AgriCos e-Newsletter
ISSN: 2582-7049
Volume : 01 Issue : 03 July 2020 Article No: 58

Effective Control of Locust by means of Farm Mechanization

Kanade S.A.[1], Fartade A.C.[1], and Thakur P.S.[2]
[1]M.Tech Scholar, Dept. of Farm Machinery and Power Engineering, BCKV, Mohanpur, West Bengal
[2]M.Tech Scholar, Soil and Water Conservation Engineering, CAET, Godhra, Gujrat

SUMMARY

In this article an overview of locust management and its control is covered. The methods of controlling threat by most dangerous pest is discussed in brief. This includes the integration of remotely sensed and GIS data with efficient plant protection system. These locust outbreaks are now better controlled within shorter duration and decrease extent. Locust life tracked by remote sensing provides great advantage for determining control method to be adopted. Extreme impact by locust threat in past made it necessary to control it at primary stage. Which is accomplished by mechanization in farming. Modern technologies for pesticide application with computer technologies made it possible which includes power sprayers and unmanned aerial vehicles.

INTRODUCTION

Locust population density is predicted and monitored using the high technology information platform, such as global positioning system (GPS), remote sensing, geographic information system (GIS), and computer science. With this platform, operator get details about densities of locusts. Higher densities of locusts may be controlled by the use of chemicals where pesticides are sprayed mainly by Unmanned aerial vehicles (UAV) or by the use of reduced agent and area treatments (RAAT). A biological control is recommended for medium densities of the locusts. This control is achieved either at field where swarm will rest or in air while travelling towards vegetated area.

Effective Control Methods

Previously used controlled methods includes control by means of application of chemicals, biological agents and manually beating drums and making sounds. Each of the method is efficient for particular situation and season. Biological method is time consuming method of control and most probably used for lower density of locusts. For the huge swarm a chemical control is preferred. Which can potentially control locusts attack and prevent economic losses. This method includes use of advanced technology and tracking of locusts life cycle. The details about locusts swarm is recorded with help of GIS, GPS, Remote Sensing and computer technology. This data gives details about density of locusts, average age, speed of travel, time of breeding, vegetation available, etc. All these data determine the appropriate control method. For applying chemicals like pesticides various sprayers are available in the market. Most of them are tractor mounted, and used for spraying over land surface. But nowadays Unmanned aerial vehicles are widely used for spraying in air and it has advantage of not getting in contact with pesticide. It also increases the speed of operation, which can result in immediate action.

Mechanization used for Pesticide Application

The materials used for spraying are biologically active by nature; thus, their responsible use needs not only efficient mechanical systems but also attributes designed to protect non-targets, such as critical environmental areas, human and animal communities, non-target crops, application workers, and natural species. Improved vehicles, atomization devices, analytical methods for measuring spray drift and droplet size, and electronic on-board sensing and control systems have been developed to address these requirements. An equipment and techniques for the application of pesticides address a wide range of insect, pathogen and weed pests and a wide range of chemical and other means for their economic control. This category of agricultural equipment comprises a wide range of **ground** equipment as well as a wide range of **aircrafts**, both fixed and moving, used in livestock, forestry and pest and vector control, impacting humans, animals and plants.(Akesson & Yates, 1976)

Sprayers

A sprayer is a device used to spray a liquid. Liquid sprays are the most widely used formulation to control locust. Spraying involves breaking a liquid pesticide into droplets that are distributed across the target area. It has become an essential piece of farm equipment for efficient crop production today. With advanced technologies such as auto guidance, auto shut-offs, and Y-Drop, sprayers keep getting more sophisticated.A technique using much smaller quantities of spray liquid less than 5 L/ha, called Ultra Low Volume (ULV) spraying. It is 0.25-2 L/ha for aerial vehicles. It was initially developed in the 1950s for use against the Desert Locust in combination with Unmanned Aerial Vehicle (UAV), and now it is the most efficient method available. ULV spraying is considered to be the fastest and most cost-effective method of controlling locusts, provided the correct equipment is available and the control staff are trained in ULV spray techniques. ULV also known as controlled droplet application (CDA).

Ground Equipments

These equipments are used when there is controlling of locust over the field. Ground sprayer offers a fast and inexpensive way to destroy locust hoppers. A few days before hatching, the established Egg fields are sprayed so that hoppers die when they consume the sprayed vegetation. This method kills hoppers by depositing insecticide on the vegetation which they eat and this is successfully achieved by drifting a very fine spray over and in front the area they occupy. Prediction of such areas are done with the help GIS and remote sensing.

Power Sprayer

Power sprayers are used for high pressure development and high discharge to cover large areas. These sprayers are operated either with auxiliary engines or electric motors. For easy transportation the complete assembly is mounted on the stretcher type frame or on the wheel barrow. Depending on the model the number of lances will vary from 1 to 6. The pump extracts the spray liquid from the tank, imparts pressure energy and sends it to the delivery line. The target is then hit by directing lance in desired direction and operating trigger. The spray pattern is adjusted by adjusting the nozzle or by selecting the appropriate nozzle. Also, a bamboo lance can be used to deliver the spray liquid to large distances / height. Such sprayers can spray up to the height of 15 meters.

Tractor mounted Boom Sprayer

Field sprayer booms are an important part of the pesticide delivery system and may influence the accuracy and effectiveness of the application.

Depending on their use, booms come in all shapes and sizes and deliver the spray solution to the nozzles and tips at the desired target pressure (CJS Pannu et al., 2008). The sprayer essentially consists of a fiberglass or plastic tank, pump assembly, strainer suction pipe, pressure gages, air chamber, nozzle-fitted delivery pipe and spray boom. The sprayer is mounted on the tractor's 3-point linkages and utilizes the tractor's PTO power to operate the sprayer pump. It uses high pressure and high discharge pump, as the number of nozzles can be up to 20 depending on the requirements. There is a provision of raising the height of boom with increase in crop height.

Tractor operated Aero Blast Sprayer

Aero blast sprayer is useful for spraying on horticultural trees and tall crops, mounted on the tractor's 3-point link and powered by tractor PTO. The air blast distributes the chemical in the form of very fine particles over its swath width, which is on one side of tractor. The major portion of swath width is taken care of by the main blast through the main spout and the supplement nozzles cover the swath area near the tractor. It can cover up to 2.5 ha / h, with operating speeds varying from 1.5 to 1.75 km / h. Aero-blast sprayer causes low damage to vegetation and distance spraying can be achieved (CJS Pannu et al., 2008). The spraying is done by means of ultra low volume and very fine droplets. Operator should pay close attention to the direction of use. The volume of spray and the air stream velocity and volume can also be adjusted as per the requirement. The pump sucks and sends the liquid to the spray head, which atomise the liquid, while droplets meet the air stream in order to carry them towards the target.

Ultrasonic Sensor based Sprayer

A sensor-based tractor mounted automatic spraying system for detection of plant canopy and spraying of liquid chemicals over the detected plant canopy has been developed at IIT Kharagpur. The percentage savings of liquid with the sprayer are 25-30 percent for turbo nozzles, and 45-50 percent for hollow cone nozzles. Sensor-based spraying saves chemicals and lowers damage to the environment by reducing the amount of spray and pesticides application. The easily adjustable boom for height adjustment and nozzle tilt improved spraying efficacy. Turbo nozzle spraying with this sprayer is better compared to hollow cone nozzle spraying and no spraying mode (Tewari et al., 2018)

Unmanned Aerial Vehicle (UAV)

An Unmanned Aerial Vehicle (UAV) is a type of aircraft that operates without a human pilot on-board. Which is controlled by a pre-programmed flight plan or by remote control. This UAV-based agrochemical application technology is a high-efficiency alternative to conventional manual spray operations.

An Unmanned Helicopters under operation

Japan is the first country to use unmanned helicopters for the application of agricultural pesticides, and also one of the leading countries to successfully commercialize this technology. This system of UAV has quick response to the working rate and the adjustment of the target flow of pump with variable spray function. In a recent study by (Lian et al., 2019) it is found that the average control response time of system was 0.18s and its average stability time of pump flow change was 0.75s. UAVs are more suitable for complex terrain and small-sized farms with separate plots. Drones are used for ultra low volume spraying. These automated drones are integrated with spraying system and multi spectral cameras. The spray device is connected below the drone with a nozzle underneath the pesticide tank to spray the pesticide downstream toward the target area. The monitoring is done by the multi spectral cameras which simultaneously updates remote sensing unit. In single flight the UAVs can cover hectares of fields. The built-in GPS module maintains GPS co-ordinates for every image recorded. The GPS coordinates of those images are then stored in UAV to automatically spray pesticides without manual control. A pressure pump is a part of the drone-mounted sprayer system which squeezes the pesticide into the nozzle and the integrated circuit motor driver is used to pressure the pump as necessary. Nowadays drones are provided with mobile connectivity and offers fastest data transfer.

CONCLUSION

To keep land covered with vegetation continuous efforts towards controlling and monitoring are necessary. This controlling method need continuous improvements. An alternating method for locusts control should be practiced simultaneously. As locusts outbreak pandemic is international in nature it needs government involvement for better management and effective control. Preventive strategies should be adopted as it is economical and effective. which results in better control over outbreak within shorter time period. The

development is needed for adoption of UAV and other advanced machineries. UAV have great opportunities in developing countries like India.

REFERENCES

Akesson, N. B., & Yates, W. E. (1976). Recent developments in the application of herbicides by aircraft. *Weeds Today*.

CJS Pannu, I K Garg, Anoop Dixit, & Baldev Dogra. (2008). Spray Boom Set-up on Field Sprayers. *AICRP on Farm Implements and Machinery Central Institute of Agricultural Engineering*, 4.

Grasshopper—Wikipedia. (n.d.). Retrieved June 6, 2020, from https://en.wikipedia.org/wiki/Grasshopper

Lian, Q., Tan, F., Fu, X., Zhang, P., Liu, X., & Zhang, W. (2019). Design of precision variable-rate spray system for unmanned aerial vehicle using automatic control method. *International Journal of Agricultural and Biological Engineering*, *12*(2), 29–35.

Pandey, D., Shukla, A. K., & Shukla, A. (2013). *GIS: Scope and Benefits*. AET-2013-ISBN-978-81-927082-1.

Qian, P., & Zhen, Y. L. (2006). *Research and Application on Agricultural Ontology*. China Agricultural Science and Technology Press.

Riley, J. R. (1989). Remote sensing in entomology. *Annual Review of Entomology*, *34*(1), 247–271.

Tewari, V. K., Chandel, A. K., Nare, B., & Kumar, S. (2018). Sonar sensing predicated automatic spraying technology for orchards. *Current Science (00113891)*, *115*(6).

What is GIS? | Geographic Information System Mapping Technology. (n.d.). Retrieved June 11, 2020, from https://www.esri.com/en-us/what-is-gis/overview

Wilkie, D. S., Finn, J. T., & Finn, J. (1996). *Remote sensing imagery for natural resources monitoring: A guide for first-time users*. Columbia University Press.

Zhang, L., Lecoq, M., Latchininsky, A., & Hunter, D. (2019). Locust and Grasshopper Management. *Annual Review of Entomology*, *64*(1), 15–34. https://doi.org/10.1146/annurev-ento-011118-112500