



Review on Automatic Adjustable Techniques in Agriculture for Pesticides Spray

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ABSTRACT

Agriculture has been the backbone of Indian economy. It has to support 17 percent of world population with only 2.3 percent of world's geographical area, 4.2 percent of world's water resource, with 2 percent total consumption of world's total pesticide. To fulfill the need of food to the population agricultural sector is important. There are many applications in agricultural field where rate of utilization of new thing is slow. The one main application where rate of modernization is slow is pesticide spraying machine. By utilizing the new innovative things in these sector pesticides can be evenly distributed on farms which will reduce wastage of pesticide and hence prevents wastage of inputs applied on farms which reduces cost of production. By using modern techniques in pesticide spraying technology will lead to higher productivity with minimum input. Indian farmers are using some old spraying mechanisms which lead to wastage of pesticides with some hazardous ill effects on their health. Now day's some technologies are developed and some inventions are there in this field but they are not much suitable for Indian farming conditions.

KEYWORDS: *Agricultural engineering, agricultural machinery, unmanned aerial vehicle (UAV), precision, pesticide spraying, sprayer, Crop*

1. INTRODUCTION

The use of pesticides is an integral part of worldwide agriculture. Between 30% and 35% of crop losses can be prevented when harmful insects and diseases are eliminated by use of pesticides. Although pesticides are necessary in modern agriculture, they are poisonous and dangerous for humans and for the environment. Current methods for pesticide

application include a human operator traveling along the crop rows and selectively spraying the targets manually using a backpack sprayer [Fig. 1(a)], and mechanized non selective spraying in which a human drives a tractor with a sprayer connected to a trailer behind the tractor that sprays the crops continuously [Fig. 1(b)]. Despite the use of pesticide protection equipment (personal head mask and central filtration system for the manual and mechanized spraying methods, respectively) the human is still exposed to hazardous pesticides that can cause negative health issues. Besides health concerns, mechanized and manual spraying methods have other drawbacks. The mechanized spraying is not target specific and is designed to spray a crop strip with preadjusted height (e.g., for spraying just the grape clusters the farmer will press the spray nozzles to spray a strip 0.5 m wide with no consideration of the fruit location). Furthermore, manual spraying is tedious work, slow, and limited due to the lack of workers in agriculture. The use of spraying nozzles in modern industry is widespread for different applications such as cleaning, coating, fire suppression, and painting. Manufacturers offer a wide range of nozzles with manually adjustable spraying angles and even automatic spraying systems that can control the flow rate (e.g., Spraying Systems co, PulsaJet, and Auto Jet). Due to the nature of the products and applications in the industrial domain, the nozzle spraying angle is preset manually according to the designated target, which is well defined. In the agricultural domain, the targets have inherent high variability in size (e.g., watermelon and lettuce) and shape (e.g., grape clusters, cherry tomatoes, eggplant, kiwi, and strawberry) that requires adjusting the spraying coverage to the specific target. Extensive research has

been performed over the past two decades on spraying robots, mainly for the automotive industry, with a focus on path planning of the robotic arm and achieving uniform paint thickness layers. Several agricultural spraying robots have been developed for weed control and plant protection applications aiming to reduce the use of pesticides while preventing crop losses due to pests. The goal of this paper is to study the traditional techniques for pesticide spraying mechanisms.



(a)

(b)

Fig.1. Pesticide spraying methods. (a) Backpack sprayer: the human carries the pesticide and sprays manually. (b) Tractor sprayer: the human drives a tractor with spraying equipment.

2. Literature Review

Agricultural biota (e.g. seeds, insects, pollen, plant pathogens, etc) may be transported over long distance. It is important to understand the methods and techniques of airborne that transmit through the air, so as to minimize the propagation of unwanted species in crops that are important for human welfare. The long distance transport of biota takes place primarily in the planetary boundary layer of the atmosphere the layer of atmosphere extending from approximately 50km to 1km above the surface of the earth. Investigator have identified and characterized seeds, and fungi in the PBI. One of the techniques for characterizing specific airborne species is to collect samples at different altitudes under a variety of environmental conditions (e.g. day/night, temperature, humidity, and wind conditions.) One method that enables aerobiological sampling at various altitudes is the use of remotely controlled air craft designed to fly specific patterns and collect aerobiological sampling in the agricultural ecosystem. Agents that cause plant disease are through to travel long distances in the atmosphere and the transport mechanisms are not well understood.

In agriculture, the first UAV model is developed by Yamaha .Unmanned helicopter Yamaha RMAX was

introduced for agriculture pest control and crop monitoring applications. However, Yamaha stopped their production in 2007. A technical analysis of UAVs in precision agriculture is to analyze their applicability in agriculture operations like crop monitoring, crop height Estimations, pesticide Spraying , soil and field analysis . However, their hardware implementations are purely depended on critical aspects like weight, range of flight, payload, configuration and their costs.

You et al. studied the extent of the crop disease stress and acoustic emission, the relationship between environmental factors based on the transpiration rate temperature, humidity, light intensity and CO₂ concentration as a crop input precision spraying system. Miller et al. presented an experiment to determine the effectiveness of using a UAV for dispersing pesticides to reduce human disease due to insects. The purpose of that study was to perform non-chemical or least toxic chemical techniques to control pests and disease vectors. Huang, et al. have designed an agricultural spray system for small UAV including specialized electrostatic rotary atomizers. The use of multiple coordinated UAVs for spray application was presented by Wang, et al. Yan et al. proposed a study of map based automatic spraying pesticide system to targets in real time sensory technology. The performance of their system was not sufficiently strong. The requirement for low volume application, in consideration of limited payload capacity, was proposed by Ru et al. Sugiura et al. achieved the development of on-board monitoring systems to assist the ground-based observer about the situation of the UAV's status.

3. Pesticide spraying machine

Now a days spraying machine available with the manual involvements, these are Hand Sprayer, Tractor Mounted Sprayer, Aerial Sprayer, Bicycle Mounted Sprayer, and Motorcycle mounted sprayer.

3.1 Hand Sprayer

The hand sprayer is small with low capacity pneumatic sprayer made of chromium plated brass tank. The man is involved. The manual operation of this pump is has done by air pump which remains inside the tank. The sprayer uses the plastic tube to which adjustable nozzle is attached. For spraying tank is usually filled to about 70% of its capacity and pressurized by air pump. This compressed air causes mixture of pesticide to force out on operation of

trigger. It is commonly used for small nurseries, small or household gardens.



Fig.2. Handsprayer



Fig.4. Aerial sprayer

3.2 Tractor Mounted Sprayer

Tractor mounted sprayers are high capacity hydraulic energy sprayers which utilizes the power of tractor to operate pump. The complete spraying assembly is mounted on three point linkages of tractor. Spraying of pesticides is carried out through maximum of 20 nozzles depending upon make of sprayer and formation of crops. These nozzles are carried by spray boom which is adjustable depending upon height of plants. The overhead spray boom is useful for tall crops while ground spray boom is designed for small to medium heighted crops. This sprayer assembly consists of fiber glass or plastic tank, pump assembly, suction and discharge pipes with filters, pressure gauges and regulators, spray boom which all are designed for high pressure, high discharge conditions.



Fig.3. Tractor mounted sprayer

3.4 Bicycle Mounted Sprayer

Bicycle mounted sprayers is medium capacity innovative pesticide sprayers which utilizes the power of bicycle to operate pump. This is developed by Mansukhbhai Jagani, a Gujarat based farmer who is famous for his agricultural „Jugaad“. He simply made an assembly of modified sprocket-pump, tank, and an adjustable sprayer. This portable system is mounted on bicycle with drum carrying pesticide firmly attached to frame of bicycle. The reciprocating pistons of pump are connected to sprocket with chain linkage. Output of this pump is given to boom carrying number of nozzles. While pulling along the bicycle forward or backward movement of chain and modified sprocket arrangement is transferred to pump assembly which pumps air into tank to generate power for spraying. This pesticide spraying machine is not useful for every condition of agriculture in India.



Fig.5. Bicycle mounted sprayer

3.3 Aerial Sprayer

An aerial sprayer is high capacity sprayer which is beneficial for farmers having large farms. It uses modern technique in agricultural field. In this spraying is done with the help of small helicopter controlled by remote. Tank and spraying boom is attached to helicopter using various techniques. Spraying boom carries variable number of nozzles and spraying is worked out on farm from some altitude. This is rarely used in India as it is very costly

3.5 Motorcycle mounted sprayer

Motorcycle mounted sprayers is an innovative pesticide sprayers which utilizes the power of an engine to operate pump. This is developed by Ganeshbhai Nanjibhai Dodiya, a Gujarat based farmer. He just mounted his innovative sprayer on Enfield motorcycle which is powered by engine. The spraying of pesticides is done through a nozzle mounted on a spray boom installed at back of motorcycle. The pesticide filled tank is placed above

the pump and gravity ensures the pump gets automatically primed as fluid tends to flow into pump and flood the chamber. As this „Jugaad“ requires Bullet it is not affordable to every farmer in India.



Fig.6. Motorcycle mounted sprayer

4. Conclusions:

In this paper we review the development of mechanism of pesticide spraying machine. It is concluded that pesticide spraying machine is main factor in India for development of agricultural sector and increase the food productivity. So to improve productivity there is need of development in pesticide spraying machine in agriculture is needed. By using robotics we can efficiently reduce the effort of labors and uniformly spray the pesticide all over the farm. So there is need of development of user friendly, efficient and low cost robots in agricultural sector especially in pesticide spraying machine.

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