Design & Fabrication of Multipurpose Agricultural Vehicle
Vinay Shaha¹ Ayyaj Mulla² Ganesh Shinde³ Mayur Kumbhar⁴ Shailesh Mokashi⁵
¹,²,³,⁴,⁵Student
¹,²,³,⁴,⁵Department of Mechanical Engineering
¹,²,³,⁴,⁵Trinity Academy of Engineering Maharashtra, India

Abstract— India is an agricultural country cultivating more no of ground nuts, corns and various horticulture in the village side of the country. The available automatic machines are imported from foreign countries. The imported machines are not only bulk in size but also costing around rupees 1 Lakh. In this project the attempt has been made for the design and fabrication of Multipurpose Agriculture Vehicle exclusively for small farmers at cost not exceeding Rs.20000/- per unit with less maintenance. The different components of above multipurpose machine are modelled using CATIA. The modelled components are fabricated and assembled together to form a complete vehicle. A study has been carried out to develop multipurpose agricultural vehicle for performing major agricultural operations like spraying, fertilizing, ploughing. It will reduce the cost of spraying, pesticides sprinkling and crop cutting the field and will help to increase economic standard of an Indian farmer. The model does not need to use any kind of fuel or motor power as a power source. The design of multipurpose agricultural vehicle machine will help Indian farmer in rural side.

Key words: Spraying, Fertilizing, Ploughing

I. INTRODUCTION
The agriculture plays an important role in the Indian economy [1]. These areas are spraying pesticides, fertilizer insertion, plugging and many more. The basic task is to use an ideas and knowledge to invent some new techniques and equipment’s to improve the agricultural process to reduce effort and time required. For this purpose, by doing the survey of certain villages and by observing the available techniques of farming in villages, there is need of implementing certain new ideas and technique in the field of agriculture so that farmers will have comfort and safety in their work. Indian agriculture is undergoing a gradual shift from dependence on human power and animal power to mechanical power because increasing cost for upkeep of animal and growing scarcity of human labor. Further, use of mechanical power has a direct impact on the productivity of crops apart from reducing the labor and facilitating timeliness of agricultural operations. There is a strong need for taking farm mechanization. Multi-purpose equipment for field experiments needs to include modern technology, be affordable and meet tough requirements interchangeability, accuracy, reliability and maintenance. It must plant zero ploughing, reduced ploughing and cultivated ground with equal application to accommodate the change over from historical cultivation and accuracy without compromising the safety of vehicle. A multipurpose agriculture machine is an innovative machine designed to render agricultural production more efficiently and profitable. These devices can make the work easy but at the same time they are less expensive. In India, most of the farming work is done manually when compared with

1) Piston pump by hand operated mechanism.
2) Piston pump by electrical system operated.
3) General method of insertion of fertilizer

II. PROBLEM STATEMENT
To prepare a model which perform the multi operations like ploughing, spraying, fertilizing without using any power source like fuel or motor and the cost of machine should be less than available machines in market.

III. OBJECTIVE
1) To perform spraying, fertilizer insertion and ploughing operations
2) To control the quantity of fertilizer by fitting control valve to the pipeline
3) To perform ploughing operation along with spraying and fertilizer insertion operation
4) To reduce the weight of machine as compared to current machines used in farm

IV. LITERATURE REVIEW
Patil Nikhil V et al. [1] have studied some problems such as how to minimize the losses, how to increase productivity and how to minimize cost. In India, two types of agricultural methods are used, manual method (conventional method) and mechanize type method. Mechanization involves the use of a hybrid device between the power source and the work. This hybrid device usually transfers motion, such as rotary to linear, or provides ample of mechanical advantages such as increase or decrease or leverage of velocity. Agricultural machinery is machinery used in farming or other agriculture. The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. The benefit of agro automation is that it saves the labor cost. However, it also saves the energy and cost of materials and to improve the quality, accuracy, and nicety. The seed feeding, pesticides sprinkling and crop cutting are the important stages in the agriculture field. The design of multipurpose agro equipment machine will help Indian farmers in rural side and small farm. It will reduce the cost of seed feeding, pesticides sprinkling and crop cutting the field and will help to increase economic standard of an Indian farmer.

R Jaffar Sadiq et al. [2] carried out study to develop multipurpose agricultural equipment, for performing major agricultural operations like goods carrying, pesticide spraying, laddering, inter-cultivating and digging operations of sandy loam deep soils, to increase the efficiency and reduce the production and handling cost. Modification was carried out, and the modification includes fabricating a vehicle which is small, compact in size which can move easily across the fields. This vehicle was named as NCET kissan all in one. which consists of various agricultural implements like inter-cultivator ladder, pesticides sprayer, goods carrying container, plough, which can be easily
assembled and Dis assembled by a single person, the cost of equipment is less by 83% compared to a tractor. And 40% compared to a tiller.

V Maheshwari et al. [3] had done the research on how the robot system is used to develop the process of cultivating agricultural land without the use man power. The aim of the paper is to reduce the man power, time and increase the productivity rate. The entire basic automation robot works like weeding, harvesting and so on. Here the designing systems like ploughing the land, sowing the seed, watering the plant or spraying the fertilizer and navigate the vehicle motion. The first mechanism contains to navigate the assembly of the robot vehicle, whereas second mechanism is preparing the plough the land, seeding and watering it. This project can be very useful for farmers. Waghmare S. N. et al [4] have analyzed that human and animal efforts can be replaced by some advance mechanization which will be suitable for small scale farmer from economical and effort point of view. So, we are developing this equipment which will satisfy all this need and to solve labor problem. In this equipment we used 24cc engine for digging operation and for spraying used motor with 12V battery. Next two operations are manual base which is cultivation and sowing. This machine performs four farming operation (digging, sowing, cultivation, spraying) which is used small scale farming. By using above attachments, one may perform various farming operations in less time and economically. After the manufacturing and trial on the “Multipurpose Agricultural Automobile (Farm Machine)” conclusion which we made are as follows:

1. Based on the overall performance of the machine we can definitely say that the project will satisfy the need of small-scale farmer, because they are not able to purchase costly agricultural equipment.

2. The machine required less man power and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and we hope this will satisfy the partial thrust of Indian agriculture. So, in this way we solve the labor problem that is the need of today’s farming in India.

V. COMPONENTS WITH SPECIFICATIONS

A. Frame

The main function of frame is to carry whole assembly on it, so it has to be strong enough to sustain it. It is made up of mild steel by using welding operation. The frame dimensions are such that bio-fertilizer insertion system, spraying system and ploughing system are easily installed and operated.

Frame Size - 1220*760mm.

B. Storage Tank

The storage tank is designed in such a way that it carries almost 30 liters pesticide which is very high as compared to conventional machines. The storage tank is in cylindrical shape having diameter of 380 mm. Conventional machines use storage tanks made up of mild steel. In this project, material used for storage tank is plastic fiber. Plastic fiber has less weight as compared to MS & available at low cost.

Tank Diameter - 380mm

C. Handle

Handle is designed according to ergonomics and aesthetic consideration. Height of handle should be up to waste of man. Handle are design should be easy to operate.

Length of handle= 740mm

Width of handle= 610mm

Thickness of handle= 30mm

D. Stirrer Mechanism

For proper mixing of pesticide, in a given tank, stirrer is operated manually. At the bottom of the stirrer, square blades are attached for better stirring effect.

Height of stirrer-520mm

The blade of stirrer is in square type having dimension - 6x6mm

E. Flexible Pipe

The flexible pipe will be provided to carry the pesticide through tank to the outlet i.e. the nozzle. The pipes are selected to accommodate easy flowing of fertilizer grains during feeding operation and flow of pesticides without leakages and maintaining required pressure.

F. Wheel

There are four wheels arranging in the project for balancing of vehicle and to carry the total assembly on vehicle. Wheel of various sizes are already available in market with variable load carrying capacity & cost. In this project, wheel of 457 mm diameter is selected for providing sufficient height to vehicle for proper application.

G. Nozzle

The nozzles are made from brass and are non-corrosive. The nozzles are not designed specially and they are standard flat pan nozzles. In order to spray the pesticide over the crop, standard nozzle with diameter of 10mm is used.

H. Hopper

The main purpose of this hopper is to store the bio-fertilizer inside the tank. Two outlets are provided to the base of the tank through which fertilizers are inserted at the base root of the plant. There will be a one knob provided so that the required amount of fertilizer is directly inserted to exactly at the root of the crop. This is the main reasons why crop growth is better and there will be an increase of yield.

For top – 380x380mm2

For bottom – 70x70mm2

H. Chain Drive

To achieve speed of the vehicle, chain drive is used because use of fuel or motor is avoided. There is a one shaft provided in between two main horizontal shafts, on which small pulley and large pulley is mounted to perform spraying operation mechanically. Also chain and sprocket arrangement is done for ploughing operation.
VI. 3D MODEL OF VEHICLE

Fig. 1: D Model of Vehicle

VII. SYSTEM WORKING

According to the magnitude of force, the vehicle movement takes place. When the wheel rotates, the motion of wheel is transmitted to the piston pump. There is a pulley and belt drive arrangement, used for motion transmission. As the piston rotates, the spraying operation is performed. Discharge from pump is depending on the speed of vehicle.

Insertion of fertilizer is simply achieved due to gravity during fertilizing operation. To control the discharge quantity of fertilizer, control valve is used which is attached to the hopper pipe.

Ploubet teeth’s are welded on separate shaft which is attached near to the main horizontal shaft through metallic strips at the handle side of vehicle. Metallic strips are adjustable to maintain distance from ground surface. It’s depth of cut depends upon the applied force of handle.

VIII. CONCLUSION

In this way, by using multipurpose agriculture vehicle, at a time, spraying, fertilizing, ploughing operations are performed in efficient manner. The use of belt drive is effective to increase the speed of spraying operation. By doing multi operation, total cost of vehicle is reduced & also operation time and wastage is less as compared to conventional machine.

IX. FUTURE SCOPE

At ploughing side, ploubet system can be replaced by rotor blades to perform crushing of lime operation if required. By doing modification in basic design, seeding operation also can be performed. Also, ploughing arrangement can be made at both the sides to enhance grass removing process. To achieve the speed of operation, this vehicle can be used by using small tractor by providing knuckle joint at the handle.

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