

## Use of Drone Technology in Agriculture: A Review

**Bhavana Tomar<sup>1</sup>, Pragya Verma<sup>1</sup> and Luxmi Kant Tripathi<sup>2</sup>**

<sup>1</sup>Research Scholar Department of Soil Science & Agricultural Chemistry, School of Agriculture, ITM University Gwalior (M.P.)

<sup>2</sup>Assistant Professor Department of Soil Science & Agricultural Chemistry, School of Agriculture, ITM University Gwalior (M.P.)

### SUMMARY

As mentioned before, agricultural drone technology is undoubtedly the future of the Indian agrarian community. It can transform traditional farming methods in uncountable ways. Even though this technology is more complex to be familiar with, it will yield its results in no time once learned. Farmers must understand the entire process. Determination of goals, creating an equilibrium in the drone and software utilized, and being familiar with the principles of using such technology will stand as a challenge. The farmers will inevitably need comprehensive training or partnerships with third-party experts in the drone industry for the acquisition of reliable data. Drones have changed the course of obtaining data in almost every type of industry, and will only seem to become bigger and better in the coming years.

### INTRODUCTION

An agricultural drone is an unmanned aerial vehicle used to help optimize agriculture operations, increase crop production, and monitor crop growth. Sensors and digital imaging capabilities can give farmers a richer picture of their fields. Using an agriculture drone and gathering information from it may prove useful in improving crop yields and farm efficiency. The aerial view provided by a drone can reveal many issues such as irrigation problems, soil variation, pest and fungal infestations. Multispectral images show a near-infrared view as well as a visual spectrum view. The combination shows the farmer the differences between healthy and unhealthy plants, a difference not always clearly visible to the human eye. Thus, these views can assist in assessing crop growth and production. Crops can be surveyed at any time using agricultural drones, allowing for rapid identification of problems.

### What is Drone?

Unmanned aerial vehicles (UAV), commonly named drones, are small aerial platforms weighing up to 20 kg (50 lbs). Due to their size, they cannot be boarded by a human body (yet). Drones can be operated in two ways; directly, in which a human has complete control of the vehicle by wireless remote; and autonomously, in which the vehicle is able to control itself and follow a route based on the data from GPS or other sensors.



### Use of drone in Agriculture-

There is different way we can used drone in agriculture. Which is given below:

#### Soil Analysis for field planning:

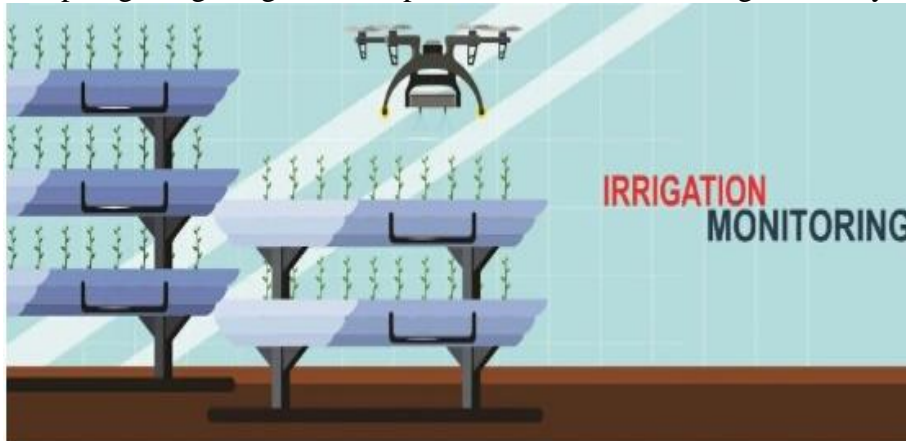
Drones can be used for soil and field analysis for irrigation, planting planning and nitrogen level in soil. Along with this, drone is helpful to produce accurate 3-D maps that can be used to conduct soil analysis on soil properties, moisture content, and soil erosion.

### Seed Pod Planting:

Although invented but seldom prevalent just yet, some companies have come up with additional attachment below the drone systems able to shoot pod containing seed and plant nutrients into the already prepared soil. This is helping to reduce planting costs.

### Crop Monitoring:

Crop monitoring is the biggest headache not only for farmers, but also various other stakeholders associated in agriculture operations. This challenge has got worse also with rise of unpredictable weather patterns, which lead to rising crop loss risks and maintenance costs. Drones can be used to set its monitoring routes by gathering multispectral geospatial and temporal datasets at pre-defined scales that relate to crop development and health. Data analytics help in getting insights on crop health much before being visible by manual field scouting.



### Crop Spraying:

Drones can carry suitably sized reservoirs, which can be filled with fertilizers, herbicides, or pesticides for crop spraying on large areas in less time. Crop spraying is much safer and cost-effective by its autonomous and pre-programmed run on specific schedules and routes. Drones are also programmed to self-adjust its altitude and speed using ultrasonic echoing, TOF lasers and GNSS signals to achieve uniform and optimum spraying results across varying topography. Smart farms use drones for agriculture spraying, which reduces the contact of humans with fertilizers, pesticides and other harmful chemicals. Drones are also un-comparable when it comes to spot treatment automated with stress detection technology which uses sensors and cameras and work on them while leaving the healthy parts intact. Drones enhances spraying capacity up to five times faster than with traditional machinery.



### Irrigation:

Drones loaded with thermal, multispectral or hyper-spectral sensors can identify the parts of the field with moisture deficits using multispectral indices. This helps in planning timely irrigation to the identified areas with precision.

**Crop health assessment:**

Plants reflect visible & near-infrared light and its intensity varies with health status and stress levels experienced by plants. Drones fitted with sensors capable of scanning crops using visible and near infrared light can be used to track crop health over period of time and also to monitor response to remedied measures.

**Crop surveillance:**

It is nearly impossible to estimate the overall state of crops in large fields. Drones based agriculture mapping can help farmers remain area-wise updated on the plants status and point out which field areas require attention. Drones inspect the field with infrared cameras and determine light absorption rates to estimate the state of crops. Based on real-time and accurate information, farmers can take measures to improve the state of plants in any spot of the field. This feature of crop surveillance and crop health assessment also forms the basis of the use of drones for enhancing agricultural insurance tools for cross verifying farmers' insurance claims. However, financial implications vis a vis insurance model adopted and practical possibilities will decide the future potential use.

**Controlling weed, insect, pest and diseases:**

Apart from soil conditions, drones can also detect and inform farmers about field areas inflicted by weeds, disease and insect pests. Based on this information, farmers can optimize the use of chemicals needed to fight infestations, hence reducing the expenses and also contribute to better field health.

**Tree/crop biomass estimation:**

Crop/tree canopy density and distance from ground surface can be measured using ultra compact LiDAR sensors mounted on drones. This enables estimation of the tree/crop biomass change derived from differential height measurements that forms basis for estimating timber production in forest and production estimates in crops like sugarcane.

**Scaring birds:**

Birds are the major problem after sowing seeds of many crops. This needs labour to protect the field. A couple of drone flights can scare the birds away from field.

**Benefits of Drone Technology-**

As innovators introduce new technologies, their commercial uses increase day by day. The government has been easing restrictions for drone usage and is supporting startups to come up with novel ideas. As drone surveys become more common, they also become more cost-effective. In agriculture, they have a plethora of advantages. Some are as follows:

- **Enhanced Production** - The farmer can improve production capabilities through comprehensive irrigation planning, adequate monitoring of crop health, increased knowledge about soil health, and adaptation to environmental changes.
- **Effective and Adaptive Techniques** - Drone usage results in regular updates to farmers about their crops and helps develop strengthened farming techniques. They can adapt to weather conditions and allocate resources without any wastage.
- **Greater safety of farmers** - It is safer and more convenient for farmers to use drones to spray pesticides in terrains challenging to reach, infected areas, taller crops, and power lines. It also helps farmers prevent spraying the crops, which leads to less pollution and chemicals in the soil.
- **10x faster data for quick decision-making** - Drone surveys back farmers with accurate data processing that encourages them to make quick and mindful decisions without second-guessing, allowing farmers to save the time invested in crop scouting. Various sensors of the drone enable capturing and analyzing data from the entire field. The data can focus on problematic areas such as infected crops/unhealthy crops, different colored crops, moisture levels, etc. The drone can be fixed with several sensors for other crops, allowing a more accurate and diverse crop management system.

- **Less wastage of resources** - Agri-drones enables optimum usage of all resources such as fertilizer, water, seeds, and pesticides.
- **99% Accuracy rate** - The drone survey helps farmers calculate the precise land size, segment the various crops, and indulge in soil mapping.
- **Useful for Insurance claims** - Farmers use the data captured through drones to claim crop insurance in case of any damages. They even calculate risks/losses associated with the land while being insured.
- **Evidence for insurance companies** - Agricultural insurance sectors use Agri-drones for efficient and trustworthy data. They capture the damages that have occurred for the right estimation of monetary payback to the farmers.

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