DESIGN AND IMPLEMENTATION OF TRANSPORTABLE GRANULAR SPREADER FERTILIZER USING CONVENTIONAL METHOD

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ABSTRACT

Agriculture is currently on the decline due to a scarcity of skilled labor. All of the equipment and machinery are mechanized using the most up-to-date technology. Fertilizers are extensively utilized in agricultural production. Fertilizer spreaders for large-scale farming are effective, but they are costly. For small-scale farming, the traditional method of spreading fertilizers is done manually. It has issues such as inconsistent fertilizer distribution, taking more time, and requiring a lot of human effort. Physical handling of highly chemically constituted fertilizers puts farmers in a dangerous scenario. We have built a Portable Granular Fertilizer Spreader for small-scale farming in this suggested project, which requires less human labor and has a lower cost effect. Our work seeks to cut down on time, money, and human effort. The main part of the design is rotating disc, which helpsin spreading the fertilizer uniformly. Thus the spreader can be used even by a common man in small scale farming effectively.

Keywords: Fertilizers, Conventional method

1. INTRODUCTION

Agriculture is the backbone of India. India has an agriculture-based economy.43% of India's territory remains employed in agricultural activities as against 11% in the world. In India around 70% of the population earns its livelihood from agriculture .India's geographical condition is unique for agriculture because it provides many favorable conditions. There are 20 agro-climatic regions and nearly 46 out of 60 soil types in the country.

2. LITRATURE REVIEW

Nartode R.R.Studied that, a method was generated to spread the fertilizer uniformly over a fallow land by dropping the fertilizer over the impeller disc. The system consists of a 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. 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. In normal conditions spring is not in tension and hopper is closed.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. The speed of wheel is varied by control lever connected through a cable. In this the fertilizer spreads only in front side of impeller while its back side 180 is covered. The size and width of the fertilizer is reduced to make it less weight and suitable for multi crops. From this method the cost fertilizer spreader is reduced by 50%

Arun Abraham.Studied that, conventional spreading of fertilizers for small scale farming are by hand. It has some problems like uneven spreading of fertilizer, more time consuming, high human effort. The farmer have to carry heavy bags throughout the spreading process. So 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

S.Ramchandra.Studied that, in India 73% of population is directly or indirectly depends upon the farming. Hence it is said that India is an agricultural based country but till now our farmers are doing forming in same traditional way. They are doing seed sowing, fertilizers and pesticide spraying, cultivating by conventional methods. There is a need of development in this sector and most commonly on fertilizer broadcaster technique, because it requires more efforts to spread uniformly over the entire field.

The main objective of fertilizer broadcaster at sowing time is to uniformly distribute the fertilizer over entire field. The present trend in fertilizer broadcaster in India is based on manual method. It's time to replace the manual method by the motorised. It will decrease the manual effort and time to spread the fertilizer over the entire field.The present project work is concentrated on design and fabrication of fertilizer broadcaster which will uses the solar energy to run the motor. This makes the work is easier, more efficient and less time to spread the fertilizer on farms.

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. 13 longitudinal and transversal distribution profiles with 11 centrifugal spreaders were evaluated: five with limestone, two with gypsum, two with magnesium oxide, one with monoammonium phosphate (MAP), one with super simple phosphate (SS), one with chloride potassium (KCl) and one with formulated fertilizer (02-20-20).

The collectors and the form of distribution followed the ASABE S341.3 standard (2006). The broadcasted distribution by centrifugal spreaders performed unevenly over the applied area. Therefore, application evaluation, in addition to correct regulation, should be performed frequently for each type of product, even on machines with capacity in variable rate. Hydrogen has a very low energy density when compared to gasoline. This is a disadvantage for storage, transport and safety purposes since it will need to be stored at very high pressures. In addition, hydrogen cannot be used to produce energy by combustion at temperatures below 0 Celsius, since the fuel requires a higher temperature to burn. Therefore the challenge becomes storing hydrogen at extremely high pressures without drastically reducing the temperature.

3. AGRICULTURE

India is agricultural based country. Near about 70% of people of our country are farmer. Our economy also depends on agricultural product. Now a day tremendous changes have occurs in conventional method of agriculture like seed plantation, irrigation system, pesticides & spray used for developing our economic condition. It is necessary to increase our agricultural productivity & quality also. Farming process includes many stages out of which fertilization is one of the best important stages, & which is not exploded up to the mark up till.

Now a days we are used to spreading of fertilizer in traditional way which is the more time consuming, costly as well as not provide comfort to the farmer. So, we are going to design a manually operated machine for fertilizer spreading by taking into consideration the user group & their needs which helps to them to work easy & functional. So, using fertilizer spreading machine equal amount of fertilizer spread, Good fertility, less waste, savetime & reduce effort of farmer.

Agriculture is the science and art of cultivating plants and livestock. Agriculture was the key development in the rise of sedentary human civilization, whereby farming of domesticated species created food surpluses that enabled people to live in cities. The history of agriculture began thousands of years ago. After gathering wild grains beginning at least 105,000 years ago, nascent farmers began to plant them around 11,500 years ago. Pigs, sheep and cattle were domesticated over 10,000 years ago.

Plants were independently cultivated in at least 11 regions of the world. Industrial agriculture based on large-scale monoculture in the twentieth century came to dominate agricultural output, though about 2 billion

people still depended on subsistence agriculture into the twenty- first. Modern agronomy, plant breeding, and agrochemicals such as pesticides and fertilizers, and technological developments have sharply increased yields, while causing widespread ecological and environmental damage. Selective breeding and modern practices in animal husbandry have similarly increased the output of meat, but have raised concerns about animal welfare and environmental damage.
Environmental issues include contributions to global warming, depletion of aquifers, deforestation, antibiotic resistance, and growth hormones in industrial meat production. Genetically modified organisms are widely used, although some are banned in certain countries.

4. CLIMATE FOR PADDY CULTIVATION

Rice is a tropical climate crop that can grow from sea level to an altitude of 3000 meters. Paddy cultivation can also be done in temperate and sub-tropical climate under humid conditions. A high temperature, humidity and sufficient rainfall with irrigation facilities are the primary requirements of paddy cultivation. It also needs bright sunshine with temperature ranging between 20 and 400C. It can tolerate temperature upto 420C.

5. SEASON FOR RICE CROP

Since rice can grow in a variety of climate and altitude it is cultivated in different seasons in different parts of the country. In areas of high rainfall and low winter temperature (northern and western parts) rice crop is grown once a year- during May to November. Two or three crops are grown in the southern and eastern states. India has three rice farming seasons- summer, autumn and winter. However, the chief rice growing season is 'kharif season also called 'winter rice'. The sowing time is June- July and is harvested during November- December months. 84% of the country's rice supply is grown in the kharif crop.
Rice cultivated during rabi season is also called as 'summer rice'. It is sown in the months of November to February and harvested during March to June. 9% of total rice crop is grown in this season. Early maturing varieties are normally grown during this time.
The pre-kharif or 'autumn rice' is sown during May to August. The sowing time also depends on the rainfall and weather condition. Hence the timing may differ slightly from place to place. Generally, it is harvested during September- October months. 7% of the total rice crop in India grows in this season and short duration varieties which mature within 90-110 days are cultivated.

6. SOIL FOR RICE CULTIVATION

Almost every type of soil can be used for rice cultivation provided the region has a high level of humidity, sufficient rainfall with irrigational facilities, and a high temperature. The major types of soils for rice cultivation are black soil, red soil (loamy and yellow), laterite soil, red sandy, terai, hill and medium to shallow black soil. It can be even cultivated on silts and gravels. If the cultivating soil has rich organic matter and if it powders easily on drying or forms a puddle when wet then it is considered to be ideal.

7. RICE CULTIVATION METHOD

Paddy seedlings in nursery bed ready to be transplanted. Most farmers practice nursery bed method. Nursery beds are made occupying about 1/20th of the total field area. The paddy seeds are sown in the bed. They are ready within 25 days of sowing in low land areas while in higher altitudes they take about 55 days to become ready for transplantation. There are four different practices of cultivation of rice, viz. transplantation method, drilling method, broadcast method and Japanese method.

8. TRANSPLANTATION

The most commonly used method wherein seeds are first sown in nursery and the seedlings are transplanted to the main field once they show 3-4 leaves. Although this is the best yielding method, it requires heavy labor.

DRILLING METHOD

The exclusive to India. In this method, one person ploughs a hole in the land and the other person sows the seed. Ox is the most commonly used 'person' to plough the land.

BROADCAST METHOD

Generally involves scattering of the seeds manually over a large area or in the entire field. Labor involved is very less and so is the precision. This method produces very less yield as compared to others.

ASIAN METHOD

It has been adopted for the high yielding variety of rice and those that need a high amount of fertilizers. Seeds are sown in nursery beds and then transplanted to the main field. It has shown tremendous success for the high yielding varieties.

9. INTRODUCTION TO FERTILIZER

Urea is a fertilizer material used for direct application to crops or in the preparation of blended fertilizers. Under most circumstances, it is equivalent to or superior than most other nitrogen sources. To understand the significance of urea, as opposed to other sources of nitrogen, one must examine the nature of commercial fertilizers and how they are blended. Commercial fertilizers are complex mixtures of various blended materials that contain at least the minimum level of nutrients, as per the label guarantee.

In the case of nitrogen, there is usually more than one form of nitrogen, and often more than one source of nitrogen used in any blend. The two major forms of nitrogen found in most blends are nitrate-nitrogen (nitrate-N) and ammonium nitrogen (ammonium-N). Nitrate- N is the form directly utilized by plants.

However, it is not readily held by soil particles and, if present in excess, is readily lost by leaching and/or conversion to nitrogenous gases. Ammonium-N, on the other hand, is not normally utilized by plants directly and is not subject to losses by leaching.

Most ammonium-N is converted, however, during the growing season, to nitrate-N by soil microorganisms. Under some conditions, ammonium-N can be volatized to the atmosphere, although this often occurs within high pH soils or when large amounts of ammonium/ammonia are not worked into the soil at application. Under ideal conditions, therefore, it would be desirable for a fertilizer to supply only enough nitrate-N to get a crop growing early in the season and then enough ammonium-N for conversion to nitrate-N over the course of the season, as the crop needs it.

Unfortunately it is difficult to achieve this ideal balance of nitrate-N and ammonium-N in a fertilizer. It does point out, however, some advantages of having different forms of nitrogen in most fertilizer blends. Fertilizer is any material of natural or synthetic origin used to enhance the growth of plants. Fertilizers are commonly used for growing all crops, with application rates depending on the soil fertility, usually measured by a soil test and according to the particular crop. About 90% of fertilizer is applied as solids (eg: Urea, Di-Ammonium Phosphate, Super Phosphate). Fertilizer spreaders for large scale farming are tractor mounted. Conventional spreading of fertilizers for small scale farming are by hand. It has some problems like uneven spreading of fertilizer, more time consuming, high human effort.

The farmer have to carry heavy bags throughout the spreading process. For small scale uses, it not possible to use costly tractor mounted spreaders. 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 fertilizercan also be avoided.

The fertilizer spreading for small scale farming is by hand. For large scale farming tractor mounted fertilizer spreaders aroused. It is not possible to buy costly tractor mounted fertilizer spreaders for small scale farming. Handspreading has some problems like uneven spreading of fertilizer, more time consuming, high human effort. So a trolley mounted fertilizer spreader reduces these problems. The trolley mounted fertilizer is economic and can reduce the time consumption, human effort and it will provide, even spreading of fertilizer. On successful implementation, the fertilizer spreading equipment shall find its application in small scale farming.

10. UREA

Worldwide, urea is one of the most widely used dry granular sources of nitrogen. It is preferred by the fertilizermanufacturing industry since it is relatively easy to manufacture.

Urea also has a high nitrogen content (46%), incomparisonto other popular nitrogen sources (i.e. ammonium nitrate). On urea contains 35% more nitrogen than ammonium nitrate. This has implications on the storage and transport of nitrogen fertilizer products. Urea is considered a relatively stable product to store and transport, and it is for this reason that the transportation of urea is considered very cost effective in comparison to its most commonalternative, ammonium nitrate. Since ammonium nitrate is now classified as a hazardous product (because it can be used as an explosive), there are many restrictions and potential additional costs related to its transportation. For example, each tonne of urea contains 35% more nitrogen than a tonne of ammonium nitrate.

11. GRANULAR FERTILIZER

Granular fertilizer spreaders are very popular for agricultural field use, commercial turf applications, and home lawn use. Several hundred thousand fertilizer spreaders are sold in the United States each year. Many of the people purchasing those spreaders do not know how to select an appropriate spreader for their needs nor how to use the spreader properly to obtain optimum performance. Proper use of spreaders is important economically and environmentally. Granular materials should be applied in a uniform pattern and at the correct rate. If the rate is too low or if there are low spots in the pattern, the product will likely not be efficacious.

If the rate is too high or there are high spots in the pattern, several problems are possible: the application will be morecostly than necessary due to the use of more product than necessary; there is a risk of crop damage from over application; and excess product can be harmful to the environment. It is advantageous to the applicator and to society to be sure products are applied uniformly at the correct rate.

Much of the research reported in this bulletin has been done on turf spreaders because they are smaller and easier to work with, but most of the principles discussed here are applicable to large agricultural spreaders as well. The information should make it easier for anyone using a fertilizer spreader to select an appropriate type of spreader and to obtain optimum performance from the selected spreader. This bulletin summarizes 24 years of design,study, research, and teaching about fertilizer spreaders.

12. SPREADER

Spreader application of granular fertilizer and pesticides offers several advantages over sprayer application

of liquid formulations, especially for home gardeners andhome lawn applicators. Granular materials do not have to be diluted or mixed. It is much easier to apply granules evenly than it is to apply liquids evenly with the equipment available to homeowners.

For large scale farming tractor mounted fertilizer spreaders are used. It is not possible to buy costly tractor mounted fertilizer spreaders for small scale farming. Hand spreading has some problems like uneven spreading of fertilizer, more time consuming, high human effort. So a trolley mounted fertilizer spreader reduces these problems. The trolley mounted fertilizer is economic and can reduce the time consumption, human effort and it will provide, even spreading of fertilizer. On successful implementation, the fertilizer spreading equipment shall find its application in small scale farming.

13. PROBLEM IDENTIFICATION

Even though many developments in technology, still in many rural areas farmers are struggling to gain profit for their investments. Recent studies saying that, India need to increase its agricultural production by 12 percent in order to feed the tremendously increasing population of the country in 2020.But due to many reasons and problems there is stagnation in production rate. If this trend continues, there would be a huge gap between the demand of ever growing population and the production.

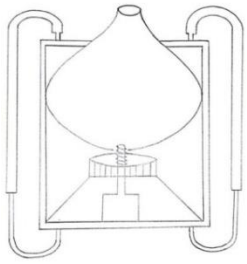
14. PADDY SUSTAINABILITY PRACTICES

Food safety is a serious concern among the consumers of agricultural products. Toxicity risks are created by theacute presence of contaminating chemicals in foods. The usage of chemical inputs in paddy farms has not onlycaused health issues for farmers but it has also adversely affected the environment, killed animals, and polluted air and water. This creates controversial issues that need immediate attention, since sustainable agriculture needs to meet both consumers' and farmers' welfare in terms of food and farmers' safety, respectively.

The data from the questionnaire were analyzed and the Farmer Sustainability Index was calculated. The range of index is from 0 to 100, where 0 is not sustainable at all and100 is highly sustainable. Eighty (80) paddy farmers from Sungai Petani, Kedah participated in the study and the result shows that 80% of the farmers practice quite unsustainable paddy farming with an average score of less practices, such as excessive use of unauthorized pesticide that will be included in creating the Farmer Sustainability Index. The main practices are pest and weed control, maintaining and enhancing soil fertility, controlling soil erosion and other practices to compute the scores. The total Index value for each farmer represented the sum of the sustainability scores in terms of the farmingprocess including seeding, fertilizer application,

The production practices that are included in the calculation of the Farmer Sustainability Index value are shown in Table 1. To facilitate the interpretation of the Index scores, the score were adjusted to fall within a rangeof 0-100. In order to create a structured questionnaire for data collection, each of the farming practices were included and phrased as a question about types of input used, amount of input applied, and frequency of application per hectare of farm per season.

15. EXPERIMENTAL SETUP DRAFTING



Drafting of portable granular fertilizer spreader

PARTS OF EXPERIMENTAL SETUP

- Container, Delivery unit

- Nylon Spiral Rod, Motor
- Battery, Speed regulator
- Polymer Strip, Container Stand than 40.0 on a scale of 0-100.

16. MATERIAL AND METHODS CONTAINER

The container is used to carry the granular fertilizer like

It is crucial to understand the attitude of farmers who can drive this sector from conventional to sustainable at farm level by their individual actions to transform farming practices. Previously, a series of surveys were conducted on the sustainability of English cabbage farming in the Cameron Highlands, Malaysia. The purpose of the study was to develop the Farmer Sustainability Index for Englishcabbage in Malaysia in order to identify the factors associated with the adoption of sustainable farming practices. This would make it possible to visualize the degree of sustainability in farming practices. As an index of farmer sustainability, there is controversial farmer urea, potassium complex etc. The maximum capacity of the container is approximately 15kg of granular fertilizer.

DELIVERY UNIT

- Nylon spiral Rod
- Spin wheel or rotating wheel

NYLON SPIRAL ROD

The spiral rod takes the mixture of fertilizer from the tank and deliver it to the spin wheel.

SPIN WHEEL

When the spin wheel is rotated the granular fertilizer is spreaded uniformly on the agricultural field.

MOTOR

The motor used in this project is 12v high speed DC motor. It helps in rotating the spin wheel and spiral rod which was attached to the motor

BATTERY

The battery used in the project is 12v 9Ah

SPEED REGULATOR

The speed regulator is used to control the speed of the DC motor

POLYMER STRIP

It is used to control the angle of the fertilizer spreaded.The one end of the strip is fixed and the other one is moveable. So that the angle can be adjusted using the strip.

CONTAINER STAND

It is used to mount the high speed DC motor, battery and other electronic gagets. The container is also mounted above the stand along with break rest and shoulder belt.

FABRICATED MODEL

The fabricated model of the portable granular fertilizer speared

17. WORKING PRINCIPLE

For spreading of granular fertilizer, the container is filled with the granular fertilizer. The spiral rod and the spin wheel attached with the DC motor is used to spread the granular fertilizer uniformly.

18. PERFORMANCE TEST

The container is filled with 10kg of urea is belter on the shoulder of our back and the performance test is conducted. At the minimum speed of the motor. The granular fertilizer are spreaded to a distance of 8m the sidewards and 4m on backwards at an angle of 65^{o}

The 10kg of urea was spreaded within 5 min to a distance of 90m. The speed can be varied by using the speed regulator. Performance test on portable granular fertilizer spreader

19. CALCULATION

Power calculationBattery:

Total power of the battery= 12V *9A = 108 W

Motor power at max speed = 12V*3A = 36 W

Duration of power withstanded by the battery is= 108/36 = 3

Therefore, the battery duration or the working time ofthe battery is 3 hours.

Area Calculation

Total area of fertilizer spreaded = 90*8 = 720 sq. m
One Acre = 4046.85 sq. m ~ 4047 sq. m
Total quantity of fertilizer used for one acre= 4047/720 = 5.6
10kg of fertilizer is spreaded to the area of 720 sq. m at5 mins= 5.6*10 = 56 kg
Therefore quantity of fertilizer required for one acre is56 kg

Time Calculation

Time taken to spread 10 kg of fertilizer to the area of720 sq. m is= 5 mins
Amount of fertilizer required for one acre = 56 kg
Time taken to spread the fertilizer on one acre= 56/10 = 5.6 = 5.6*5 = 28 ~ 30 mins
Let us take maximum of 2 mins for loading of fertilizer= 5*2 = 10 mins
Therefore, the total time taken to spread the fertilizeron one acre, = 30+10 = 40 mins

RESULT AND DISCUSSION

- Thus the portable granular fertilizer spreader is fabricated and the performance test was carried out.
- From the performance test, the portable granular fertilizer spreader machine is capable of spreading 50kg of fertilizers in 40mins on 1acre of agricultural field.
- On comparing the result, there is no doubt that this project would be a part of agricultural enhancements.

CONCLUSION

From the performance test, we conclude that the portable granular fertilizer spreader machine is capable of spreading the fertilizer on one acre of agricultural field at 40 min. Thus, there is no doubt that this project would be a great enhancement in the agricultural field.

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