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WHEEL SPRAY PUMP

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Abstract

India is a land of agriculture which comprises of small, marginal, medium and rich farmers. Small scale farmers are very interested in manually lever operated knapsack sprayer because of its versatility, cost and design. But this sprayer has certain limitations like it cannot maintain required pressure; it leads to problem of back pain. However, this equipment can also lead to misapplication of chemicals and ineffective control of target pest which leads to loss of pesticides due to dribbling or drift during application. This phenomenon not only adds to cost of production but also cause environmental pollution and imbalance in natural eco system. This paper suggests a model of manually operated multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time.

Keywords: Nozzle, Pump, Cultivation, Sprinkler,Chain-Sprocket.

Introduction

Agriculture plays a vital role in Indian economy. Around 65% of population in the state is depending on agriculture. Although its contribution to GDP is now around one sixth, it provides 56% of Indian work force. The share of marginal and small farmer is around 81% and land operated is 44 % in 1960-61. As far as Indian scenario is concerned, more than 75 per cent farmers are belonging to small and marginal land carrying and cotton is alone which provide about 80 % employment to Indian workforce. So, any improvement in the productivity related task help to increase Indian farmer's status and economy.

The current backpack sprayer has lot of limitation and it required more energy to operate. The percentage distribution of farm holding land for marginal farmers is 39.1 percentage, for small farmers 22.6 percentage, for small and marginal farmers 61.7 percentage, for semi-medium farmers 19.8 percentage, for medium farmers 14 percentage and for large farmers 4.5 percentage in year 1960-61. Clearly explain that the maximum percentage of farm distribution belonged to small and marginal category.

Literature Review

2.1 R.D. Dhete has worked on "Agricultural fertilizer & pesticides sprayers". In his work he emphasizes on different method of spraying devices. Day by day the population of India is increasing and to fulfil the need 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.

2 Pavan B. Wayzode, Sagar R. Umale, Rajat R.Nikam, Amol D.Khadke, Hemant carried out their work in "Design Fabrication of Agricultural sprayers, weed with cutter Chemicals are widely used for controlling disease, insects and weeds in the crops. They are able to save a crop from pest attack only when applied in time. The chemicals are costly. Therefore, equipment for uniform and effective application is essential.

Dusters and sprayers are generally used for applying chemicals. Dusting, the simpler method of applying chemical, is best suited to portable machinery and it usually requires simple equipment. But it is less efficient than spraying, because of the low retention of the dust.

In this work we have proposed an equipment that is wheel and pedal operated sprayer, it is a portable device and no need of any fuel to operate, which is easy to move and sprays the pesticide by moving the wheel and also peddling the equipment. In this equipment using reciprocating pump and there is a accumulator provided for the continuous flows of liquid to create necessary pressure for the spraying action. This wheel operated pesticide spray equipment consumes less time and avoids the pesticide from coming from front of the nozzles which will in contact of the person who sprays pesticides. Weed management is one of the tedious



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operations in crop production. Because of labour costs, time and fully manual weeding is unfavourable. Hence effort is made to design and develop efficient Farm equipment to perform weeding without using electric power.

Objectives

- Aim of this project is that the farmer need not carry the entire pesticide sprayer pump on his shoulders but just pull/push the mechanism mounted on the trolley to operate the pump and spray the pests. This makes the farmer feel comfortable, relaxed and less tiresome.
- To reduce human efforts due to the constant pumping action for creating pressure inside the pesticide sprayer and thereby provide a suitable environment for the user reducing the fatigue load acting on the body. As discussed previously, the farmer has to continuously keep on pumping using one of his hands and spray the pests on the crops using the other hand. This at a long run is a tiresome and cumbersome job and the farmer slowly loses interest from it.
- This project focuses on the problem of health-related issues of the farmer (operator). Majority of them don't use any precautions like face-masks and hand-gloves against the hazardous chemicals and work in direct contact with it. Consequently, this harms the farmer as the spray in the conventional method directly hits the face.

Multi-nozzle is used and hence larger area of field can be sprayed at faster rate.

Methodology

- Multi sprinkle system work on principle of reciprocating pump. This reciprocating pump uses single slider crank mechanism, in which wheel sprocket works as crank. There are two sprockets which is mounted on two different axles in which one sprocket is directly attached to wheel axle. Connecting rod is attached to another sprocket axle through disc. In this power is given to piston of reciprocating pump through rotation of wheel.
- When piston reach at top dead centre, it creates negative or low pressure inside the cylinder due to pressure difference between reservoir and cylinder space, water moves to fill the cylinder chamber space. In this process suction valve open and delivery valve close.
- When piston reaches at bottom dead centre, it creates high pressure inside the cylinder chamber & due to the pressure difference between cylinder & delivery pipe. Water moves through discharge pipe to sprinkle. In this process suction valve closed and delivery valve open. This process repeats again and again to get desire output.
- Motion transmission by chain and sprockets arrangement.
- Slider cranks mechanism.
- Rotary motion converted into reciprocating motion.



Above figure shows the assembly of the agricultural reciprocating multi sprayer. The operator grabs the handle and pushes the cycle forward as cycle moves forward, the wheel rotate. When the wheel rotates then the gear sprocket mounted on wheel is also



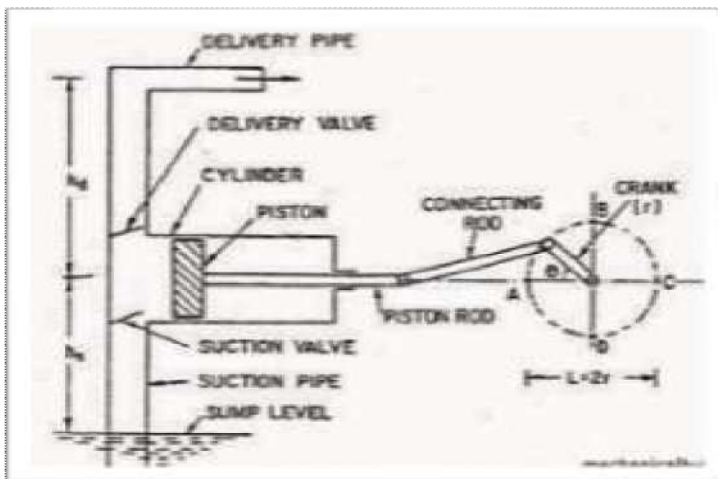
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rotate at same speed. The chain drive transfers the motion of gear sprocket to pinion sprocket. The pinion sprocket and crank is mounted on either side of same shaft, the rotary motion of shaft is converted into the reciprocating motion with the help of crank and connecting rod mechanism. The connecting rod is also connected with lever and then the lever oscillates at fulcrum. The piston connected at fulcrum produce reciprocating motion in cylinder and the required pressure is achieved. The pesticide from tank sucks in cylinder and piston forced the pesticide to nozzle through the pipe; the numbers of nozzles are connected to spray the pesticide. We can adjust the pressure, which is required for spraying with the help of special arrangement is to change the length of crank by providing slot on crank. By providing some adjustment at joint of connecting rod and lever free rotation of crank or neutral position can be achieved. Using these adjustments pumping is stop and the wheel rotate freely when you need not spray pesticide. Height, position and angle of the nozzle can be adjustable.

Single Slider Crank Mechanism:

The Slider-Crank Mechanism is used to transform rotational motion into translational motion by means of a rotating drive beam, a connecting rod and a sliding body.

In another word Single Slider Crank Mechanism is used to transform straight line motion (Reciprocating Motion) into rotary motion and vice versa.



Applications

- Its major use in agriculture to spray fertilizer.
- In city and urban area, it can use for spraying water on lawn.
- It may be exercise device at morning during utilize in lawn.
- Use from spray chemical Pesticide in plants in farm.
- It is use for spray painting in industry.
- It is use for spray water in garden on the plants.
- It is use for transfer water from one place to its nearer place.
- For the insecticides application to control insect pests on crops and in stores, houses, kitchen, poultry farms, barns, etc.
- For the fungicides and bactericides application to control the plant diseases.
- For the herbicide's application, to kill the weeds.
- For the harmony sprays application to increase the fruit set or to prevent the premature dropping of fruits.
- For the application of plant nutrients as foliar spray.

Conclusion

- The suggested model has removed the problem of back pain, since there is no need to carry the tank on the backbone and solder.
- More no. of nozzle which cover maximum area of spray in minimum time at maximum rate.



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- Proper adjustment facility in the model with respect to crop helps to avoid excessive use of pesticides which result into less pollution.
- Imported hollow cone nozzle should be used in the field for the better performance.
- Muscular problem is removed and there is no need to operate lever.
- This alone pump can use for multiple crops.
- After having a trial, we have found that one finds it easy to operate push type machine.
- The pump can deliver the liquid at sufficient pressure where output of the nozzle in 1min is 0.3 and spray width 0.4m from calculation so that it reaches all the foliage and spreads entirely over the spray surface.
- It is little heavy but efficiently working in rough conditions of farm. It is economical therefore affordable for all kind of farmers.
- It requires comparatively less time for spraying so we can get more fields spraying per day. It is cost effective than the existing spraying pumps available in the market as no direct fuel cost or cost for maintenance is needed for this.
- It is upgraded design of manually operated sprayer and weeder which will be helpful for small land farmers.
- It consumes less time and saves money as compared with conventional spraying and weeding.
- This machine does not require any fuel or power so maintenance is less.

Future Scope and Work

The gear ratio we have used in this project is 1:2.2 which can be varied according to the need and design in order to obtain variety of performances in the sprayer. More number of nozzles can be utilized. Higher capacity bag pack sprayer can be used.

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