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## DRONES IN AGRICULTURE: PRECISION, MONITORING, AND MANAGEMENT

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### Abstract

The usage of drones in the agricultural sector is progressing swiftly. From crop scouting to field security, drones are being adopted widely on both large and small farms. They play an important role in precision agriculture, facilitating collection of real-time field data. This data supports farmers in making informed agronomic decisions related to planting, irrigation, and input management to achieve optimal yields. Drones also aid in efficient spraying of fertilizers, pesticides, and other treatments, significantly reducing labour requirements and ensuring uniform and targeted application at a lower cost. Furthermore, they are instrumental in monitoring plant health, creating accurate field maps, and even supporting irrigation management—making them an indispensable tool for modern, data-driven farming.

### Introduction

Drones are increasingly integral to modern large-scale precision farming. By collecting detailed field information at specific heights and times, they help farmers make informed decisions on planting, input use, and overall crop management to maximize yields. They are especially useful for monitoring plant health, evaluating field conditions, directing planting and seeding, enabling accurate chemical

spraying, and managing irrigation through drone technology.

### Monitoring field conditions

Drones can make precise field maps, including elevation data, that enables farmers to identify undulations across their fields. Some drones are armed with advanced sensory systems that estimate soil nitrogen levels, helping optimize fertilizer application help identify and improve poorly performing sections of the field.

### Planting and seeding

Automated drones are increasingly used in forestry, where a fleet of just 10 drones can plant approximately 400,000 trees in a single day.

### Spray application

Drone sprayers minimize the need for farmers to manually traverse fields with backpack sprayers. They deliver fine, targeted applications of chemicals, maximizing efficiency, saving on input costs, and significantly reducing labour and time requirements.

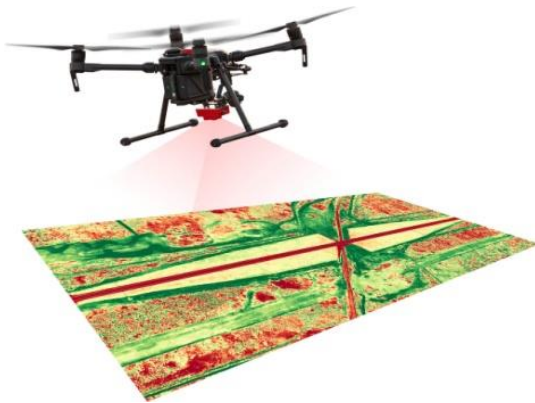
### Drone Irrigation

Drone-based irrigation is increasingly important as climate change intensifies drought conditions. It allows precise water delivery, reducing waste, conserving resources, and maintaining optimal soil moisture. With integrated sensors, drones permit real-time

irrigation adjustments, supporting efficient and climate-smart agricultural practices.



**Fig. 1 Spraying of chemicals through drone**



**Fig. 2 crop monitoring through drone.**

### Monitoring plant health

Drones equipped with specialized imaging technology, such as the Normalized Difference Vegetation Index (NDVI), capture detailed colour information to assess plant health. While farmers can use satellite imagery to monitor crop growth, density, and coloration, analysing such data is quite expensive. However, drones can capture high-resolution images at the field level, allowing farmers to detect gaps between plants or rows for replanting, as well as identify early indications of pest and disease infestations. Consequently, farmers can respond swiftly, mitigating losses and controlling the spread of pests and diseases.

### Conclusion

Drone technology is revolutionizing the agricultural sector by offering innovative

solutions to age-old challenges. From precision farming and crop monitoring to efficient pesticide application and yield estimation, drones are empowering farmers with real-time data and increased operational efficiency. As technology becomes more affordable and regulations evolve, drones are set to become an integral part of modern agriculture—promoting sustainability, reducing costs, and improving productivity. Embracing this shift is not just an option but a necessity for the future of farming.

### References

1. Dutta, G. and Goswami, P., 2020. Application of drone in agriculture: A review. *International Journal of Chemical Studies*, 8(5), pp.181-187.
2. Guebsi, R., Mami, S. and Chokmani, K., 2024. Drones in precision agriculture: A comprehensive review of applications, technologies, and challenges. *Drones*, 8(11), p.686.
3. Muraru, S.L., Cardei, P., Muraru, V., Sfiru, R. and Condruz, P., 2019. Researches regarding the use of drones in agriculture. *International Multidisciplinary Scientific GeoConference: SGEM*, 19(6.2), pp.683-690.
4. Nazarov, D., Nazarov, A. and Kulikova, E., 2023. Drones in agriculture: Analysis of different countries. In *BIO Web of Conferences* (Vol. 67, p. 02029). EDP Sciences.
5. Singh, N., Gupta, D., Joshi, M., Yadav, K., Nayak, S., Kumar, M., Nayak, K., Gulaiya, S., Ashutosh Singh Rajpoot. (2024). Applications of drone technology in Agriculture.