Design and Development of Fertilizer Spreading Attachment

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ABSTRACT

India is agricultural based country. Our economy is also depending on agricultural related product. In the recent days it has been found that farmers are unable to grain more crop production by use of conventional agricultural methods. This project is based on manually fertilization process. A method is generated to spread the fertilizer over a fallow land by dropping the fertilizer over the impeller disc. The fertilizer spreading attachment is designed in such a way that it can be easily assembled and dismantles. From last two decades 'Indian farmers are using chemical fertilizer instead of using muck fertilizers. The attachment consists of cutter blades which are mounted on rear supports of trolley with the help of two pedestal blocks and drive is given by the chain and freewheel mechanism to the shaft as well as the ram arrangement is provided at the front side of the trolley to move the fertilizer backward to maintain the contact between cutter blades and the fertilizer. With this attachment, percentage reduction in time required for Fertilization was observed to be 70% and reduction in labor cost as compared to conventional method was 80%. It has solved the problem of traditional way of Fertilization

A manure spreader or muck spreader or honey wagon is an agricultural machine used to distribute manure over a field as a fertilizer. A typical (modern) manure spreader consists of a trailer towed behind a tractor with a rotating mechanism driven by the tractor's power take off (PTO). Truck mounted manure spreaders are also common in North America.

Keywords –Cutter blade, Ram Mechanism, Drive system, Labor cost and Fertilization time

INTRODUCTION

1.1 Background

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 financial condition, it's necessary to extend our agricultural productivity and quality also. Farming process includes many stages, out of which fertilization is one among the important stages and which isn't exploded up to the price till now. Now-a-days, we are wont to do spreading of fertilizer in traditional way which is time consuming, costlier also as not provide comfort to the labor. Also, some tractor operated machines for spreading of fertilizer are available. So, what we'd like is an alternate to the normal also as tractor operated fertilizer spreading machine which can fulfill all the wants. So, we are getting to design automatic operated machine for fertilizer spreading by taking into consideration the user group and their needs which helps to them to figure easy and functional

Day by day the population of India is increasing and to satisfy the necessity of food modernization of agricultural sectors are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. It will reduce the cost of production. Mechanization gives higher productivity in minimum input. Farmers are using same traditional methods for spreading fertilizers. There is no mechanism developed in India which spreading the fertilizers equally as per requirement of farmer, so we design and make one model of fertilizer spreading attachment for tractor trolley which is detachable .by using these attachment farmers can easily spread muck / sugarcane waste(Mali)/poltry waste/ soil etc.

1.2 Problem Statement

As we can see today, the major problem faced by the farmers is shortage of labor's and also the time required for spreading the Fertilizers(muck)is more. So in order to have solution to it, it was proposed to manufacture a Fertilizer Spreader attachment which is easily detachable to tractor trolley and less expensive than other machines available in markets. So, the farmers can work easier and functionally.

1.3 Objectives

The Fertilizer Spreader machine should satisfy the following objectives:

- Fertilization process should be less time consuming.
- The Smaller Size attachments can be manually operated.
- Less cost.
- The attachment is easy to use.
- In less time we can cover more ground.

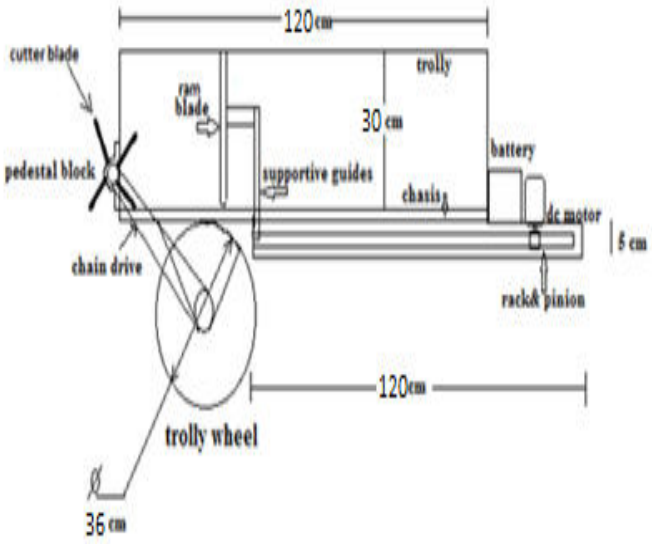


Fig no 1.1 Auto-CAD drawing of fertilizer spreading attachment.

LITERATURE REVIEW

Mr. G.D Yadav, Dr. M.S Pawar(1) Here from the paper we came to know about organic manure and different types of manure spreaders. Organic manure plays important role to yield productivity of soil. It is good quality source of nitrogen phosphorus and excellent source of calcium and potash. The evenly spreading of manure on farm field is extremely important to realize better effect. In India traditionally manure has distributed with help of fork and other robot which is extremely tedious and slow process. There are mainly two types of spreader viz. animal drawn spreader and tractor operated spreader. Performance of obtainable spreader on different parameter has been studied which shows tractor operated spreader gives better result. Study also focus on their limitations of design and source of power supply. There is scope of develop tractor operated spreader attachment which will drive by rear wheel of trailer. By dismantling the attachment we will use trailer for transportation.

R.C Singh and C.D Singh(5) Here from this paper we came to know about how we can use a bullock cart for spreading manure in the farm. In this paper they uses a bullock cart for spreading manure in farm, they calculate some speed of the bullock cart and also weight of trolley with weight of manure and with spreading attachments, From this calculations they calculate the time required to spread the manure in the farm. Also they analyze this process with modern techniques and get the comparative study of spreaders.

Deshpande P.M., Shinde M.A., Wadile A.S., Vaidya R.R. , Shukla V.P(6) Here from this paper we get some information about manually operated fertilizer spreading attachment, in this research paper they broadly give information about construction and design details of fertilizer spreader which is very useful to us. In recent days it's been found that farmers aren't ready to gain more crop production by use of conventional methods. This project is concentrated on manually fertilization process. A method is generated in which fertilizer is spread by means of rotating impeller. The system contains two wheels which are wont to impel fertilizer; a hopper to store fertilizer alongside flow control mechanism. Below this system there is an impeller.It is mounted on output shaft; pair of bevel gears which are coupled to the shaft of wheel. The whole design is supported by frame and column.

METHODOLOGY & WORKING PRINCIPLE

Methodology:

Reduction of cost, efforts of farmer and time required to spread the manure in the farm is the major concern of our project, As we know the Muck Spreaders or Manure spreaders or Honey wagon are available in the market but their costs are too high so our aim is to reduce the cost. Farming is very important concern in India so by using such techniques we can update our farming process.

The project is basically consist of dc motor ram blade which is attached to the rack. The rack is driven by the pinion and it is connected to the dc motor is the dc motor rotates clockwise or anti clock wise then it will moves forward or in reverse direction. The ram is used to push the fertilizer towards the cutting wheel, the cutting wheels are attached to rear wheel with the help of chain drive. As the trolley wheels rotates it rotates the cutter wheel and the fertilizer is sprayed over land uniformly.

When the trolley moves forwards then the motion of the trolley wheel is transferred to the cutter blades trough the chain wheel and freewheel mechanism as cutter blade rotate is spread the fertilizer which comes in contact with the blades the ram blade maintains the contact of fertilizer with the cutter blade by rotating the motor by DPDT switch . We can vary the speed of cutter blade by changing the chain wheel.

Working principle:-

We use cattle dunk or manure as fertilizer in the project. Here we are going to spread manure in the farm with less effort & less time so for this we use a trolley, ram, cutter, DC motor battery, alloy wheels, pedestal block, Chain drive

& sprocket wheel, etc. These are the main components of our machine which are briefly explained further.

The manure is dumped in the trolley. Trolley having two attachments which are:

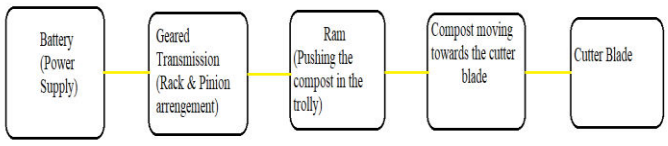
1 Ram attachment:

In this ram is operated by rack and pinion gear, the rack is connected with ram and as rack moves the ram will also move forward and backward. The pinion is connected with Dc motor which turns the pinion and will give drive to rack and ram will move forward and backward. This dc motor is connected with 12v and 7.5 ah DC battery which will drive the motor. The type of motor is DC wiper motor of 12v and it connected with battery through DPTH switch.

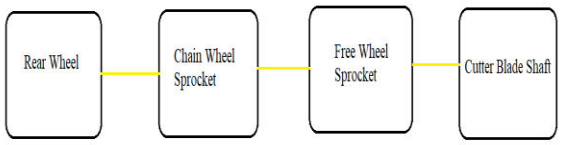
2 Cutter attachment:

Cutter is used to separate the manure and spread it in the farm. This cutter is driven through front wheel they are connected with each other throughchain drive. This cutter will move with front wheel, as we move trolley forward the cutter will rotate. Material for cutter is Mild steel.

This fertilizer spreader will spread compost of around 1000 kg in 8 minutes so it spreads compost or manure in less time and in less effort. Also it reduces cost required for worker in the farm.



Block Diagram For Working of Cutter and Ram



Block Diagram for Power transmission to the cutter

Fig no. 2.1 Block Diagram

Design and Calculations

While designing a fertilizer spreading attachment we firstly decide the material of the components and calculate the approximate cost of each, and every component. We do this thing first because we have to confirm that the cost of the attachment should be minimum so, it can be used by every farmer, also while designing we kept all things simple so while operating it becomes easy to the farmer.

We calculate the velocity of the trolley for that we consider a speed about 2 km/hr, we calculate velocity because we want to know RPM of the trolley wheel. The velocity of the trolley in the normal condition is around 34 m/min and the RPM of trolley is approximately 30rpm. From this data we calculate the speed of cutter blade as we run the cutter blade with the help of backwards wheels of trolley through chain drive, speed of cutter blade is around 0.55 m/sec.

Now we know that when a vehicle is moving on the road it faces some resistances so to overcome we have to produce that much torque to move ahead. Resistance offered by the trolley while moving in the farm are Rolling resistance, Gradient resistance & Acceleration forced by calculating them we got total tractive effort & after that we find the wheel torque which is around 18.74m

After that we design a rear axle for that we use V. B. Bhandari book as a reference. We use carbon steel material as its weight is not high and the properties are favorable to us. It has modulus of elasticity 2.1×105 N/mm2 & the length of the bar is around 50 mm. we have to make sure that the deflection of the bar it should be minimum so has to calculate this for that we calculate moment of inertia of bar & from that we find deflection of the bar it is up to 1.23 mm which is negligible. Our main aim is to spread manure to less time, so we also calculate the time required to spread manure from the trolley, as the dimensions of the trolley are 1.2*0.75*0.3 m so the manure spread in 7.5mins

RESULTS AND DISCUSSION

By taking trials on the field of our machine and gathering all information of other possible methods we have got following results. The result obtained is compared as shown in bar charts:

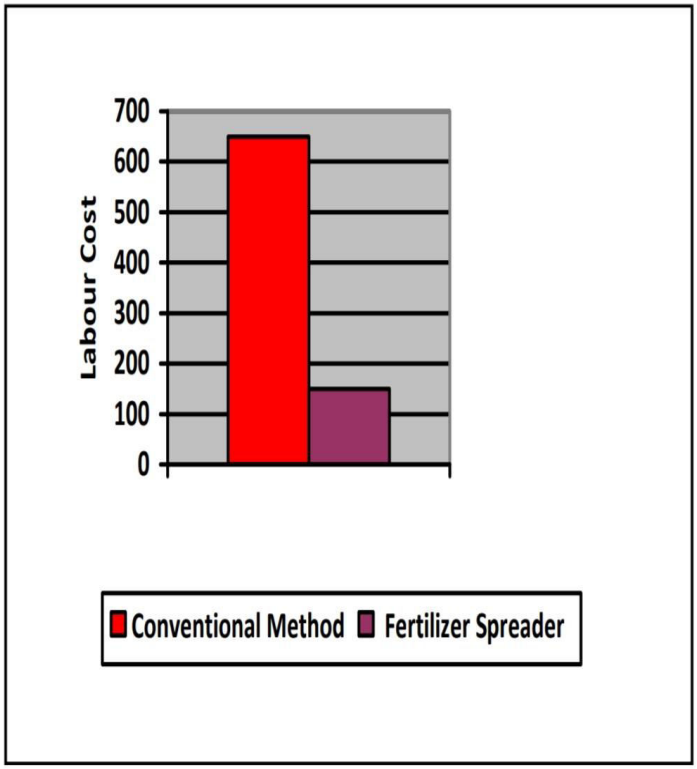


Fig no 4.1 comparison between conventional process and fertilizer spreader

- **Advantages**

1 In less time the spreader covers more area so time consumed for manure spreading will be less

2 As this spreader can be attached to the tractor as a trolley so the hectic work of spreading manure in field gets easy.

3 High speed Fertilization.

4 Applicable for small and medium farms

5 No separate electric power is required

6 Easy to operate, as no skilled operator required.

- **Limitations**

Manure should be dumped in the trolley first and then spreader is moved in the farm.

CONCLUSIONS

Our goal was to build a system which is efficient to perform a various applications with the help of Manually Operated Fertilizer Spreader Machine. With the scope of improvement, the project is done to fulfil the demands of agricultural applications. The main objective of our project was to fulfil the need of farmers suffering from the problems of increasing cost of Fertilization, labour cost and availability as it is operated by single person. With this machine, percentage reduction in time required for Fertilization was observed to be 50%.And reduction in labour cost as compared to conventional method was 80%. It has solved the problem of traditional way of Fertilization. Since the capital cost is essential factor while selecting type of equipment for farming. This machine has very less capital cost as compared to other type of machines and also principal advantages of having Eco friendliness and easy troubleshooting. By undergoing all this discussion and undergoing all the factors associated with Fertilization, this machine will be great boon for the Indian Agriculture.

Fig no Frame structure of trolley.

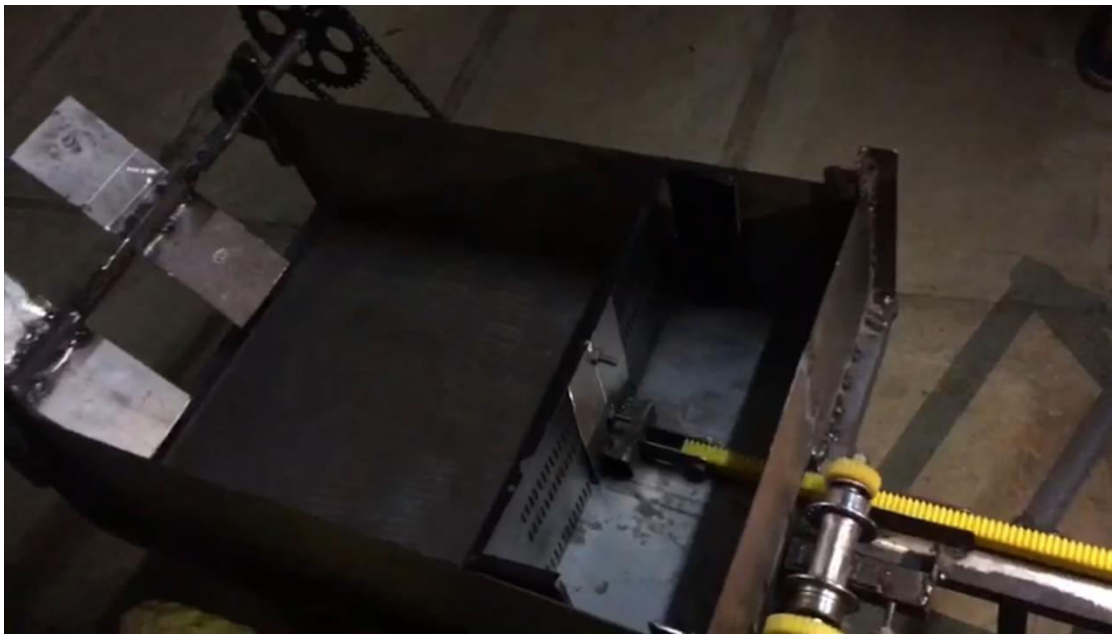


Fig no Fertilizer spreading attachment

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