THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
Oct, 2023; 3(10), 2605-2608

Popular Article

Drones: Revolutionizing Indian Agriculture

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https://doi.org/10.5281/zenodo.10029331

Abstract

India's economy is mostly based on agriculture. For the vast majority of rural households, agriculture continues to be their main source of income. A significant amount of India's exports are agricultural products, which are another important component of its economy. Despite the growing importance of agriculture, the industry is still lagging behind in terms of technical development. The main causes of this situation have been cropping failure owing to unfavorable weather and unmanaged pest problems. Researchers, farmers, and managers of natural resources must understand how plants, animals, and landscapes as a whole are impacted by shifting environmental conditions and other stresses in order to maximize resilience and productivity. A promising method for describing landscapes, specific plants and animals, and the numerous pressures they face is remote sensing with drones

There have been just too many advances in precision agriculture in recent years to not increase crop output. Over 70% of the rural population relies on agriculture, particularly in developing nations like India. The illnesses cause severe losses in the agricultural lands. Despite how heavily India depends on agriculture, it still falls far short of incorporating cutting-edge technologies to create high-quality farms. Precision agriculture monitoring is crucial for supplying essential ideas for improving agricultural productivity and food management. Precision agriculture is a crop management idea that is more beneficial for increased productivity and is field-specific. In order to make better decisions for increased productivity, precision agriculture uses real-time data from sensors and geospatial tools (remote sensing, geographic information systems). The most recent development is the use of drones or other unmanned aerial vehicles for precision agriculture. An aircraft that can fly without a human pilot and is controlled by radio channel is called a UAV or drone. Drones have a wide range of uses.

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Published: **21.10.2023**

The use of land vehicles to monitor various agricultural processes in conventional farming methods required a lot of human labor and time. Drones are a better option for agricultural operations than traditional techniques. Due to their most amazing qualities, using drones in agriculture has a significant positive impact on both time and money. Numerous studies conducted in recent years have shown that drones can cover an area that is nearly 10 to 15 times larger than what can be reached using conventional land-based methods. Computers can control drones based on their capabilities, allowing them to be automated over a wide region, locate remote areas, and even be semi-automated. Because of their effectiveness, drones can be utilized for a variety of agricultural tasks some of which are discussed in detail as under:

a) **Mid-Season Crop Health Monitoring:** The most common use of drones in farming is to use near-infrared (NIR) or normalized difference vegetation index (NDVI) sensors to scan crop growth from a height of roughly 100 metres. Traditionally, this job was carried out by often-reluctant college interns who entered the fields with a notepad. Modern drones enable the capture of data that cannot be seen by the human eye (such the NDVI or near-infrared), as well as the covering of a larger surface area in a shorter amount of time. Additionally, it greatly reduces human error in traditional inventory work, while it is still advised to physically verify a potential problem location after viewing the picture. Crops in production of agriculture can be damaged in a variety of ways that result in structural or spectral changes. Weather-related structural change can be brought on by things like wind and hail. Drone mapping can help to locate and quantify crop damage caused by weather-related events as well as a wide range of other factors, such as insects and illnesses. These adjustments can range from subtle, like a modest shift in the vegetation index, to drastic, like a complete change in colour, like when sooty mould covers the leaves of sorghum. The user may choose to do this kind of inspection. Drone inspection intervals are now being researched to complement current mapping assets like satellites and manned aircraft.

b) **Irrigation management:** One of the biggest issues facing agriculture today is the scarcity of water, and pressure on water resources is predicted to grow in the future. In order to protect crops from drought-related losses, water management systems that can adapt to shifting water demands almost instantly are needed. To do this, it is necessary to have reliable data that reflects emerging water deficits before those shortages result in loss of production. To measure the loss of soil moisture in the soil profile, soil moisture sensors are normally placed at a few carefully chosen sites around the field. To determine the amount of water needed, irrigation system managers used data from soil moisture sensors along with knowledge of the crop type,

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soil properties, and climatic factors including temperature, precipitation, and humidity. By improving the efficiency of data generation, drones can significantly contribute to the evolution of irrigation systems. Under a wide range of environmental circumstances and with unmatched levels of data generating efficiency, aerial sensing devices can give a reliable spatial and temporal assessment of crop water stress.

c) **Weed management:** Drones have advantages in this application because of the great degree of flexibility in spatial resolution. Weed mapping is a frequently utilized application of remote sensing in agriculture. In terms of how the aerial mapping phase is carried out and the imagery is analyzed, the difficulty of mapping weeds is identical to that of mapping seedling emergence. Farmers and their agronomists may readily distinguish between areas of high-intensity weed proliferation and healthy crop areas growing next to them using NDVI sensor data and post-flight image processing to build a weed map. Typically, multispectral photography is best suited for mapping weeds in crop fields. To ensure understanding of the morphology, phenology, and ways in which they differ from crop species, the agronomist must collaborate closely with the image analyst when mapping weeds.

d) **Nutrient management:** The use of drones to inspect the soil is one of their main applications. In the conventional method of farming, there are many steps involved in inspecting the soil, including physically visiting the site and inspecting the soil sample for various factors. In contrast, the drone is equipped with a variety of censors and highly developed equipment for precisely inspecting the soil and providing accurate reports. For the goal of improving Nitrogen, Phosphorus, and Potassium applications in agriculture, ground-based inspections combined with satellite imaging, together with a dedicated grid soil sample programme, are more viable.

e) **Agriculture spraying:** Since drones are flying devices, a spraying technique can be used to effectively deploy them in agriculture for smart farming. Drone sensors will gather data from agricultural areas, and depending on the need, fertilizers and pesticides will be sprayed on the necessary crops. These technologies are helpful in situations where human interaction is not possible, such as when there is a labor shortage. The drones can also detect the diseased crops and the severity of the illness. Based on the severity of the infection, certain crops will receive fertilizer applications while pesticides won't be applied to healthy crops. With the automation of currently manned aerial application aircraft, this small-scale application could potentially result in large-scale application. A specific application of solids is found in the large-scale planting of trees, where drones release biodegradable seed capsules into the soil.

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Conclusion

Farmers in the agricultural industry can profit from drones in a variety of ways, including higher productivity, better yields, and lower expenses. Farmers may be hesitant to accept this technology due to worries about job loss, a lack of expertise, and inadequate training. While drone technology acceptance in rural India is still in its infancy, initiatives are being made to overcome these issues and advance drone use in agriculture. It is crucial that farmers comprehend the potential advantages of this technology and get the support and training they need to use it successfully. It is crucial that farmers and policymakers collaborate to ensure that the advantages of drone technology in agriculture are realised while also addressing any worries or issues that may arise. By doing this, we can contribute to the development of an agriculture sector that is more productive and sustainable and that benefits both farmers and consumers.

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