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**Original Article****Drone Technology In Agriculture**<sup>1</sup>Neeraj, <sup>2</sup>Naveen and <sup>3</sup>Parveen<sup>1</sup>Ph.D. Scholar, Department of Agronomy,<sup>2</sup>M.Sc. Scholar, Department of Vegetable Science,<sup>3</sup>M.Sc. Scholar, Department of Agronomy

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**INTRODUCTION**

Agriculture is the backbone and primary source of income of Indian rural farming community, but still we are lagging in adoption of innovative technologies in agriculture. Indian farmers continue to use traditional methods of agricultural cultivation and field management. However, with the increase in the challenges posed by climate change, labour scarcity, fluctuating unpredictable market demands there is a growing need of novel ideas and technologies to enhance production on a sustained basis. One such novel and latest technological breakthrough is the use of drones in agriculture, which is slowly gaining recognition across the country. Drones, also called as Unmanned Aerial Vehicles (UAVs) or Unmanned Aircraft System that are piloted remotely are transforming the agriculture by offering precision, accuracy and efficiency.

Drones may perform a variety of agricultural operations which were previously time-consuming and labour-intensive, giving farmers the tools they need to optimize their yield and offering reduction in cost of cultivation along with conservation of resources. Use of UAVs can reduce the work load of farmers. UAVs are equipped with the cameras and sensors which can capture high quality and high-resolution images of the farm area.

**APPLICATIONS OF DRONE TECHNOLOGY IN AGRICULTURE**

**1. Monitoring of crop health:** Drones can easily monitor the crop health throughout the crop season. Need-based decisions and timely actions can be taken accordingly. Numerous multispectral indices can be computed based on the reflection pattern at different wavelengths by the use of various sensors pertaining to visible, NIR and thermal infrared rays. Accurate

assessment of the conditions of crops like nutrient stress, water stress, insect-pests infestation and prevailing diseases can be made through use of these indices. The sensors can easily detect the incidence of diseases, pests even before the appearance of visible symptoms. Thus, drone may contribute in early detection of the diseases. The UAVs are able to cover up hectares of fields in single flight. The quick real time basis sound decisions and appropriate actions can prevent yield loss. Use of drone technology will eliminate the need of visual inspection of the crops by the farmers. Monitoring of the dense crops and tall trees present in remote areas (like in mountainous regions) will become easy, which are otherwise challenging to scout physically by farmers.

- 2. Disease monitoring:** Drone equipped with infrared cameras can see inside plants giving a crystal-clear image of the prevailing condition. If a farmer can detect an infection earlier before its spread, preventative measures can be taken well in advance before the spread of the infection.
- 3. Efficient Weed Control:** Drone can capture high resolution images and can derive data from the whole field to generate accurate and precise weed cover map depicting the spots where weed density and growth is more and where the agrochemicals are needed the most. Spraying can be made possible under any field condition (muddy, weeds, insects-pest etc) through use of drone. Application of herbicide through use of drone is efficient, economical as it ensures optimal dose of herbicide by considering heterogeneity and spatial variability present in the field.
- 4. Mechanical pollination:** Drones can also function as a mechanical pollinator. Although insect vectors remain the most important pollinators, drones may eventually provide vital support to carry out pollination, particularly with the decline of bees. Drones are promising for effective transport and dispersal of pollen seeds in orchards or fields.
- 5. Aid in Precision Farming:** One of the most significant advantages of drones is their ability to conduct aerial surveys and provide real-time data of the soil and crop. Equipped with high-resolution cameras and sensors, drones can fly over large no. of fields to monitor plants growth, identify pests and diseases infestation and can detect nutrient and water stress easily. This allows farmers to apply fertilizers, pesticides, insecticides and irrigation only when and where needed in a particular part of the field. It will contribute to reduce wastage of inputs and improvement in the overall health of the soil and crops. This site-specific farming approach not only ultimately increases agricultural productivity but also reduces the environmental impact of agriculture by minimizing the use of agrochemicals.
- 6. Efficient application of agrochemicals:** Traditionally, application of fertilizers and pesticides in large fields required immense manpower and a lot of time. Through use of drone technology, farmers can apply these agrochemicals accurately, ensuring their even distribution and avoiding over use of these agrochemicals without bearing any labour cost. Drone reduces the health hazards associated with exposure to pesticides, as farmers have no need to handle these hazardous chemicals directly or spend long hours in the fields during spraying operations.
- 7. Early Warning Systems:** Another important benefit of drones in agriculture is their ability to provide early warnings of potential issues, such as disease outbreaks or pest infestations. Drones can easily detect subtle changes in colour of the leaves or growth patterns that may indicate the

actual problem. Immediate action can be taken by farmers to prevent the spread of diseases or pests, protecting their crops and can ensure better yield. This is particularly useful in Haryana, where pests such as whiteflies in cotton and diseases like rust in wheat can lead a devastating loss. Early detection through drones can save entire harvest, reducing financial loss to farmers.

**8. Accurate Mapping and Resource Management:** Drones also play a crucial role in land and resource management by creating accurate maps of fields. These maps may help farmers to plan irrigation systems, understand soil types and even design crop rotation strategies. In Haryana, where water scarcity is an ongoing challenge, drones can help farmers optimize their use of resources by providing detailed information on field topography and soil moisture level. This technology ensures optimal use of water and help farmers to conserve precious resources.

### **SUCCESSFUL EXAMPLES OF USE OF DRONE TECHNOLOGY IN INDIA**

Drone technology has the potential to revolutionize the Indian agriculture sector. By adopting drones, country farming community can ultimately secure better livelihood for themselves and can contribute to the nation agricultural success.

**1. Madhya Pradesh – The Bhavantar Bhugtan Yojana:** Under this government scheme, drones were used to assess the quality of Kharif season crops particularly soybean for better price realization and financial support. Drone-based surveys were carried out. It helped to ensure fair compensation for farmers when market prices were lesser than the cost of production. More accurate and quicker crop assessments benefitted the farmers of the state allowing for timely financial aid. This particular example represents how drone technology can contribute in crop monitoring and ensuring financial security for farmers.

**2. Use of Drone for spray of biopesticides on mango in Andhra Pradesh:** Drones have been extensively used for the spray of bio-pesticides on mangoes. The deployment of drones in mango orchards has reduced the time required for spraying from days to mere hours. Besides in improving operational efficiency it also ensures the even distribution of biopesticides across the orchards, protecting the crops from pests. Better fruit quality were achieved along with reduced labour costs.

**3. Crop Surveillance for Disease Management in Punjab:** Large-scale use of drones for crop surveillance can be observed in Punjab particularly for monitoring rice-wheat crop rotation. Drones have been used to detect early signs of disease, such as yellow rust in wheat. It enables farmers to take preventive measures on real time basis. It saved crops from being damaged by diseases and pests, reducing the need for chemical treatments and improving overall crop health.

### **CONCLUSION**

Drones have immense potential to revolutionize Indian agriculture. The use of drones may attract and encourage the youth towards agriculture as it reduces hard work and drudgery involved in agriculture activities. Farmers can understand and learn more about their farm through use of drones. Almost all farmers who have used drones have seen some sort of benefits. They can make better use of their resources, eradicate pests before they ruin entire crops, can monitor soil health to boost crop growth, can manage irrigation for dry areas and track fires before they spread. Therefore, in the upcoming future, drone may become part and parcel of agriculture by helping

farmers to conserve their precious resources, better management of their field in a sustainable way. With the potential to improve operational efficiency, reduction of costs and production of better yields, drone may prove to be a game-changer for indian peasants.