International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979
Impact Factor: RJIF 5.72
Received: 14-05-2018; Accepted: 15-06-2018
www.allsubjectjournal.com
Volume 5 Issue 6; June 2018; Page No. 86-87

Design and Manufacturing of horizontal-vertical spray pump

Hanumant Kate[1], Dhiraj Deshmukh[2], Prathamesh Deshmukh[3], Gunavant Ahirrao[4], AkashGavli[5]
[1]Assistant Professor, Department of Mechanical, DYPCOE, Ambi, Maharashtra, India
[2-5] Student, Department of Mechanical, DYPCOE, Ambi, Maharashtra, India.

Abstract
As India is agriculture based country and 70% people do farming and related work and day by day the population of India is increasing, so to fulfill the need of food, modernization of agricultural sectors are important. 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. Constant flow valves can be applied at nozzle to have uniform nozzle pressure.

Keywords: modernization, backpack, small marginal farmers, pesticide sprayers

1. Introduction
Status of Agriculture in India
India is set to be an agricultural based country approximately 75% of population of India is dependent on farming directly or indirectly. Our farmers are using the same methods and equipment for the ages. e.g. seed sowing, spraying, weeding etc. There is need for development of effective spraying machine for increasing the productivity. Most of the late developing countries of Asia have the problem of higher population and low levels of land productivity as of compared to the developed nations. One the main reasons for lower productivity is insufficient power availability for the farms and very low levels of farm mechanization. This is especially true for India.

2. Materials
List of Material

Table 1: List of Material

S. No.	Name of Component	Material	Material specification
1	Frame	M.S	Cheap, durable, good strength
2	Tank	Plastic	Light in weight, durable
3	Nozzle	Steel	Flat nozzle for 4 bar pressure
4	Adjuster bar	Steel	Durable, light in weight
5	Link	M.S	Cheap, durable,good strength
6	Tyre	Rubber	For friction purpose without indentation
7	Hoses	Rubber	Durable, light in weight, for 4 bar
8	gears	M.S	Specification for transmitting force up to 100 N, chip, durable
9	Shaft	M.S	Cheap, durable, good strength

3. Working
This is a single wheel body with cranking mechanism with pump being cranked by pushed and pulled to result in pumping, building the pressure in the tank for pesticide spraying. The working of this manually operated multi nozzle pesticides sprayer pump is based on the principles of motion transmission due to gear mechanism and plunger cylinder arrangement. The operator first stand behind the trolley. He will grab the handle and lift it and push the trolley forward. As trolley move forward, the wheel rotates in counter clockwise direction. As the gear is mounted on same shaft of wheel, it also rotates in counter clockwise direction. Due to this, the small gear start rotating which give motion to link as it is fixed on the disc. The plunger is attached to disc via link. The plunger got motion due to this which stimulates pesticides to come outside via six nozzles.

4. Figures
i) Cad Model

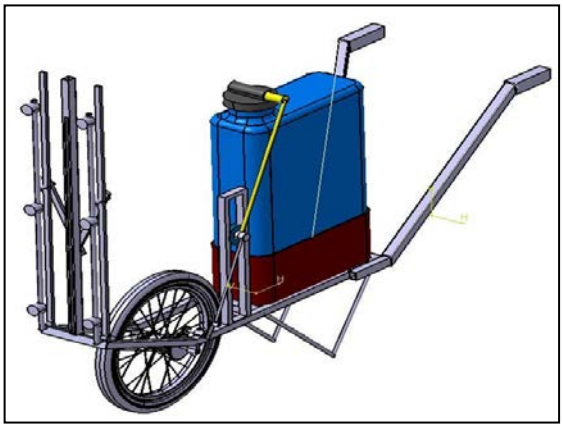

Fig 1: CAD model of manually operated multi-nozzle sprayer pump

ii) Actual Model

Fig 2: Actual Model

5. Design

i) Design of Nozzle

Data collection for flow rate calculations

Table 2: Data collection for flow rate

Time consumed	60 Seconds
Replicate	Volume of water collected(*lts*)
1	1.1
2	1.2
3	0.9
4	0.95

Average flow rate = $1.1 * 10^{-3}$ m^3/min

i.e. 1.1 liter/min = $1.1 * 10^{-3}$ m^3/min

Average volume flow rate = (1.1+1.2+0.9+0.95)/4= 1.0375 lts

Total No. of Nozzle = 6

Discharge of single Nozzle = $1.03*10^{-3}$/ 6 = $1.71*10^{-4}$ m^3/min

Pump discharge per stroke =A*L

Diameter of piston = 50 mm and length = 80 mm from available size of Pump

$=\pi/4*(0.05)^2*0.08$

$=1.5*10^{-4}$ m^3/stroke

Required speed or stroke N =Total Discharge per min /Pump discharge per stroke

N= $1.1 * 10^{-3}$ /$1.5*10^{-4}$ =7.3 strock/min = 7.3 rpm

Waking speed of person = 5 Km/hr from Wikipedia (https://en.wikipedia.org/wiki/Walking)

= 1.38 m/s

Selection of Wheel

Distance between two plants = 1.25 feet = 38 cm.

Line covered by one rotation of wheel = 38 * 4 = 152cm

$152 = 2\pi r$

$r = 152/2\pi$

= 24.19cm = 25 cm

The diameter of wheel = 50 cm = 0.5 m

Determine speed of Wheel =

V= r

1.38= 0.25*

= 5.52 rad/sec

2 *n

n= 0.8785 rps = 52.71 rpm

1. Max. Principal strain theory t= $\sqrt{\quad\quad\quad\quad}$
2. Thickness of thin cylinder, t=

6. Conclusion

1. Cost of the sprayer has reduced compared with existing sprayer, so it can be operated by small scale farmers.
2. The model has removed the problem of back pain, physical fatigue and health hazards.
3. This alone pump can be used for multi crops
4. The arrangement of nozzles is adjustable according to the crops**.**

7. References

1. Development of Multinozzle Pesticides Sprayer Pump", Sandeep H. Poratkar, Dhanraj.
2. Raut. International Journal of Modern Engineering Research (IJMER); www.ijmer.com Vol.3, Issue.2, March-April. 2013, 864-868.
3. Prof. NR Jadhao. Agricultural sprayer vehicle with router weeder and seed sower, International Journal of Advance Engineering and Research Development. 2015; 2(4).
4. Shailesh Malonde. Design and Development of Multipurpose Pesticides Spraying Machine. International Journal of Advanced Engineering and Global Technology. 2016; 04(3).