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Cam Operated Agrochemical Pesticide Sprayer

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Abstract **- Agriculture is the backbone of India. Agriculture sector is required to enhance and increase the productivity of the field crop by use of a cam operated agrochemical pesticide sprayer. This project deals with design of COAP, in turn improve the spraying methods, increase the crop productivity, and reduce the farmer's effort with skill implementation in agriculture sector. The sprayer tank kept at rear basket of bicycle and placed for four nozzles to the pipe diameter of 10mm.The spaying method is purely mechanical based in which rear wheel of bicycle sprocket connected with chain to cam. As bicycle start moving forward kinetic energy converted into rotating energy, then pump press on pressure tank to create a suction pressure to discharge the flow rate of water through nozzle.**

Keywords: Bicycle, COAP, Skill implementation, Agro farmers.

INTRODUCTION

The agrochemicals are widely used for controlling agriculture crop disease, insects and weeds etc. The farmers are able to save an agriculture crop from pest attack to improve the more growing of crop applications. The agrochemicals are costly and to design the agrochemical pesticide equipment with lower cost for small farmers and big farmers. Dusters and sprayers are generally used for applying chemicals to crop. The new invention of a sprayer brings revolution in the agriculture or horticulture sector, this enables farmers to obtain the maximum agricultural output.

Insects are largely responsible for the crop destruction. Insecticides or pesticides, a man made or natural preparation are used to kill insects or otherwise control their reproduction. These herbicides, pesticides, and fertilizers are applied to agricultural crops with the help of a special device known as a "Sprayer," sprayer provides optimum performance with minimum efforts. The invention of a sprayer, pesticides, fertilizers bring revolution in the agriculture or horticulture sector especially by the invention of sprayers, enable farmers to obtain maximum agricultural output. They are used for garden spraying, weed and pest control, liquid fertilizing and plant leaf polishing. There are many advantage of using sprayers such as easy to operate, maintain and handle, it facilitates uniform spread of the chemicals, capable of throwing chemicals at the desired level, precision made nozzle tip for adjustable stream and capable of throwing foggy spray, light or heavy spray, depending on requirement. Agriculture sector is facing problems with capacity issues, shrinking revenues, and labor shortages and increasing consumer demands. The prevalence of traditional agriculture equipment intensifies these issues. In addition, most formers are desperately seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer in an agriculture field.

Objectives

1. To develop a Cam operated Agrochemical pesticide sprayer.
2. To reduce human fatigue and effort during agrochemical spray.
3. To reduce the labor cost by using COAPS.
4. To develop simple and cost effective device for agriculture applications.

Statement of the Problem

- ✓ The initiative tackles the problem of pesticide losses by using cam operated sprayer for horticulture and agriculture crops.
- ✓ The pesticide spraying with standard technology for improvement in crops growth .
- ✓ To improve the human comfortably in particular crops with Cycle operated sprayer.
- ✓ The labor problems fulfilled by using cycle operated sprayer.

LITERATURE SURVEY

Sandeep H. Poratkar, Dhanraj R. Raut (2013), the authors reviews on development of multi-nozzle Pesticides Sprayer Pump. Agriculture land in India comprises of small, marginal, medium and rich farmers. Small scale farmers are around 30% are used manually lever operated knapsack sprayer rand by use of this sprayer cannot maintain uniform required pressure. This leads to problem of back pain. The suggested model has removed the problem of back pain, since there is no need to carry the tank (pesticides tank) on the back.

Varikuti Vasantha Rao, et al(2013),the authors were reviews about the multiple powered supplied fertilizer sprayer. The design and implementation of multiple power supplied fertilizer sprayer and proposed system is the modified model of the two stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. The two stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit.

Shivaraja kumar,et al(2014), the authors were reviewed about design and development of wheel and pedal operated sprayer. The equipment that is wheel and pedal operated sprayer, it is a portable device and no need of any fuel to

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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.

Sumit D. Raut,et al(2014), the authors were reviews about the design and construction of a pedal operated reciprocating pump used in large irrigation project areas and orchard and drainage line. They have conducting a different types of pumps and reciprocating devices were constructed and tested at different suction heads in the laboratory to evaluate their performances. The pedal operated reciprocating pump can be available by local markets and simple skills required to manufactured it. But this would be suitable to irrigate large and orchard land, especially to pump water from a tank (capacity of up to15 lit.) to irrigate small plots like vegetables and seed beds with less physical effort.

Abhilash Gurjar,et al(2015), the authors were reviews on solar powered sprayer. Solar powered sprayer is a technology suitable application in the farming comm.
unity of India. Solar powered sprayer can be used as a fuel alternating device. It works on the principle of solar photovoltaic (PV), with certain modifications on the existing power sprayer in the market. The annual maintenance charge of the sprayer is expected to be around Rs.500 with the initial investment of Rs.5000 towards the cost of the sprayer. “Solar Sprayers” as “Energy Alternate Devices”.

Bibhu Santosh Behera,et al(2015), the authors were reviews on solar energy application for agriculture application in India. Sun is the real source of energy to minimize environmental degradation and enriching agriculture. Renewable energy and farming are a winning combination. Wind, solar and biomass energy can be harvested forever, providing farmers with a long-term source of income. Renewable energy can be used on the farm to replace other fuels or even sold as a cash crop. It is one of the most promising and important opportunities for value-added products in agriculture.
Alaa Kamel Subr,et al(2015), the authors were reviewed about Practical deviation in sustainable pesticide application process. Using agrochemicals becomes essential practice of modern farming but in the same time it puts risk to human, animal health and the environment. The initial actions to create balance between this negative impact and the necessity to use the pesticides concerning the environment, people's living conditions and the economic, those factors are defined as the sustainable development. In this paper the algorithm to gain the sustainability of pesticide application was set to highlight some places where the sprayer operator has to make subjective decisions about the correct procedure.

Sanjay.S,et al(2015),the authors were reviews about the design and fabrication of mechanical pest sprayer . They have designed a model running without any fuel and also easy to operate for a user. In this model we find that we have simply used a sprocket mounted on rear shaft which will actuate piston inside cylinder in the tank. Also the assembly consists of 4 wheels out of which 2 are mounted on front shaft and 2 are mounted as guide wheel at rear end. A sprocket is mounted on front side exactly at the end of shaft. By pushing the trolley, sprocket rotates in its direction so it actuates the piston inside the cylinder, due to this the compression takes place inside the tank. So it leads to spray Pesticides (or) water inside the tank. By our project, spraying is done using sprocket mechanism. This project is requires less man work for spraying.

Shailesh Malonde,et al(2016), the authors were reviews the design and development of multipurpose pesticides spraying machine. Pesticide spraying is the necessary procedure in cultivation of the crops. The present idea deals with the designing and fabricating a pesticide sprayer which will be useful and affordable to the farmers which will assist to increase the productivity of crops. The authors concluded that Cost of the sprayer has reduced compared with existing sprayer, so it can be operated by small scale farmers. Flow rate is increased by 2.5 times the manually operated sprayer. Area sprayed per hour has increased by 2.6 times of the manually.

Akhilesh K.Bhatkar, et al (2016), the authors were reviews on the development of pesticide spraying machine. Agriculture is the backbone of Indian economy. This has to support 17 % of world population with only 2.3%percent of world’s geographical area, 4.2 % of world’s water resource, with 2 % total consumption of world’s total pesticide. The need of food modernization of agricultural sector is important and one of the main sectors is pesticide spraying machine. By proper use of pesticide to reduce wastage of crop productions.

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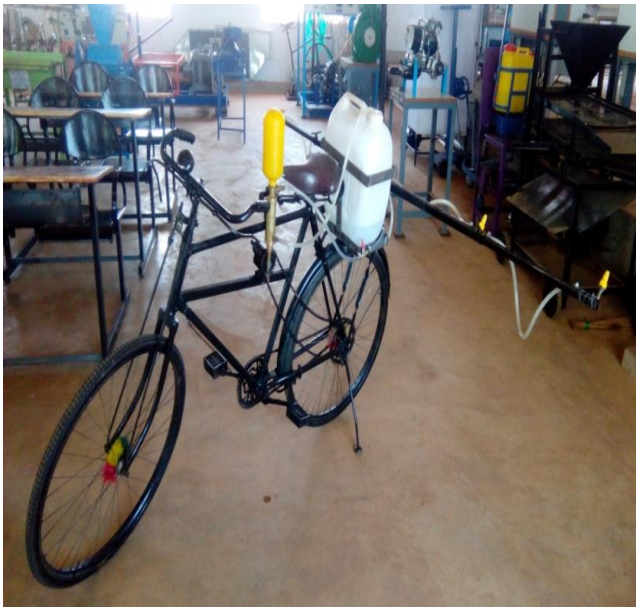
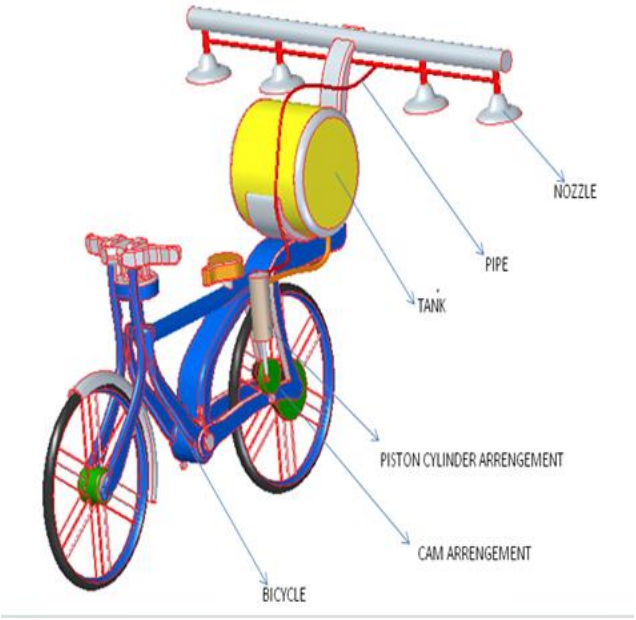
METHODOLOGY





Diagrammatic view of Agrochemical pesticide sprayer and CAED Model COAP

A Cam operated piston pump is a mechanical device which converts the mechanical energy into hydraulic energy and transfers same to the fluid through the pipe line thereby increasing the pressure and energy of the flowing liquid. A cam operated piston pump is a positive displacement pump which is mounted on a back side of the bicycle and which in turn connected through pulley to rear wheel of a Bicycle. As the bicycle moves on Agriculture land, the rear wheel of bicycle transform the kinetic energy to piston pump via Cam shaft. The pipe from the storage tank creates a Vacuum Pressure and pesticide move towards the nozzle which start spraying at a high pressure on the respective crops. From this arrangement we are getting more efficiency of the man and agrochemical pesticide spraying machine and it reduces the more men power because a man who drive trolleys at same time he can spray the Pesticide to agriculture crops.

The agrochemicals are widely used for controlling agriculture crop disease, insects and weeds etc. The farmers are able to save an agriculture crop from pest attack to improve the more growing of crop applications. The agrochemicals are costly and to design the agrochemical pesticide equipment with lower cost for small farmers and big farmers. Dusters and sprayers are generally used for applying chemicals to crop. The new invention of a sprayer brings revolution in the agriculture or horticulture sector, this enables farmers to obtain the maximum agricultural output.

Design consideration

A_1=cross sectional area of pipe ,m^2
A_2=cross sectional area of outlet nozzle, m^2
d_1=diameter of pipe, m
d_2=diameter of outlet nozzle in mm
N=speed of the small sprocket in ,rpm
v_1=inlet velocity/s
v_2=outlet velocity/s
Q=discharge,m^3/s
Speed of the small Sprocket N= 250rpm

Diameter of the pipe = $d_1 = 10mm$

Diameter of the nozzle = d_2 = 1mm

Area of the pipe = $A = \frac{\Pi}{4} d_1^2$

$= \frac{\Pi}{4}(10\times10^{-3})^2 = 7.85\times10^{-5} m^2$

Area of the nozzle

$$A_2 = \frac{\Pi}{4}(d_1^2 - d_2^2)$$

$$= \frac{\Pi}{4}\times((10\times10^{-3})^2 - (1\times10^{-3})^2)$$

$$= 7.77\times10^{-5} m^2$$

Inlet velocity

$$v_1 = \frac{\pi d_1 N}{60}$$

$$= \frac{3.142\times10\times10^{-3}\times250}{60}$$

$$= 0.130 m/s$$

Outlet velocity

$$A_1 v_1 = A_2 v_2$$

$$7.85\times10^{-5}\times0.130 = 7.77\times10^{-5} v_2$$

$$v_2 = 77.5 m/s$$

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Per nozzle

$$\frac{v_2}{4} = \frac{77.5}{4} = 19.37 m/s$$

Discharge

$$Q = A_1 v_1 = 7.85 \times 10^{-5} \times 0.13$$
$$= 1.43 \times 10^{-5} m^3/\sec$$
$$= 0.01020 lit/\sec$$
$$= 0.612 lit/\min$$
$$= 36.73 lit/hour$$

The total Discharge of pesticide through nozzle 36.73lit/hour

Discharge of one nozzle is 9.18lit/hour

ADVANTAGES OF COAPS

1 Reduces the human efforts.
2 Good performance with higher efficiency.
3 Less consumption of time.
4 Easy maintenance and repair.
5 User and eco friendly.

DISADVANTAGES OF COAPS

1 Applications limited for some crops.
2 Uses limited for dry land.
3 Additional maintenance cost.

APPLICATIONS

1 Groundnut
2 Cabbage
3 Carrots
4 Onions
5 Mung beans
6 Tomatoes, etc.

CONCLUSION

1 The suggested model has removed the problem of back pain, since there is no need to carry the tank on the back.
2 As suggested model has more number of nozzles which will cover maximum area of spraying in minimum time & at maximum rate.
3 Proper adjustment facility in the model with respect to crop helps to avoid excessive use of pesticides which result into less pollution.
4 Muscular problems are removed an there is no need to operate the lever.
5 This alone pump can used for multiple crops

Outcome of the Project

1. The utilization of kinetic energy of Bicycle to hydraulic energy by using cam operated piston pump.
2. The cam operated piston pump is a light duty component capable of spraying a high pressure of fluid through nozzle.
3. The Cam operated agrochemical pesticide sprayer reduces man power for operation.
4. For a shorter period of time farmers can cover the more hector of agriculture land.

Future Scope

1. To design various capacities of water storage tank for large farmer application.
2. To minimize the pesticide wastage by using hight and width adjustable for various crops.
3. To modify the sprocket and nozzle diameter for high pressure creations.To increase the number of nozzle for large farmer application.
4. To modify the pump capacity.

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