machinery of agricultural [1–3]. The intended attention and important needs and familiar in national as well as the level of European for giving technological explanation beside the danger of devastating, infectious as well as cutting while utilizing self propelled or else spreaders of the towed manure[4–6]. Their invention was quite extensive in livestock farms however it possibly even high widespread of future since the change of climate may need high organic matter contribution of soil in excess of huge globe areas [7, 8].

The sector of individual literature as well as surveys [9, 10] were recognized exacting positive and grave issues from some of the machines present in field as well as previously in purpose so as to engage the above mentioned risk then decide the incidence number of significant in serious as well as major accidents. The technical standards of force relating for this kind of machines otherwise the risks happening through its purpose [11] were not forever effectual to protect the labors. A dangerous point which was frequently noted look upon washing as well as operational maintenance followed through operators placed hopper inside while motioning of the rotating parts. The same incidents as well happening in another machines called forest chippers [12].

This types of machines for agricultural utilized for spreading the manure and another materials on field [13]. Furthermore, the growths of a security indicator while design of machine as well as its respective algorithm to assess as well as optimize the outcomes and could develop the protection of machine. [14–16].

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* Correspondence Author
Sengottaian K, Mechanical Engineering, R.M.K Engineering College, Kavaraipettai, Chennai, India. Email: ksn.mech@rmkec.ac.in
Mohanrajhu N, Mechanical Engineering, R.M.K Engineering College, Kavaraipettai, Chennai, India. Email: nmj.mech@rmkec.ac
Palani S*, Department of Mechanical Engineering, Vel Tech Multitech, Chennai, India. Email: spalani@veltechmultitech.org
Jayabalan C, Department of Mechanical Engineering,, R.M.K. Engineering College, Chennai, India, Email: amuthabalan2011@gmail.com

The number of immense ways so as to go about fertilizing the land for creates an abundant and healthy of crop. More farmers were their own chosen technique, excluding a small number of helpful as well as proficient in this manure injection. The apparatus is now obtainable in the market so as to assist inject manure into the soil and tilling of land and burying nitrates for reducing runoff as well as keep smell of the machine minimum as possible in the nearby inhabitants.

In our research work is to reduce the manual efforts of farmers in spreading manure or bio - fertilizers and provide the most convenient and cost-effective way of spreading manure on farm fields. Cow dung is vital for the fertilization of the farm land. So, to do all this there is a hectic process. The organic manure has been taken into account so as eco friendly bio fertilizers in more polluted new era. The main objective in this research is to create particular design for easy maneuverability along the field and compact enough to occupy less storage space. For helping farmers with small holding of agricultural land for improving crop cultivation with less effort and less cost.

II. CONVENTIONAL SPREADING OF MANURE

A. Process Involved

By Human Effort:

Farmers in the early days as well as presently spread the manure in the agricultural field with their bare hands. It is very difficult to cover the field with human effort because of mass amount of manure. And it is also a unhygienic process which may affect the health of farmers and cause infection if there is any open wounds. The conventional spreading of manure is shown in Figure 1.

Fig. 1. Conventional Spreading Of Manure

By using Machines:

In present days, large-stake farmers utilize machines to spread the manure in the agricultural fields which causes uneven distribution of mineral in the field. As a result it affects the cultivation of crops. The machine spreading of manure is shown in Figure 2.

Fig. 2. Machine Spreading of Manure

B. Health Effects

The Live stock manure has precious foundation of nutrients to produce crop however when considering the health of the public hazard as well as encompass harmful impacts on the environmental. Our research considers the management of manure practices between urban as well as peri urban live stock keepers in Chennai surrounding rural area for identifying risk behaviors as well as socio economic feature related including manure handling. With a review together with 204 households have been carry out and involving a prearranged questionnaire including demographics, characteristics related to socio economic and furthermore practices with household for the management of manure. The samples of faecal have been collected through pig pens as well as pig manure storage units for investigating potential zoonotic pathogens and Salmonella enteric i.e Polymerase Chain Reaction and Mc Master Flotation method. This survey exposed the variation in management among cattle as well as pig manure. The manure from cattle has been widely utilized as fertilizer to produce crop about 66% i.e $p < 0.001$ while pig manure has been most general environmental dumped about 46% i.e $p < 0.001$. The model of Logistic regression indicated that households include a minimum position of socio economic and for dumping pig manure i.e $p < 0.001$ by means of land of agricultural scarcity i.e $p < 0.001$ as well as the lack of carts to transport manure in the level of $p < 0.01$ is identified factors of contributing. The amount of detection of salmonella enterica is 9.7% from the sample of manure at the same time as the detection amount from Ascaris suum as well as Trichuris suis are 1.6% as well as 2.4% samples in that order. The outcomes deliberate through this investigation shows that the management of manure through urban peri urban households may perhaps a threat of public health as well as the hazard in environmental. There is obviously a requirement of additional support of knowledge for livestock keepers for promoting a well management practices..

III. PRINCIPLES OF MANURE SPREADING MACHINE

The spreader of manure or else spreader of muck otherwise called honey wagon are machines for agricultural which are purposed for distributing manure for fertilizer on the field. This type of new manure spreader have trailer by towed at the back of tractor by means of a mechanism with rotating and driven through the power of tractor's take off. This spreader of manure initiate with the unit of ground driven and pulled through horse otherwise the team of horses. The numbers of ground driven spreaders are manufacturing today and mainly have structured with small units which could be pulled at the back through big garden tractor otherwise an all terrain vehicle. Now a day, the hydraulic as well as power take off units for driven are modified for offering different rate of application.

The numerous models have also developed by means of removable revolving apparatus called beaters and side extensions with attachable with tailgates intended for hauling chopped forages with cereal grains in addition to the other crops. This type of modern manure spreader including trailer towed at the back tractor by way of a revolving device which is driven through tractor's power take off is shown in Figure 3.

Fig. 3. Trailer towed tractor with revolving apparatus

IV. EXPERIMENTAL SET-UP OF PROPOSED INNOVATION

The project aims to develop a compact and cost-effective manure spreader. The innovative design helps a farmer to either manually move the spreader across the land or hook it at the back of a tractor and be pulled along the farm field. The setup allows small scale gardeners to spread manure in their garden land area. The entire setup is supported by a frame which acts as the integral member. The manure is initially dumped into a truncated square pyramid shaped basin which holds the manure until spreading is required. The manure is then forced down with the help of gravity into the pulverizer drum which consists of rotating blades which pulverizes the manure into tiny particles. A 230V 50Hz single phase motor at 1300rpm is used to power the blades. An electric blower of 13000rev/min and 2.5m^3/min capacity is used to blow or impel the pulverized manure into the field. The powdered manure is directed on to the field through a 2inch PVC pipe. The setup is moved with the help of wheels which is fixed to all four ends of the frame. The material used for fabricating the basin is of alloy steel. The frame is a 1inch square made of Mild Steel.

V. RESULT AND DISCUSSION

The basin is used to store the manure temporarily until the spreading is required as shown in Figure 4.

Specifications: Material: Alloy Steel, Thickness: 2mm, Volume: 0.079 m^3.

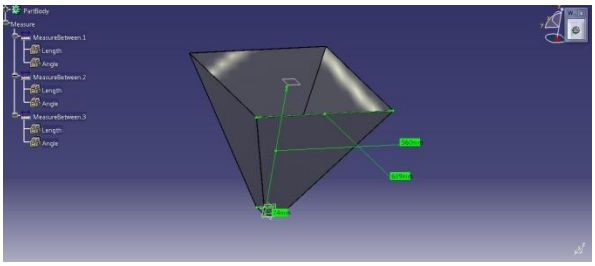

Fig. 4. Basin for store the manure temporarily until the spreading is required

The frame is the supporting member of all the components is shown in Figure 5. It is rigidly fabricated to prevent any disorientation of the mounted parts. It has a rigid structure and welded at each sections using Arc welding. **Specifications: M**aterial: Mild Steel, Cross-section: Square, Size: 1 inch, Length: 813mm, Width: 560mm, Height: 560mm.

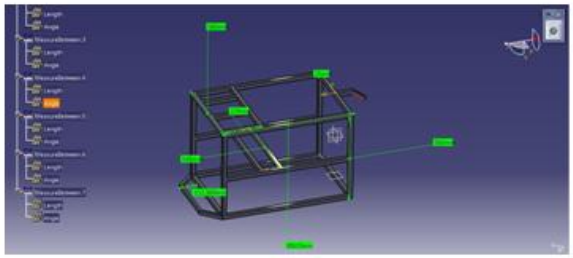

Fig. 5. Frame for supporting member of all the components

The pulverizer consists of a shaft has a number of blades for pulverizing process. The pulverizer receives power from the motor which rotates the blades at 1200rpm. The pulveriser is very important because it reduces the power consumption of the machine by powdering the solid bulky manure. And it is also useful for effective spreading of manure in even proportion. The pulverizer drum and blades is shown in Figure 6.

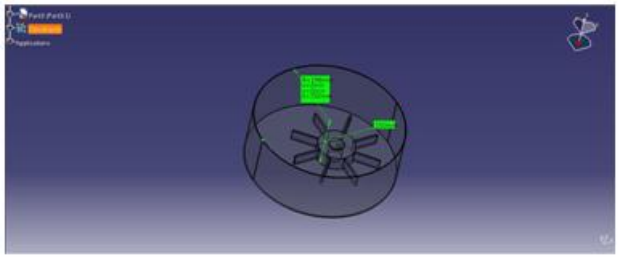

Fig. 6. Pulverizer drum and blades

Motor used to run the pulverizer is shown in Figure 7. **Specifications: V**oltage: 230V, Frequency: 50Hz, Phase: Single Phase, Rated power: 150W, Current: 1.3A, Speed: 1300RPM.

Electric blower: An electric blower is used to impel or blow the pulverized manure into the agricultural field is shown in Figure 8. **Specifications of electric blower: V**oltage: 220V, Frequency: 50Hz, Speed: 13000RPM, Flow rate: 2.5 m^3/min. Selection of suitable material is important because it determines the performance of the machine. The entire machine depends on the selection of suitable materials. This is the following factors to be considered while designing the manure spreading machine. They are Hardness, Corrosion resistance, Weight, Thickness, Durability, Tensile strength and Compressive strength. Hardness is the important property of the material in this machine it plays a vital role because to withstand heavy load and to withstand the vibration during the movement of the vehicle. So the material should have the hardness property. Hardness means one of the properties for evaluating resistance of plastic deformation which is encouraged through both mechanical indentation and abrasion.

Few of the metals have harder than others for example plastics and wood. Macroscopic hardness has normally characterized through the bonds of strong intermolecular although the solid metals behaviour with respect of complex force so various hardness measurements like scratch hardness; indentation hardness as well as rebound hardness. Hardness has ductility dependent called elastic stiffness; plasticity; strain; strength; toughness; viscoelasticity as well as viscosity. The general example is the hard matter like ceramics; concrete; certain metals as well as super hard materials that are contrasted through the soft matter.

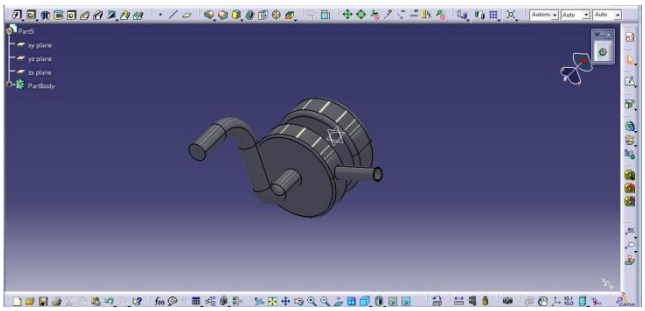

Fig. 7. Motor used to run the pulverizer

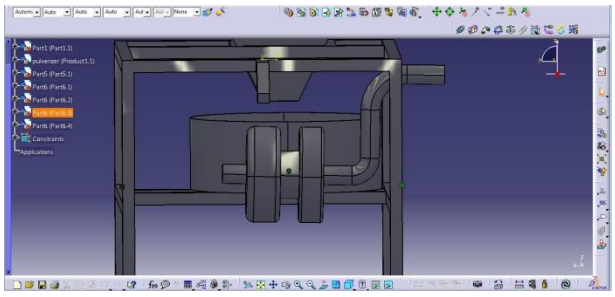

Fig. 8. Electric blower to impel or blow the pulverized manure into the agricultural field

The natural manure contains some moisture so it is important that the material used in this machine should have the corrosion resistance to withstand the moisture. It is difficult to handle the machine with heavy weight, so the material should have less weight otherwise it may also affect the performance of the engine of the vehicle. It increases the fuel economy of the vehicle and reduces the efficiency of the engine. The material should have exact thickness, if it is too large it increases the weight of the machine, if it is too small it decreases the other property of the material. Hence it is used for the agriculture purpose the material should have long life, so the material should have very good durability property. Because during spreading of manure in uneven field due to external and internal forces it affects the life of the material, hence this property is important. The durability has capability of physical part for remaining functional with no need further maintenance and repair work while meeting regular operational challenges on design lifetime. A number of calculations are available for determining the durability including years of life; hours of use as well as number of operational cycles. In the concern of economics the goods include a extended usable life has referred as durability of the goods. The material should have the high tensile strength, because to withstand the forces during movement of the vehicle and to withstand the shock load of the vehicle the material should have high tensile strength and ultimate strength otherwise Ftu within equations are the ability of material or else structure for withstanding loads tending to elongate. The opposition of compressive strength which are withstanding loads tending for minimizing the size. Furthermore, the tensile strength opposes tension i.e. being pulled apart while compressive strength opposes compression i.e. being pushed together. The ultimate tensile strength has intended with maximum stress so as to the metals withstand at the same time being stretched otherwise pulled earlier of breaking. Our research work deals with the material strength such s tensile; compressive as well as shear could be examined individually.

Some of the materials are broken extremely sharply with no plastic deformation that is brittle failure. In further for more ductile most of the metals have experienced plastic deformation as well as perhaps necking earlier than fracture.

The UTS has normally established through taking tensile test as well as engineering stress and strain. The uppermost point of the stress vs strain curve is the UTS. It is also called as the property intensive so its value not depending on the test specimen size. On the other hand, it is reliant on other factors that specimen preparation and the defects on surface as well as the test environment temperature including material. The tensile strengths has exceptional utilization while designing of ductile members although very important also brittle members. They are nominated as general materials called alloys; composite materials; ceramics; plastics as well as wood. The tensile strength could be distinct through liquids and solids based on conditions. For example, the tree draws water from its roots to upper leaves through transpiration; the column of water has pulled upwards from the top using the method of cohesion of water in the xylem then this force has transmitted down to the column through tensile strength. The pressure of air; osmotic as well as the capillary tension plays a role then tree's has capability for drawing up water however this only be enough for pushing column of water must less than ten meter height in addition to trees could be grown higher over 100 meter. The tensile strength has distinct through stress and has calculated as the force per unit area. Final assembly of the manure spreader is shown in Figure 9.

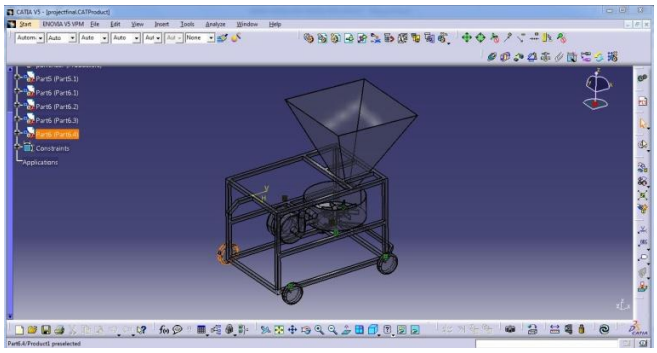

Fig. 9. Final assembly of the manure spreader

The advantages of the proposed manure spreader are Less time consumption, Minimal effort of soil cultivation, Cleanliness for the farmers,
Higher crop production.

The applications are: it is mainly applicable for gardens, small and large scale agricultural fields. This design of manure spreader allows effective spreading of manure in the soil. Since there isn't any human contact with the manure, it improves the health and hygiene of the farmers. The compact design and unique method provides the most cost-effective and easy way of cultivating the soil and developing the agricultural sector.

VI. CONCLUSION

Thus the design and fabrication of the manure spreader helps to provide support to farmers who are unable to afford heavy machineries for the spreading of manure. By the application of the manure spreader, the health and safety of farmers are ensured preventing them from infection and other diseases. It improves the crop cultivation in various agricultural fields thereby improving the economy of the agricultural sector.

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AUTHORS PROFILE

Sengottaiyan K was born in Salem in 1983. He received his B.E degree in Mechanical Engineering from Anna University in 2008 and M.E in Internal Combustion Engineering from Anna University, CEG, Chennai in 2010.He has 7 years of teaching experience and currently working as Assistant professor in Department of Mechanical Engineering, R.M.K Engineering College, Kavaraipettai, Tamilnadu. His research areas include I.C engines and new product development. He is a life member of MISTE in professional body.

Mohanrajhu N was born in Chennai in 1980. He received his B.E degree in Mechanical Engineering from University of Madras in 2002 and M.E in Internal Combustion Engineering from Anna University, Chennai in 2004. He has 13 years of teaching experience and currently working as Assistant professor in Department of Mechanical Engineering, R.M.K Engineering College, Kavaraipettai, Tamilnadu. His research areas include Nanofluid heat transfer, biofuels, and heat exchanger. He is a life member of MISTE in professional body

Palani S was born in Madurai, Tamilnadu, India, in 1967. He received the B.E., degree in Mechanical Engineering from M.K. University, Madurai, Tamilnadu, India in 2003, and the M.E., and Ph.D. degrees in Manufacturing Engineering from the Anna University, Chennai, Tamilnadu, India in 2005 and 2013, respectively. He has 13 years of experience in teaching and research and working as an Associate Professor in the Department of Mechanical Engineering, Vel Tech Multitech Dr. Rangarajan Dr. Sakunthala Engineering College, Avadi, Chennai-600 062. His research area include Advanced Manufacturing Technology, Artificial Intelligent Techniques, Machine Vision, On-line Monitoring, Material Science, Bio-Fuel, Heat Exchanger etc., He published more than 100 research papers through National and International Journals and Conferences. He is an authorized Research Supervisor for Anna University and Guiding more than 7 Ph.D., research scholars. He was awarded as a "Distinguished Scientist" by Venus International Foundation - Research Awards-VIRA 2016. He is a Life member of MISTE [LM91981} in professional bodies

Jayabalan C was born in Sundararajapuram, Virudhunagar district, Tamilnadu, India in 1969. He received the B. Tech degree in Automobile Technology from M.I.T, Anna University, Chennai, India in 1995 and the M.E., in Manufacturing Engineering from M.I.T, Anna University, Chennai, India in 2007. He has 22 years teaching experience and working as an Associate Professor in the Department of Mechanical Engineering in R.M.K. Engineering, Kavarapettai, Chennai, India. Presently doing Ph.D., in the field of nano fluid in Anna University.