

# Design and Fabrication of Adjustable Multipurpose Sprinkler for Agricultural Use

Suryabhan A. Patil<sup>1</sup> Kiran P. Suryawanshi<sup>2</sup> Swapnil V. Kasar<sup>3</sup> Bhushan A. Burkule<sup>4</sup> Naresh A Jadhav<sup>5</sup>

<sup>1,2,3,4,5</sup>Guru Gobind Singh Polytechnic, Nashik, India

**Abstract**— Sprinklers are most important equipment for irrigation. In latest sprinkler there is simple installation of sprinkler. Only on sprinkler is use for plantation and its rotate 360°. So, what happen again and again that area is sprinkled with water so the wastage of water is more it is a disadvantage for farmers. The purpose of installation of project is to reduce the wastage of water. Now a day's farmers are facing problem because of pesticides. We neglect the interference of human during operation. Water as well as pesticides can be spray with the help of this sprinkler. Sprinkler system is very old method from many year ago and having long history since many years and their method of sprinkler system are changed in this decade. So, the main focus of this project is to minimize cost of system, safety of farmers, less water more crops benefit) for farmers.

**Keywords:** Fabrication, Sprinkler, Agricultural

## I. INTRODUCTION

Our Paper is based on agriculture "Adjustable Multipurpose Sprinkler". India is more focused on the agriculture with reference to census 2011 there are 118.9 million farmers across the country or 24.6% of the total manpower of over 481 million.

The population of country is increasing day by day foe which more production for fulfilling those needs our agriculture sector is unable due to use of traditional farming methods, lack of automation, land degradation, lack of knowledge and unavailability of sufficient water.

Irrigation is the artificial application of water to land for the purpose of agriculture production effective irrigation will influence the entire growth process from seedbed preparation, germination, root growth, nutrient, utilization, plant growth and regrowth yield and quality irrigation system is best for your operation requires knowledge of equipments system design, plant species, growth stage.

Our project adjustable multipurpose sprinkler will reduce loss of water loss of fertilizers. There are many diseases to farmers which is very dangerous to the farmers this sprinkler does not required any human contact. This adjustable multipurpose sprinkler is very useful for agriculture field.

## II. PROBLEM STETMANT

In agriculture field there are so many processes to spray the pesticides as well as water. In that bamboo method, pump method, are used. In this all processes there is always a person is required the operation of that machine or equipment. In that case there are much more chances of happening an accident with that person like harmful side effects of chemical pesticides, scene problems, health problems and in some cases, person occurs death due to unsafe condition in these all processes.

As well as the soil erosion is the big problem increasing day by day. Chemical pesticides used in agriculture are affects the soil. In pump irrigation method there is always a man is needed which carries the bag of pesticide on his back and spray the pesticide with pressing the lever by one hand and other hand is to direct the pesticide on plants. In this process a weak man cannot do this because it cannot carry the bag having such a heavy weight. This is only one example in this manner there are many problems situated in conventional process.

Some modern techniques are also available in market such as drone irrigation but these methods are difficult to operate by the farmers as that requires skill operator. There for there is a need to find out a device or equipment which fulfill this requirement of farmers. Therefore, we are introducing over project to fulfill these all needs of farmers.

## III. LITERATURE SURVEY

Agriculture ministry has proposed to ban three class I pesticides from 2018 and another four from 2021. Last year, the National Human Rights Commission had asked Maharashtra and the centre to treat farmers well since most of them are illiterate and hence, are the packet, but the farmers don't get any when they purchase the pesticides.

Oxide metonmethyl was banned in 49 countries, Phorate in 37 countries, Triazophos in 40 countries and Monocrotophos is banned in 60 countries. Farmer's only sources of any information on use or misuse of pesticides are dealers and manufacturers. Instead of having a single information platform on use of pesticides, conflicting instructions in disparate sources add to farmers' trouble...The lack of consensus between government organization leaves farmers with little or no information on which pesticide to use and how. Punjab recently set an example by banning Methomyl, Phorate, Triazophos and Monocrotophos, which are considered class I pesticides by the World Health Organization. Many foreign countries, too, have banned these deadly pesticides. Maharashtra in 2017 when pesticide poisoning had claimed lives of 21 farmers in Yavatmal district. It banned Monocrotophos, the deadly pesticide, for 60 days. But, on Tuesday (march 6), when the agriculture ministry told the lok sabha that pesticides have killed 272 farmers in the last four years in Maharashtra, no promises of reforms were made.

In Mumbai three pesticide companies find themselves facing trouble after at least 32 farmers from Vidarbha died of poisoning in the past few days. The state government registered a police complaint against the firms and Krishi Seva Kendras or agro-input centers for selling pesticides not recommended for the region. Yavatmal district lost 19 farmers—the highest toll so far—but deaths also were registered in Akola, Amravati, Buldana, Nagpur and Bhandara.



Fig. 1: Pesticide's warning symbol

When the pesticide is applied on the farm, the warning symbol is placed at the starting of the farm because of this the accident may not cause. If the warning message is not placed death may occur.

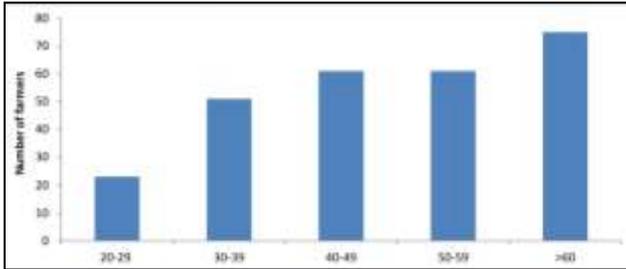


Fig. 2: Bar chart

As shown in the graph more than 50 ages the farmers are working for us.

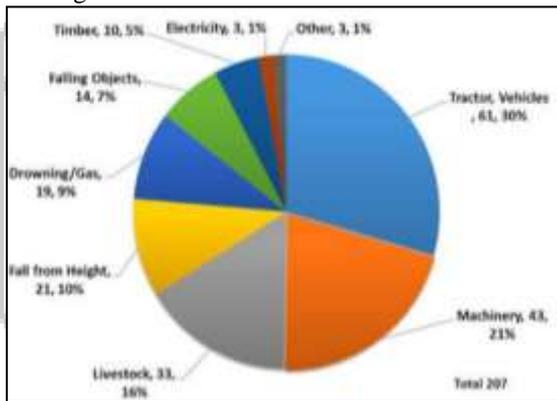


Fig. 3: Pie chart

As shown in pie chart maximum 30% death of farmers is occurring because of tractor. With the electricity the farmer's deaths are eliminated as our project will work on electricity.

During our survey we found many problems facing by farmers for reducing this problem we planned to do this project which is beneficial for the farmers.

#### IV. COMPONENTS DETAIL, WORKING AND CALCULATION SURVEY

##### A. Overview

Adjustable multipurpose sprinkler is agriculture-based project and it is used for spraying water as well as pesticides without interference of the human. By this equipment the process of irrigation gets simplified and modified due to faster rate of water and pesticides spraying with less time. It is simple in design, and it is understandable for farmers. It has higher productivity than traditional methods.

##### B. Construction



Fig. 4: Motor

##### 1) Motor:

Motor is placed at the top of the bottom plate. It is fixed with 4 panels at four sides. At the motor shaft the small pinion is placed. Watt- 90 , RPM-1350



Fig. 5: Dimmer



Fig. 6: Regulator

##### 2) Dimmer:

Dimmer circuit is connected to motor and it will change the rotation clockwise to anticlock wise direction and the speed is control with the help of fan regulator.



Fig. 7: Gear

### 3) Gears:

Two gears are used; one gear is pinion and other is spur gear. The pinion is mounted on motor shaft and other is mounted on pipe, the arrangement is that both the gear will be mesh together at slow rpm.

### 4) PVC pipes:

The centre rod as well as arm is of pvc material. For connecting the arm to the centre pipe, the T-pipe is placed at centre so at both the side water and pesticides will be spray.



Fig. 8: Rack & Pinion

### 5) Rack & Pinion:

The rack and pinion arrangement is used for arm extending process. At both the side the arrangement of rack and pinion is placed so it will cover maximum area. Rubber material is used for rack and Acrylic material is used for pinion.

### 6) Nozzles:

Nozzles are used for spraying the water and pesticides in downward direction. The nozzles are placed on the expandable arm with 3 holes in it and one and one at the end. Same for other side

### 7) Pump:

The pump is used for pumping the water as well as pesticides with

### 8) Tank:

Two tanks are used in first tank water will be there and in other tank pesticides will be there. If required water then water will be spray or than pesticides. It will assure safety of farmer.

### C. Working

Our project “Adjustable Multipurpose Sprinkler” is based on agriculture field. It has no interference of human between the processes. The motor is placed on bottom plate. On the shaft of motor pinion is mounted. On the side of the motor there will be another spur gear attached to the pipe where the pinion and spur gear will mesh together.

The height of the sprinkler will be adjustable. We have taken 3 size of different diameter of PVC pipe so they will go inside each other and will adjust with the help of bolt. The height of sprinkler will increase or decrease as per our requirements.

At the centre of rod T-pipe is fixed, and at the both side the PVC pipe is fixed at the certain length. The arm will expand at the certain length with the help of rack and pinion arrangement. The rubber material is used for pinion and acrylic material is used for pinion.

The nozzles are placed on expandable rod and at the end of rod. The slot is cut on fixed pipe because when the extending rod will come back that much area will cover and will again get forward. Water as well as pesticides will be spray. It will increase the safety of farmers. It is beneficial for farmers.

### D. Manufacturing process: -

#### 1) Welding Process

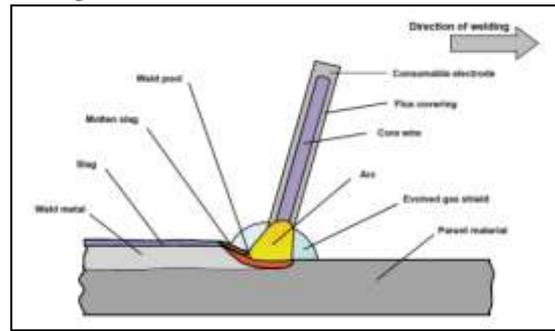


Fig. 9: Welding

A weld is made when separate pieces of material to be joined combine and form one piece when heated to a temperature high enough to cause melting. Filler material is typically added to strengthen the joint. Welding is a dependable, efficient and economic method for permanently joining similar metals. In other words, you can weld steel to steel or aluminum to aluminum, but you cannot weld steel to aluminum using traditional welding processes. Welding is used extensively in all sectors of manufacturing, from earth moving equipment to the aerospace industry. The number of different welding processes has grown in recent years. These processes differ greatly in the manner in which heat and pressure (when used) are applied, and in the type of equipment used. There are currently over 50 different types of welding processes

#### 2) Hand Drilling

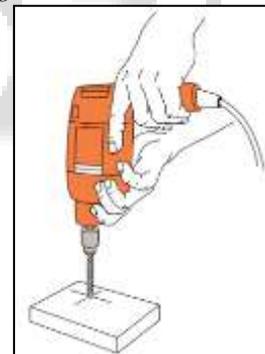


Fig. 10: Hand Drilling

A drill is a tool primarily used for making round holes or driving fasteners. It is fitted with a bit, either a drill or driver, depending on application, secured by a chuck. Some powered drills also include a hammer function.

Drills vary widely in speed, power, and size. They are characteristically powered electrically driven devices, with hand operated types dramatically decreasing in popularity and cordless battery-powered ones proliferating.

Drills are commonly used in woodworking, metalworking, machine tool fabrication, and construction and utility projects. Specially designed versions are made for medicine, space, and miniature applications.

### 3) Grinding



Fig. 11: Grinding

A grinding machine, often shortened to grinder, is one of power tools or machine tools used for grinding; it is a type of machining using an abrasive wheel as the cutting tool. Each grain of abrasive on the wheel's surface cuts a small chip from the work piece via shear deformation.

Grinding is used to finish work pieces that must show high surface quality (e.g., low surface roughness) and high accuracy of shape and dimension. As the accuracy in dimensions in grinding is of the order of 0.000025 mm, in most applications it tends to be a finishing operation and removes comparatively little metal, about 0.25 to 0.50 mm depth. However, there are some roughing applications in which grinding removes high volumes of metal quite rapidly. Thus, grinding is a diverse field.

#### E. The Different Components in the system

- 1) Gear
- 2) PVC pipes
- 3) Rack & Pinion
- 4) Bottom plate

Component	Material
Gear	Cast iron
Pipes	PVC
Rack & pinion	Rack- Rubber Pinion- Acrylic
Bottom plate	Mild steel

Table 1: Different components with material

#### F. Mechanical Material use

##### 1) Square bar



Fig. 12: Square bar

Size: - Length 30cm mild steel hollow structural section (MS) is a type of metal profile with a hollow tubular cross section. The reason to use the square bar is to support the whole structure of project. This bar is the most necessary as it is holding all the components.

### 2) Flat Strip Steel



Fig. 13: Flat Strip Steel

It is a steel product that is produced from a hot rolled strip that has been pickled. The coil is then reduced by a single stand cold roll steel mill straight away or reversing mill or in a tandem mill consisting of several single stands in a series. The strip is reduced to approximately final thickness by cold-rolling directly, or with the inclusion of an annealing operation at some intermediate thickness to facilitate further cold reduction or to obtain mechanical properties desired in the finished product. High carbon strip steel requires additional annealing and cold reduction operations. The coil is then slit to the desired width through the process of roll slitting. The reason is to use the strip is to support the battery at the three side

##### 3) Mild Steel Bottom Plate



Fig. 14: Mild Steel Bottom Plate

The reason to use the mild steel bottom plate is for mounting all the components of our project. It is a base of our project. The weight of this base is up to 12kg because it should handle all the components and the motor. It is the foundation of our project. While keeping in the farm during operation the sprinklers should not be moved or fall because of the air so we have taken maximum weight of the base

#### G. Use/ why metal gear?

In our project metal gear is meshed together for rotation for rotation of sprinkler because it should cover all the area under it. Plastic gears were also available we neglected to use plastic gear because the weight of PVC pipe is more than plastic gear when they will rotate it will give very minimum speed and the teeth will destroy. As the weight of sprinkler is more and we have to rotate the sprinkler so we have used metal gear for smooth rotation of sprinkler.

#### H. Use/ why PVC pipe?

PVC pipe is used for water and pesticides transformation to the sprinkler. Here we have taken three sizes of pipe for height adjustment of sprinkler. As first we have thought to use metal pipe for sprinkler then we thought that when water will transfer from the pipe some amount of water will splash on

the pipe thus it will corrode fast, from this problem the life of the sprinkler will decrease and this will be disadvantage of sprinkler so to avoid metal pipe we thought to use pvc pipe. PVC pipe are light in weight and its life is more than metal gear. All farmer preferred PVC pipe for their irrigation installation.

#### I. Use/ why rubber rack?

For expanding of sprinkler arm for a certain length the rubber rack and acrylic pinion is used. Metal rack is also available in market we neglect to use metal rack because the weight is too much than the expandable arms pipe it will not rotate or extend because of its high weight. As first we have told to use plastic rack and pinion it is difficult to get in market so we canceled it, then we thought to make wooden rack, it gets failed to make as it was not meshing with pinion, so finally we thought to used rubber rack and acrylic pinion.

### V. APPLICATION

- Agriculture purpose
- Water irrigation
- Gardening
- Deep irrigation (less water more craft)
- Use for flower field
- Use for food field
- Use for grain field

### VI. CONCLUSION

The Adjustable Multipurpose Sprinkler which we designed working is found to be satisfactory. The effort will be required less than motor and hand operated pesticide sprinkler.

The Gear and bearing gives the each operating and maintenance with less parts. Which reduces the weight. Our project is very useful for farmers as there is no interference between the operations.

The total cost which includes material and fabrication cost is Rs. 5000 and easy to operate

### REFERENCE

- [1] Chetan Choudhari, Gov. College of Engineering, Aurangabad, "Theoretical Development of Sprinkler", ISSN: - 2277-9655, Aug 2016.
- [2] Bala Ibrahim & Wan Ishak Wan Ismail, University Putra Malaysia, "Development of Sprinkler System
- [3] F.C.Das, Central Rice Research Institute, Cuttack, "Status and Prospects of Mechanization in Pesticides"
- [4] V.B.Bhandari, "Design of Machine Elements", Third Edition, McGraw Hill Education Private Limited
- [5] R.S.Khurmi&J.K.Gupta,A textbook of Machine Design,S.Chand Publication
- [6] R.S.Khurmi&J.K.Gupta,"Theory of Machines", S.Chand Publication
- [7] Dr.R.K.Bansal,A textbook of Strength of Materials Fifth Edition, Laxmi Publications (P) LTD
- [8] Prof.M.K.Agrawal, A textbook of Manufacturing process, Tech knowledge.