

COMBINED MANURE SPREADER

R. Ragu, R. Ramprasath, K. Siddharth

Mechanical Engineering, Easwari Engineering College, Chennai, India

ABSTRACT

The aim of this paper is to fabricate a useful one to reduce the effort of the farmers. Automation of machines can prove to be costly as they involve microprocessors as well as electricity which is rare in rural areas. So, semi automation is done through use of some basic kinematic mechanisms which can carry out spraying of various manures using a single knapsack sprayer tank with less humane effort. The pre-existing sprayer can spray only pesticides in liquid state. . Hence in order to overcome that we made several modifications to that design and came up with the idea of combined agricultural sprayer. As the name indicates, this project combines both spraying of Pesticides and spreading of fertilizers in a single tank. Manures include urea, Pottasium Fertilizers and other pesticides that are used by farmers to increase the productivity in field can be spreaded by this project.

Key words: Liquid Pesticide Spraying, Solid Fertilizer Spreading, Fertilizer Tank, Knapsack Sprayer, Combined Spraying and Spreading.

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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 favourable conditions. There are 20 agro-climatic regions and nearly 46 out of 60 soil types in the country.

2. STATEMENT OF PROBLEM

Eventhough 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.

3. SCOPE OF WORK

Combined manure spreader reduces the man power or effort needed to carry out spraying in the field, with the help of mechanisms. Urea spreader attached with tractor can be used to spread solid fertilizers. But in Indian Crop Fields where tractor cannot be entered, Combined manure spreader can be used to spray both liquid pesticides as well as solid fertilizers in a single tank with reduced cost.

4. VARIOUS SPRAYING TECHNIQUES

4.1. Sprayer

In agriculture, a sprayer is a piece of equipment that is used to apply herbicides, pesticides, and fertilizers on agricultural crops. Sprayers convert pesticide formulation, often containing a mixture of water (or another liquid chemical carrier, such as fertilizer) and chemical, into droplets, which can be large rain type drops or tiny almost-invisible particles. This conversion is accomplished by forcing the spray mixture through a spray nozzle under pressure

4.2. Components of Sprayer

The important components of a sprayer are:

1.Pump-Any spray liquid must be atomized before it leaves the spray nozzle. The pump facilitate the necessary pressure for this purpose.

2. Source of Power-It is a prerequisite to operationalize the spray pumps. The source of power may be either:

- a. Manual b.Traction c.Motor d.Tractor and air craft engines

3. Spray Tank-A sprayer may have either a built in tank or a separate tank to carry spray liquid. The tank need be large enough to avoid frequent refilling but not cumbersome to carry. The tank is equipped with a large opening with a builtin strainer and cap to fill in the liquid. Small openings pose difficulty in filling and cleaning the tank.

4. Agitator-In order to maintain the homogeneity of the liquid spray, it may be either of mechanical or hydraulic purpose. Mechanical agitators may be of metal fan or rod etc. Hydraulic agitator consists of a pipe with several side holes and closed at its free end. It is placed in the tank and fed with spray liquid with the help of pump. Liquid jets emerge from these holes, further initiating the agitation to the complete of the liquid. This is known as 'By pass system'.

5. Distribution System-It includes

- 1.Nozzle 2.Spray lance 3.Spray boom

6. Pressure regulator-Fitted to heavy duty sprayers and tractor driven sprayers, it aids the operations of the sprayers at a constant pressure. Pressure gauge is provided to check pressure.

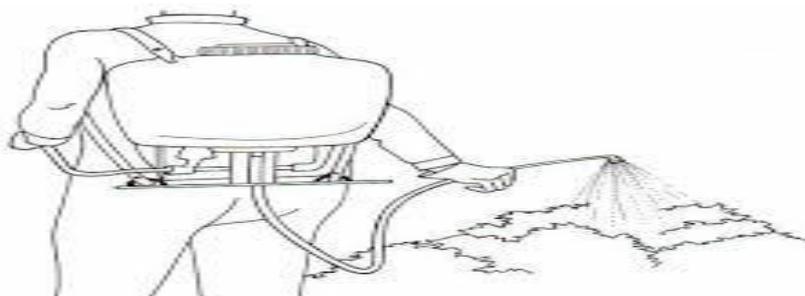


Figure 1 Knapsack Sprayer

5. TYPES OF SPRAYER

5.1. Knapsack Sprayers

These are Loaded on the back of worker during operations. Tanks may be of plastic or metal. Common Knapsack sprayers are

- Hydraulic
- Manual pneumatic and
- Motorized pneumatic

Hydraulic Knapsack Sprayers

Manually operated, tank capacity is 15 liters, mechanical or hydraulic agitation, worked with a hand lever to maintain constant pressure, particularly used for spot treatment by small holding farmer and hand treatment. Equipped with a boom. It is good for blanket application.

Drawbacks

These sprayers are mounted on the back of a man. One hand to lever sprays 0.4 ha/day and with a boom 0.8 ha/day. It is a high volume spray but low volume nozzles can also be fitted. Spray potential is 12 kg/ cm² . It is sprayed at 3 to 4 kg cm² to prevent spray drift.

Pneumatic or compressed system Knapsack

Does not require pumping during operation / spraying. The tank is pressurized after filling the liquid to 2/3rd capacity with a built in hand pump. Undesirable for weedicide as spraying pressure declines after some time resulting into uneven spray. Tank cleaning is a challenging task. It is used in limited amount to spray on weeds in paddy and jute.

Motorised Pneumatic sprayers

As a low volume sprayer, it is suitable for spraying concentrated spray liquid. A blast of air flows through spraying jet of delivery hose and nozzle tube and ejects spray liquid in this blast. Air blast atomizes spray liquid in to fine droplets. Air acts as carrier, faster the air is pressured, more the atomization. These sprayers are also used as blowers.

- Low volume spray.
- Saves time in refilling tanks.
- Portable working.

5.2. Foot Sprayer/Pedal Pump Sprayers

Popularly applied for CPP application and is operated with foot. It has provision of 1–2 long delivery hoses. Fitted with either lance or 2-6 nozzle booms. Its potential spray pressure is 17 to 21 kg/cm² output and with lance is 1 ha/ day. It can spray high volume spray and covers more area.

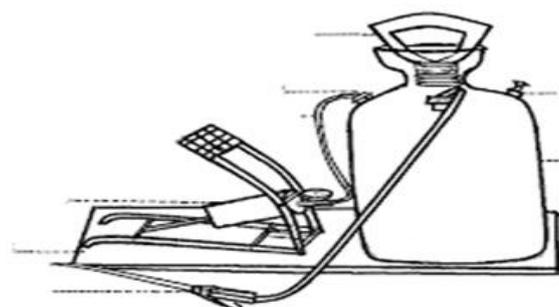


Figure 2 Foot Sprayer

Traction Pneumatic Sprayer

Indian Institute of Sugarcane Research, Lucknow has developed bullock drawn sprayer with size nozzle boom, that is powered from the wheels of the frame. It is efficient, easy to operate and simple in its construction. It uses two pneumatic pumps and develops maximum pressure of 2-8 cm² which is suited to minimize spray drift. Area covered is 2-3 ha/day equipment.



Figure 3 Traction Sprayer

Tractor Mounted Sprayers

With spray pressure of 1.4 to 2.8 kg cm² and fitted with multi nozzle boom are very useful in CPP application for large holding of farmers. Tractor mounted sprayer fitted with booms are used to spray road side vegetation. Tractor run sprayers have. 1. High uniformity of sprayers. 2. High working efficiency. 3. Full utilization of tractor during idle time.



Figure 4 Tractor Mounted Sprayer

Aerial Sprayers

The selection of a sprayer is governed by several factors

- Frequency of CPP application,
- Availability of diluents
- Availability of labor



Figure 5 Aerial Spraying

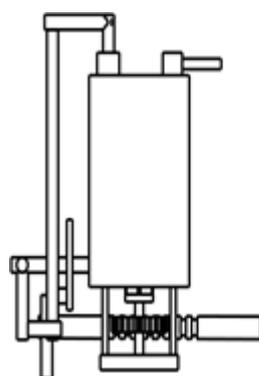
Urea Spreader

It is a form of a two – wheeled ‘walk-behind’ device which may be easily and quickly pushed by the farmers for spreading solid fertilizers like urea. Problems generally in the manually spreading of the fertilizers in the farm, some of the problems are occurring like uneven spreading of the fertilizers (wrong stuff and wrong amount) which may result in the crop damage. moreover the conventional spreading of fertilizers by hand in a farm is more time consuming method and require more human effort. This is a type of spreader which can be operated manually for spreading granular materials in farms especially for solid fertilizers like urea. the spreader has hopper with at least one orifice in it. at the bottom of hopper a rotating disc is provided for spreading granular materials. As the device gets pushed manually the rotation of the wheels get converted in to vertical rotation of spreading disc by the set of bevel gears. The spreading device normally has a bladed centrifugal spreader comprising disc which is rotated about vertical axes and onto which the product to be spread on the ground is dropped in a suitable manner. Each disk also has a plurality of substantially radial spreader blades for directing the product to be spread by the centrifugal effect induced by the rotation and for projecting it onto the ground from the ends of the blades farthest from the axis of rotation. It results in increase in uniformity of fertilizer spreading, good crop yield, reduction in time required to spread, less human fatigue, prejudiced use of fertilizers and less waste.



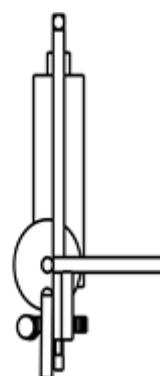
Figure 6 Urea Spreader

6. DESIGN



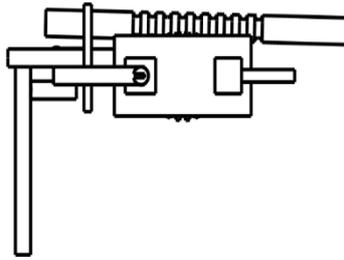
Front view

Scale: 1:1



Left view

Scale: 1:1



Top view

Scale: 1:1

Figure 7 Isometric View

7. FABRICATION PROCESS

The experimental setup consist of plastic tank, bevel gear, wheel, bearings, plastic plate, mild steel rods, power transmitting shafts , connecting link ,Rotating blade. Mild steel blade is used for the base rotation .The Mild steel blades are made to rotate, by connecting with gear setup. Gears are made to mesh with shaft in such a way it spreads solid fertilizer, once lever is actuated. It performs and spreads fertilizer in same way as like Urea spreader. Then at the other side rotating wheel is fixed, through which power is transmitted to shafts. A handle is connected to left side which creates pressure inside tank by actuating motion. This pressure is used to spray the liquid pesticide. Whereas solid fertilizer is spreaded by rotation of bevel gear setup by power from wheel via shafts and spreaded through rotating blade



Figure 8

8. WORKING DISCUSSION

When a human actuates the handle of knapsack sprayer two processes can be carried out, one at a time.

- Spraying of liquid pesticides
- Spreading of solid fertilizers

For Spraying of Liquid Pesticides-During the actuation of handle, the rod attached to it produces pressure inside the tank through vertical reciprocation of piston like set-up. The bottom hole in the tank is closed and bevel gear arrangement is removed, before actuating the handle. Hence pressure created inside the tank is used to spray the liquid pesticides.

For Spreading of Solid Fertilizers-For spreading of solid fertilizers, the rod attached to handle is removed. The bevel gear setup is attached and bottom hole is opened. When handle

is actuated, by ratchet-pawl mechanism half rotation of wheel is converted into full rotation of shafts. Which then rotates bevel gear thereby solid fertilizers are spreaded by using rotating blade.

8.1. Merits

- It ensures simple and easy operation
- It is more suitable for small and medium farmers
- Cost of maintenance is very less
- Human effort is saved
- Less tiresome as compared to conventional methods
- Electricity not required

8.2. Demerit

Weight of the tank is a concern

9. CONCLUSIONS

Combined Agricultural Sprayer is a designed and Modified tank, which will be available to the farmers at a cheaper rate and also two operations can be done in a single tank. This Sprayer is for all type of farmers and it will be an excellent solution to farmers in rural areas of agriculture based Nation like India, Where they are still spreading dangerous solid fertilizers by hand.



Figure 9

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