Design and Development of Pesticide 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 lead 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 echo system. This paper suggests a model of manually operated multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time.

In Normal Spray pump work on electrical battery operated or using manpower to operate lever for spraying pesticides. In Push operated spray pump a one trolley is there in which mechanism for translating rotary motion into reciprocating motion this reciprocating motion used to operate the pump lever. This lever operates pump increase the pressure of pesticides and pesticides will be sprayed. It is a device which is used to sprinkle pesticides without more efforts.

Keywords: - *Pesticide pump, Chain Drive, Spray, Semi-Automatic, less effort and Simple Working*

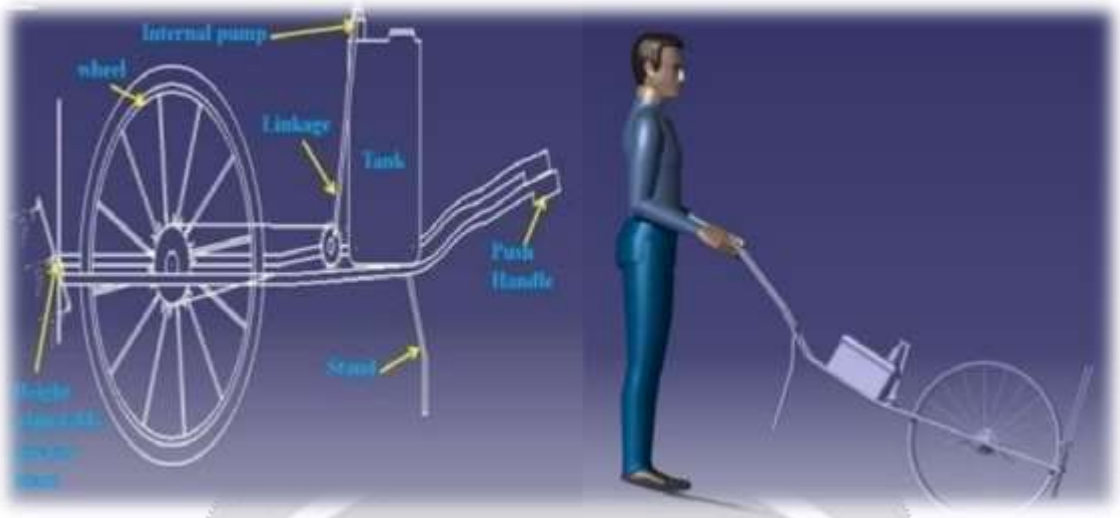
1. INTRODUCTION

Farming is the backbone of Indian economy. In this agriculture sector there is a lot of field work, such as weeding, reaping, sowing etc. Apart from these operations, spraying is also an important operation to be performed by the farmer to protect the cultivated crops from insects, pests, funguses and diseases for which various insecticides, pesticides, fungicides and nutrients are sprayed on crops for protection. Farming has undergone a great evolution in last 50 years. Out of the various reasons involved for this evolution is control of various diseases on crops.

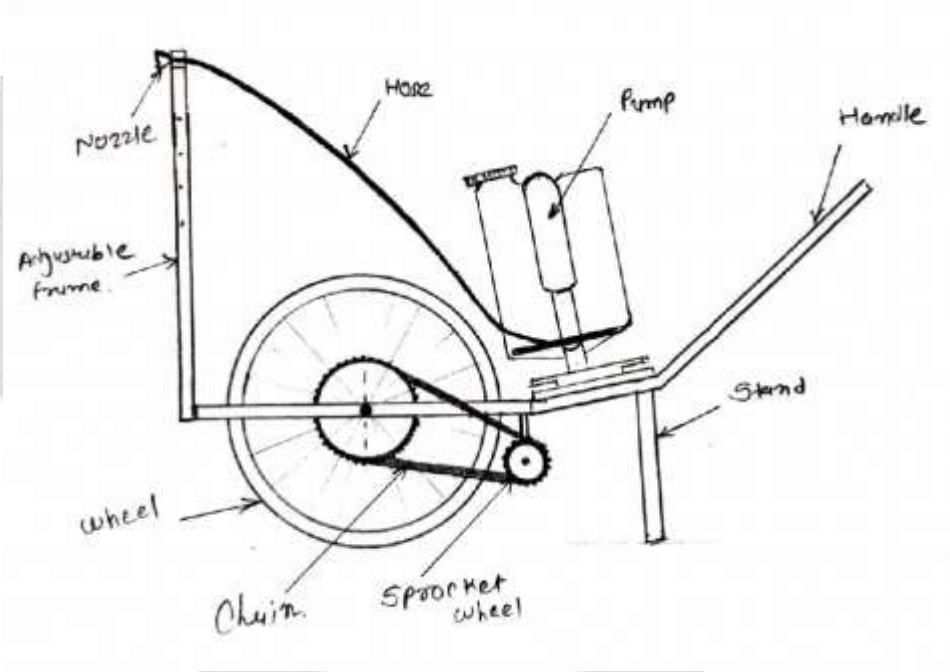
In order to reduce problems different type of sprayers has been introduced in the market, but these devices do not meet the specified problems or demands of the farmers. To solve these difficulties a new equipment that is mechanically operated wheel driven sprayer, it is a portable device and does not need any fuel to operate, which is easy to move and spray the pesticide by

Moving the wheel is to be developed. This wheel operated pesticide spray equipment consumes less time and achieves uniform nozzle pressure; crank mechanism with piston pump which is driven by the wheel is also used.

We have aimed is to design such a technology which will run on mechanical power but requiring less time for spraying and seed sowing than those which are hand operated. Thus considering today's demand, we have come up with mechanically operated multipurpose spray pump. As it has huge advantages so this concept should be used in agriculture.



(Fig:-1 Concept)



(Fig:- 2 Concept on Paper)

1.1 OBJECTIVE

- The suggested model can remove the problems of back pain, since there is no need to carry the tank (pesticides tank) on the back and solder.
- We can add more number of nozzles which will cover maximum area in minimum time and at maximum rate.
- Work reliability under different working conditions.
- Decrease the cost of machine.
- Decrease labour cost by advancing the spraying method.
- Machine can be used in small as well as in large crop area.

1.2 APPLICATIONS

- It 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.

1.3 ADVANTAGES

- It does not require any kind of non-renewable energy is mechanical, electrical and pressure energy.
- It reduces the fatigue of operator during the operation.
- It increases the efficiency of operator.
- It can cover more area of land during spray.
- It can adjust the height of spray by using adjustable
- Its cost is less than electrically and solar operated pump.
- It has is less air pollution.

1.4 DISADVANTAGES

- In irregular area of land it can difficult to operate.
- In rainy days in muddy environment it is difficult to operate.
- For irregular crops this pump is difficult to work.

2. Need of Project

For seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital, the project has been made. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer equipment in an agriculture field. A pesticide sprayer equipment has to be portable and with an increased tank capacity as well as should result in cost reduction, labour, seed sowing and spraying time. In order to reduce these problems, there are number of sprayer introduced in the market but these devices do not meet the above problems or demands of the farmers. The conventional sprayer equipment having the difficulties such as it needs lot of effort to push the liver up and down in order to create the pressure to spray. Another difficulty of petrol sprayer is to need to purchase the fuel which increases the running cost of the sprayer and seed sowing equipment. In order to overcome these difficulties we have proposed a wheel driven sprayer and seed sowing equipment, 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. The mechanism involved in this sprayer is reciprocating pump, and nozzles which were connected at the front end of the spraying equipment.

2.1. Project Concept

- To overcome the disadvantages related with previous model, we have designed a model Running without any fuel and also easy to operate for a user.

- Pesticide application plays an important role in pest management. Proper technique of application of pesticide and the equipment used for applying pesticide are vital to the success of pest control operations.

- The application of pesticide is not merely the operation of sprayer or duster. It has to be coupled with a thorough knowledge of the pest problem.

- All pesticides are poisonous substances and they can cause harm to all living things. Therefore their use must be very judicious. The application techniques ideally should be target oriented so that safety to the non-targets and the Environment is ensured. Therefore, proper selection of application equipment is necessary.

- The requirement of coverage and spray droplet size depends upon the mobility and size of the pest.

- The mode of action of pesticide, its relative toxicity and other physicochemical properties, help to decide the handling precautions, agitation requirement etc. Further the complete knowledge of the equipment is necessary to develop desired skill of operation, to select and to estimate the number and type of equipment's needed to treat the crop in minimum time and to optimize use of the equipment.

3. Calculation:

3.1 DISCHARGE

Discharge is defined as the volume of water flows or rate of water flow through given cross sectional area is called as discharge.

1. Discharge=Area of piston× stroke length× r.p.s
Q= π/4 d2 × L ×r.p.s
=π/4 (0.65)2 × 0.5 × 0.6
= 0.785 ×0.4225 × 0.03
= 0.00994988 mm3/s
Discharge (Q)= 0.00001 m3/s

3.2 NORMAL SPEED IN R.P.M

6 revolutions in 10 seconds, then how many revolutions in 1 second.
10 - 6
1 - X?
10 ***** x = 6
x = 0.6
The no. of revolution in 1 second is 0.6 then how many rev. in 1 minute (60seconds)
1sec. - O.6revs.
1 minute –x?
X= 0.6 × 60
X= 36 rpm
Normal speed in rpm = 36 rpm

3.4 Distance covered in one stroke of pump: -

Diameter of tyre = **510 mm**

Distance covered in one revolution of driving side = **510 × π = 1602 mm**

So using ratio = driving side / driven side = **10 / 3**

Distance covered in one stroke of piston = **1602 × 3 /10 = 480.6 mm**

3.5 Chain Drive

Chain dimensions

Length of chain: 65 cm

Pitch: 1 cm

Width: 0.5 cm

Driver Sprocket

No. of teeth: 16

Bore dia.: 15 mm

Outer diameter: 50 mm

Pitch circle dia.: 45 mm

Width of tooth: 3 mm

Thickness of tooth: 4 mm

Speed: 90 rpm

Driven Sprocket

No. of teeth: 24

Bore dia.: 25.4 mm

Outer diameter: 80 mm

Pitch circle dia.: 70 mm

Width of tooth: 5 mm

Thickness of tooth: 4 mm

Speed $N_2 = (T_1/T_2)*N_1$

= (16/24)*90

= 60 rpm

Velocity Ratio for Chain Drive = N1/N2

= 90/60

= 1.5

Breaking load on chain $W_b = 106p^2$

= 106*10*10

= 10600 N

Pitch line Velocity V1 = $\frac{\pi dn}{60}$

= $\frac{\pi*0.05*90}{60}$

= 0.23 m/sec

Load on chain = $\frac{\text{Rated power}}{pitch\ line\ velocity(v1)}$

= 373/0.23

= 1621 N

Factor of safety = $\frac{Breaking\ load\ (Wb)}{Load\ on\ chain\ (W)}$

= 10600/1621

= 6.53 say 7

The normal maximum velocity relates to sprockets with 17-25 teeth. [6]

Pitch	**Normal Max. Velocity**	**Chain Identity**	**Breaking Force In Newton**
8	5000	05B-2	7800
9.525	4200	06B-2	16900
12.7	3750	08B-2	32000

The minimum centre distance between the smaller and larger sprockets should be 25 to 30 times the pitch. Let us take it as 25 times the pitch.

Centre distance between the sprockets, = 25*10 = 250 mm

In order to accommodate initial sag in the chain, the value of centre distance is reduced by 2 to 5 mm.

X =250-5 = 245 mm

We know that the number of chain links

K = $\frac{T1+T2}{2} + \frac{2x}{p} + [\frac{T2-T1}{2\pi}]^2 \frac{p}{x}$

= $\frac{16+24}{2} + \frac{2*245}{10} + [\frac{24-16}{2\pi}]^2 \frac{10}{295}$

= 69.054

Length of chain L = K.p

= 70*10

= 700 mm

4. 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.
- 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 are remove and there is no need to operate lever.

5. ACKNOWLEDGEMENT

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