

Transforming Agriculture from the Skies: An Introduction to Drones in Farming

(*Upasna Digarse¹, Prajjawal Digarse², Ashutosh Singh Rajpoot¹ and Varsha More¹)

¹Jawaharlal Nehru Krishi Vishwavidyalaya, College of Agriculture, Jabalpur

²COA, Mandour, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior

*Corresponding Author's email: upasnadigarse4@gmail.com

In recent years, the integration of cutting-edge technology has revolutionized traditional agricultural practices, and one notable innovation making waves in the farming landscape is the use of drones. Drones, also known as unmanned aerial vehicles (UAV), are increasingly being used for agricultural purposes, and this is considered the most recent advancement in this sector. Drones' primary role in agriculture is to support evidence-based planning and data collection. Often referred to as "drone farming" or "precision agriculture," this technology has the potential to significantly enhance efficiency, productivity, and sustainability in the agricultural sector. Drones, equipped with advanced sensors and imaging technology, offer a new perspective on farming, allowing for precise monitoring, data collection, and decision-making. Drones were typically developed for military, humanitarian relief, disaster management, and other purposes. The use of unmanned vehicles is rapidly spreading into the crop production sector. The major areas where it is being utilized are:

- Crop production
- Disaster risk reduction
- Forestry
- Fisheries
- Wildlife conservation

The unmanned aerial system has the airborne portion, which is controlled by a pilot remotely situated elsewhere via a ground control station through wireless connections. The system can be programmed manually or it can also be operated automatically through programmed services. The size and shape of the drones depend on the type of service they offer.

Potential of drones in agriculture

The basic use of a UAS is to help farmers get a birds eye view of their crops so that they can detect subtle changes that cannot be readily identified by scouting crops at the ground level. These devices can collect multispectral images through the sensors attached to them. The images are stitched to generate spectral reflectance band, which can be utilized to calculate indexes such as Normalized Difference Vegetation Index (NDVI), Leaf Area Index (LAI) and the Photochemical Reflectance Index (PRI)



The NDVI speaks of different biomass levels in the soil, water stress, nutrient deficiencies, pest infestation, crop diseases, etc. The information provided by the NDVI is built upon through field visits and dedicated algorithms. These algorithms help as a guide for providing fertilizer inputs to the crops. The remotely sensed data helps to speed up the process of conducting crop inventories and yield estimates. The UAS technology can also be used to document the illegal land and resource use.

Improving agricultural productivity

The most important applications of drones are discussed below:

- **Soil and field analysis** - 3D maps are created by the drones and are later used for the design of planting seeds and also for the generation of data types with many applications like nitrogen-level management.
- **Crop monitoring** - this is done by the process of satellite imagery, but has some major drawbacks like too costly, imprecise images, poor weather has a bad impact on the data quality.
- **Water control and drainage** - drones monitor the crops frequently and provide regular update for the development and improvement of crop yield.
- **Health assessment**- drones generate multi-spectral images of crops that help in the analysis of health and maturity of the crops. An early detection of a bacterial or fungal infection helps in quick remedial action.
- **Irrigation**- drones detect hydric stress in the farm lands, i.e. if there is any inadequate supply of water, then the infrared and thermal sensors provide the data of areas that get too little supply of water and help in quick action.
- **Crop spraying** - drones have the ability to adjust to altitudes and flight paths according to the topography and the geography of the region. This helps the drones to scan the ground and apply liquids with great precision. The spraying action by the drones is estimated to be five times faster than the normal spraying method.
- **Aerial Planting**- planting done by the drones is a technology still under development and is considered to be an effective way of reducing labour costs during farming.

Challenges Involved in Drone Farming

Though the technology of drones has a great potential to transform the agriculture industry, there are still several obstacles for their progression beyond the small place they occupy in the market. These problems are:

- **Financial situation of the farmer:** The agriculture industry is a low margin business for many farmers with the need for financial assistance from the government during adverse weather conditions. Drones need large investment and technical expertise to be acquired and utilized.
- **Quality of data captured in Drone Farming:** The quality of data produced by the drones has to be of good quality so as to provide precise and accurate information. The speed of data collection and the flexibility of the drone usage are secondary parameters that are considered important only next to quality. The integration of new sensors, cameras, and processing technologies can help improve the quality of data captured by the drones.
- **Modernising the ability of farmers:** Farmers have to adapt themselves to modernized production practices so that they can earn good returns for their investments. Farmers can access the technology only if they

Pros and cons of drone farming technology

The positive effects of using drones in agriculture are:

- Higher yields
- Time management
- Better returns on investment
- Easy to handle
- Integrated mapping
- Imaging the crop health
- Drones are failsafe (i.e. They fly back home)
- Check water efficiency and other environmental factors

The negative impact of the use of drones is:

- Flight time estimation and range
- High cost of purchase
- Laws for using such technology
- Airspace interference
- Connectivity issues
- Weather dependency
- Ability or skill to use the tool

Conclusion of Drone Farming

Drone use in agriculture is limited in India due to land size. Drone farming would be the future in areas where there is a lot of plain land. Drone farming has emerged as a transformative force in the agricultural landscape, revolutionizing traditional practices and offering a spectrum of benefits that extend from improved efficiency to enhanced sustainability. The integration of drone technology in agriculture has provided farmers with a powerful tool for precision farming, enabling them to make data-driven decisions that optimize resource use, increase yields, and mitigate environmental impact. As the technology matures and becomes more affordable and accessible, drone farming has the capacity to play a pivotal role in shaping the future of agriculture, promoting sustainability, efficiency, and resilience in the face of evolving global challenges.