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Theoretical Study on the Advance Mechanical Sprayer in Indian Agriculture

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Abstract: ***Indian agriculture consist all type of farmers. In India small scale farmers are very interested in manually lever operated sprayer because of its multitasking versatility, low cost and easy design. But this sprayer has some limitations like it lead to problem of back pain and cannot maintain required pressure. Here considering that human health risk is a primary function of pesticide toxicity and exposure number of risks is expected to arise from high exposure to a moderately toxic pesticide than from low exposure to a highly toxic pesticide. However, whether or not dietary exposure of the general population to pesticide residues found on food and drinking water consists of a potential threat to human health, is still the subject of great scientific controversy for food and water storage production.***

In this paper we suggest a mechanical sprayer, which totally remove the back pain problem and more efficient in comparison to other mechanical sprayer equipment. This system is useful for the medium and lower level farmers, for spray the pesticide we are using the centrifugal pump and some multi nozzles.

Keywords: centrifugal pump, water tank , nozzles , shaft with extra vanes, back pain , regulators, multi nozzle, small; medium farmer.

I. INTRODUCTION

Agriculture plays an important role in Indian economy .Pesticides are widely used in agricultural production to prevent or control pests, diseases, weeds, and other plant pathogens in an effort to reduce or eliminate yield losses and maintain high product quality. Although pesticides are developed through very strict regulation processes to function with reasonable certainty and minimal impact on human health and the environment, serious concerns have been raised about health risks resulting from occupational exposure and from residues in food and drinking water. Occupational exposure to pesticides often occurs in the case of agricultural workers in open fields and greenhouses, workers in the pesticide industry .There are many kinds of benefits that may be attributed to pesticides, but these benefits often go unnoticed by the general public. Thus, from this point of view, pesticides can be considered as an economic, labor-saving, and efficient tool of pest management with great popularity in most sectors of the agricultural. Despite their popularity and extensive use, pesticides serious concerns about health risks arising from the exposure of farmers when mixing and applying pesticides or working in treated fields and from residues on food and in drinking water for the general population have been raised. These activities have caused a number of accidental poisonings, and even the routine use of pesticides can pose major health risks to farmers both in the short and the long run and can degrade the environment. In developing countries, farmers face great risks of exposure due to the use of toxic chemicals that are banned or restricted in other countries, incorrect application techniques, poorly maintained or totally inappropriate spraying equipment, inadequate storage practices, and often the reuse of old pesticide.

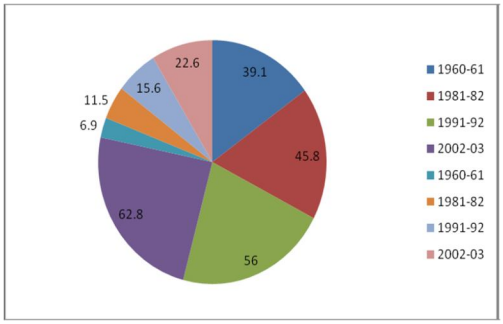


Table I: Percentage distribution of farm holding and operated area for various farmers

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Table2: shows that percentage of the marginal, small and semi medium farmers is about 92.15 %, which states that growth of these farmers require advanced equipment which will work faster than existing one]

II. DESIGN REQUIREMENT

A. *Drawbacks in Existing Sprayer Pumps*

The Indian farmers are currently using manual operated backpack sprayer. This type of sprayer consists of tank 10 -20 liter capacity carried by two adjustable straps. Constant pumping is required to operate this which result in muscular disorder .Also the backpack sprayer cannot maintain pressure, results in drifts/dribbling. Developing adequate pressure is laborious and time consuming. Pumping to operating pressure is also time consuming. Moreover, very small area is covered while spraying. So, more time are required to spray the entire land. Back pain problems may arise during middle age due to carrying of 10-20 liter tank on back

B. *Uneconomical Existing High cost Pumps for Indian Marginal and Small Farmers*

Percentage distribution of farm holding					Percentage distribution of Operated Area			
Land Class	1960-61	1981-82	1991-92	2002-03	1960-61	1981-82	1991-92	2002-03
Marginal	39.1	45.8	56	62.8	6.9	11.5	15.6	22.6
Small	22.6	22.4	19.3	17.8	12.3	16.6	18.7	20.9
Small & Marginal	61.7	68.2	75.3	80.6	19.2	28.1	34.3	43.5
Semi-medium	19.8	17.7	14.2	12	20.7	23.6	24.1	22.5
Medium	14	11.1	8.6	6.1	31.2	30.1	26.4	22.2
Large	4.5	3.1	1.9	1.3	29	18.2	15.2	11.8
Total	100	100	100	100	100	100	100	100

Presently farmers are using knap-sack sprayer for spraying pesticides on crops in their farms which costs for Rs 2000-5000/- .Pesticides are diverse and omnipresent. This sprayer has wide limitations and thus farmers can use the other sprayer also like bullock driven sprayer pump and tractor mounted sprayer. Cost of bullock driven is about Rs 28000/-. But though this these sprayer has high advantages but are not affordable by farmers of developing nation .So, it's a need to find out a golden mean among these. The height factor also play a key role in spraying .For cotton, about 5 to 6 times spraying of pesticides is done. Cotton is one of the important commercial crops grown extensively in India. Over 4 million farmers in India grow cotton as their main source and income & livelihood. The textile sector, which is primarily based on cotton fiber is the largest employer & income provider in India, second only to agriculture. It employs close to 82 million people – 35 million in textile & 47 million in allied sector.[13]

S.N.	Type of sprayer pump	No. of workers required for spraying	Area for which sprayer is used generally	Time required for spraying	Cost
1	Bullock Driven	2	More than manually operated	Less than manually operated	More than manually operated Rs 28000/-
2	Tractor Operated	1	More than other two	Less than above two	More than other two Rs 10.00 lacks to 12.00 lacks

Table3: Some High Cost And High Features Sprayer

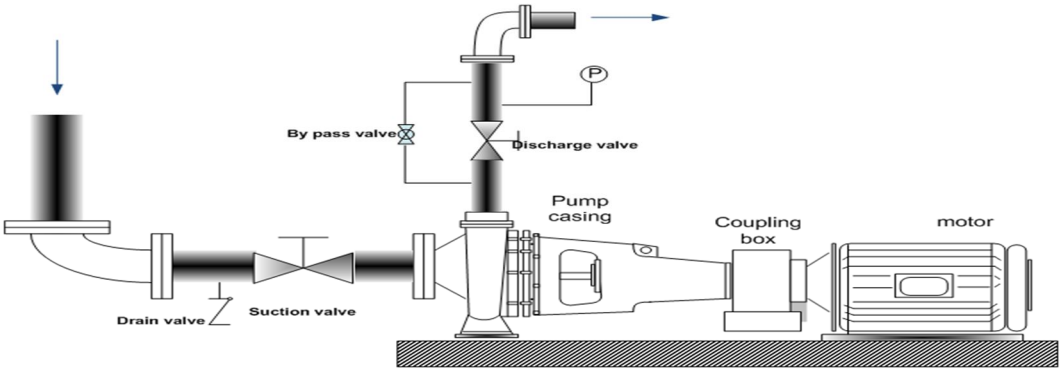
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III. RESEARCH EFFORT

A. *Centrifugal Pump*

Like most pumps, a centrifugal pump converts rotational energy, often from a motor, to energy in a moving fluid. A portion of the energy goes into kinetic energy of the fluid. Fluid enters axially through eye of the casing, is caught up in the impeller blades, and is whirled tangentially and radial outward until it leaves through all circumferential parts of the impeller into the diffuser part of the casing. The fluid gains both velocity and pressure while passing through the impeller. The doughnut-shaped diffuser, or scroll, section of the casing decelerates the flow and further increases the pressure.



Centrifugal pump system

B. *Nozzles*

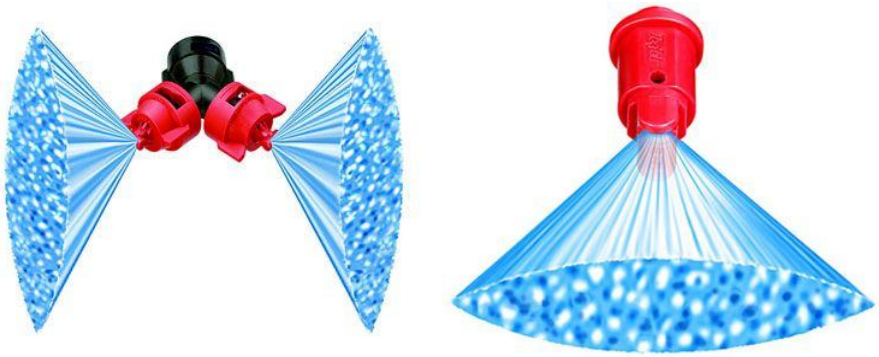


Fig2: (TURBO TeeJET NOZZLE)

The Turbo Tee Jet has the widest pressure range of the flat-fan nozzles — 15 to 90 psi. It produces larger droplets for less drift and is available only in 110 degrees. This nozzle is Excellent at pressures below 30 psi for post- emergence systemic herbicides, systemic fungicides and systemic insecticides.

It is use at pressures above 30 psi very good for post-emergence contact and systemic herbicides, contact and systemic fungicides, and contact and systemic insecticides. Tapered edge wide angle flat spray pattern for uniform coverage in broadcast spraying. Large rounded internal passage to minimize clogging.

High velocity water spray nozzles are use to cover the big area of the fields. These nozzles are used at one by one in the pipe. One nozzle is used to cover the area in the perpendicular to its flow and second is used to cover the area in the direction of flow. In this system we can also use the flat jet nozzles which can produce very high discharge

C. *Specification*

110 degree spray angle. 0.40 GPM at 40 psi
VP – polymer with VisiFlo color-coding
Pressure range 15 to 90 psi.
Best use pressure range 30 to 40 psi.
Drift management – very good

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At pressures below 30 psi – very good

D. Analysis

Nozzle discharge (GPM) = $\frac{\text{Travel speed x Nozzle spacing x Spray volume}}{5940}$

Where: Travel speed = miles per hour (mph)
Nozzle spacing = inches (in) for broadcast or band width
Spray volume = gallons per acre (GPA)

E. Pipes With L Shape

Here we use the pipes with L shape because their connection covered the large area of the field. One pipe is connected with another and the nozzles which are fixed in the pipe can cover the big area of the field by its parallel and perpendicular flow.

F. Water Tank

Water tank is use to mixed all the pesticide in one time and provide pesticide to the centrifugal pump for the spray.

IV. WORKING OF A SYSTEM

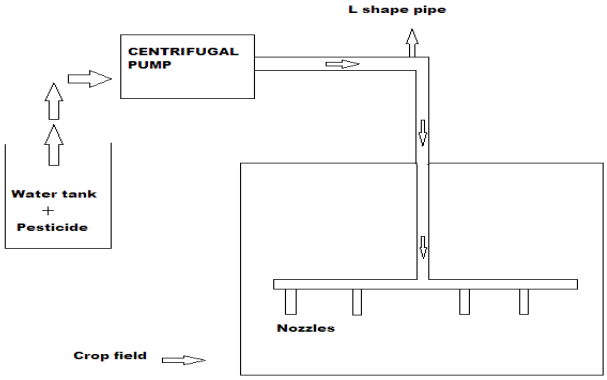




Fig 3: Complete layout of system with it's working.

A centrifugal pump is one of the simplest pieces of equipment in any process plant. Its purpose is to convert energy of a prime mover (electric motor or turbine) first into velocity or kinetic energy and then into pressure energy of a fluid that is being pumped. The energy changes occur by virtue of two main parts of the pump, the impeller and the volute or diffuser. The impeller is the rotating part that converts driver energy into the kinetic energy. The volute or diffuser is the stationary part that converts the kinetic energy into pressure energy. When the pump takes the liquid pesticide from the water tank then it pressurize it and this pressurize pesticide goes in multi nozzles with the help of pipe then the work of nozzles is to distribute this pesticide all over field.
In some cases when the pressure of water is very high or low then it can be regulated with help of the throttle valve which is

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mounted on the pipe with dial gauge.

Note: All of the forms of energy involved in a liquid flow system are expressed in terms of feet of liquid i.e. head.

V. RESULTS

A. The Human effort is zero during operation in the fields.
B. Less expensive in comparison to other sprays system.
C. Medium level of farmers can easily set this system in their fields.
D. Less time consuming in spraying pesticides comparison to other systems.
E. It can also spray the water on the leaf of the crop to remove other diseases.
F. This system would work in all weather**.**

VI. CONCLUSION

This suggested model has removed the problem of back pain, since there is no need to carry the pesticide tank on the back. Health problems from the pesticide during the spray will be zero. This model has more number of nozzles which will cover maximum area of spraying in minimum time & at maximum rate. The regulators can also be applied which helps in reducing the change of pressure fluctuation and regulator Valves helps to maintain pressure. Proper adjustment facility in the model with respect to crop helps to avoid excessive use of pesticides which result into less pollution .TurboTee jet nozzles provides better performance. Muscular problems are removed as there is no need to operate the lever. This alone pump can used for multiple crops.

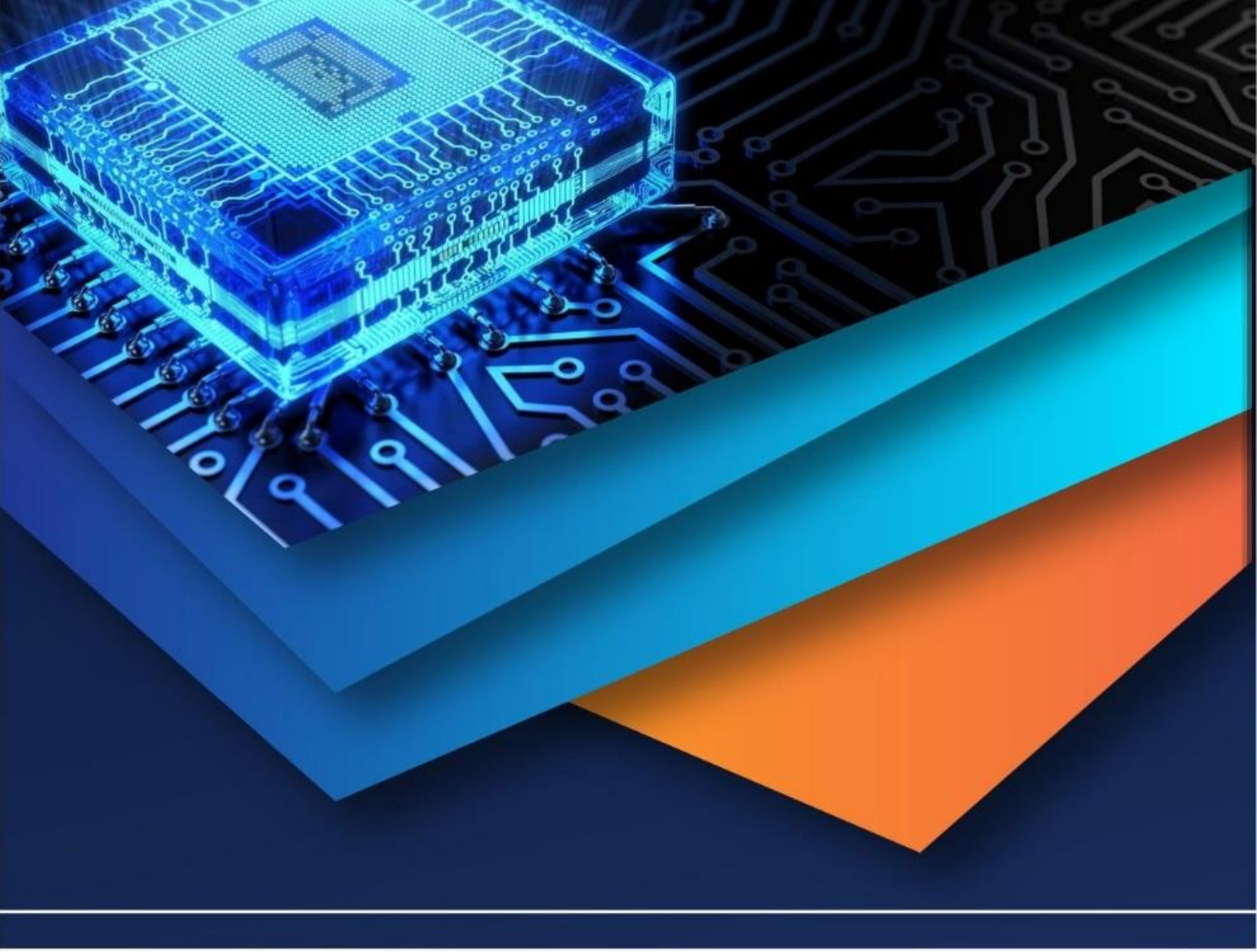
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