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Drones and the Future of Indian Farming

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Agriculture is the backbone of the Indian economy and provides livelihood opportunities to a large proportion of the country's population. However, Indian agriculture faces several challenges, including labour shortages, rising input costs, water scarcity, pest and disease attacks, climate change and declining farm profitability. In this context, agricultural drones have emerged as an innovative technology with the potential to transform traditional farming practices into smart, precision-based and sustainable agriculture. Drones, also known as Unmanned Aerial Vehicles (UAVs), are equipped with cameras, sensors, GPS and spraying systems that help farmers monitor crop growth, assess soil and crop conditions, identify pest and disease infestations and apply fertilizers and pesticides efficiently. Drone-based technologies can improve agricultural productivity by reducing labour requirements, saving time, optimizing the use of agricultural inputs and supporting timely farm management decisions. In India, government initiatives such as the Drone Didi programme and the promotion of Kisan Drones have encouraged the adoption of drone technology, particularly among farmers and rural women. Furthermore, the integration of drones with artificial intelligence, remote sensing, Geographic Information Systems (GIS) and precision agriculture offers new opportunities for improving crop monitoring and resource management. Despite their advantages, high initial investment, technical limitations, maintenance costs, limited rural awareness and the need for trained operators remain important challenges. This article highlights the applications, benefits, limitations and future prospects of drone technology in Indian agriculture. The effective adoption of agricultural drones can contribute significantly to smart farming, sustainable agricultural development, improved farmers' income and national food security.

Keywords: Agricultural drones, Unmanned Aerial Vehicles (UAVs), Indian agriculture, precision farming, smart agriculture, crop monitoring, pesticide spraying, artificial intelligence, sustainable farming, digital agriculture.

Introduction

Agriculture plays a vital role in India's economic development, food security and rural employment. India has a diverse agricultural system in which millions of farmers cultivate cereals, pulses, oilseeds, fruits, vegetables and commercial crops. However, conventional agricultural practices are increasingly challenged by changing climatic conditions, increasing production costs, shortage of agricultural labour, declining natural resources and the growing demand for food. Therefore, the adoption of modern technologies is essential to improve agricultural efficiency, productivity and sustainability.

Among emerging agricultural technologies, drones have gained considerable importance because of their ability to collect real-time field information and perform agricultural operations with greater precision. Agricultural drones are unmanned aerial vehicles that can be operated remotely or through programmed flight systems. They are generally equipped with high-resolution cameras, multispectral sensors, GPS devices and

specialized spraying equipment. These technologies enable farmers to observe crop conditions, identify problem areas and undertake targeted agricultural operations.

One of the major applications of drones is **crop monitoring and field surveillance**. Drone-mounted cameras capture aerial images that help identify variations in crop growth, plant population, nutrient deficiencies, water stress and pest or disease attacks. Multispectral imaging can provide valuable information about crop health through vegetation indices such as the Normalized Difference Vegetation Index (NDVI). Such information allows farmers to identify affected areas and take corrective measures at an early stage.

Another important application is **pesticide and fertilizer spraying**. Drone-based spraying systems can distribute agricultural chemicals over crop fields in a controlled and timely manner. They are particularly useful in areas where traditional spraying is difficult, such as tall crops, waterlogged fields and uneven agricultural land. Targeted application may reduce unnecessary chemical use and improve operational efficiency when appropriate equipment, approved products and safety procedures are followed.

Drones also contribute to precision agriculture by integrating aerial data with Artificial Intelligence (AI), Geographic Information Systems (GIS) and remote sensing technologies. These systems help farmers analyse field variability, assess crop performance and make informed decisions regarding irrigation, nutrient management and plant protection. In addition, drones can assist in agricultural mapping, land surveys, crop damage assessment and monitoring of natural resources.

The Government of India has taken several initiatives to promote agricultural mechanization and drone technology. The Sub-Mission on Agricultural Mechanization (SMAM) supports the promotion and demonstration of agricultural machinery, including drones. The Namo Drone Didi initiative aims to provide drones to selected women's Self-Help Groups (SHGs), creating opportunities for rural women to provide agricultural spraying services and generate additional income.

Despite these developments, the adoption of drones in Indian agriculture faces challenges such as high procurement costs, battery limitations, maintenance requirements, inadequate technical knowledge, regulatory compliance and the need for trained operators. Small and marginal farmers may find individual ownership difficult. Therefore, custom hiring centres, cooperative ownership, training programmes and agricultural service providers can play an important role in making drone technology accessible.

The future of Indian farming depends on the successful integration of technological innovation with traditional agricultural knowledge. Agricultural drones, when combined with suitable training, scientific recommendations and supportive government policies, can become an important component of smart and climate-resilient farming systems.

Conclusion

Agricultural drones represent an important technological advancement that can reshape the future of Indian farming. Their applications in crop monitoring, pesticide spraying, fertilizer application, field mapping and precision agriculture offer significant opportunities to improve farm productivity and resource-use efficiency. Drone technology can reduce labour requirements, save time, support timely crop protection and minimize unnecessary agricultural input applications. Government initiatives such as Kisan Drone promotion and Namo Drone Didi are encouraging the adoption of modern agricultural technologies while creating new employment and income opportunities, particularly for rural women. However, successful implementation requires affordable technology, proper training, technical support, suitable infrastructure and awareness among farmers. Custom Hiring Centres and Farmer Producer Organizations (FPOs) can make drone services accessible to small and marginal farmers. In the coming years, the integration of drones with artificial intelligence, satellite imagery, robotics and digital agriculture will further strengthen precision farming in India. Thus, agricultural drones have considerable potential to promote smart farming, sustainable agricultural development, rural empowerment and national food security.

References

1. Government of India, Ministry of Agriculture and Farmers Welfare. (2022). *Guidelines for Use of Drone Technology in Agriculture*. Press Information Bureau, New Delhi. Read here.
2. Komatineni, B. K., Makam, S., & Meena, S. S. (2024). A comprehensive review of the functionality and applications of unmanned aerial vehicles (UAVs) in the realm of agriculture. *Discover Agriculture, 2*, Article 57. https://doi.org/10.1186/s43067-024-00184-8.
3. Government of India, Ministry of Agriculture and Farmers Welfare. (2024). *Operational Guidelines of Central Sector Scheme: Namo Drone Didi*. Read here.
4. Jain, R., Ashok, A., Nisha, & Kumar, V. (2025). *Economic and Environmental Benefits of Employing Drones in Agriculture: A Study under Namo Drone Didi Scheme*. ICAR–National Institute of Agricultural Economics and Policy Research, Policy Brief No. 65. Read report.
5. Singh, R., & Singh, S. (2025). A review of Indian-based drones in the agriculture sector: Issues, challenges, and solutions. *Sensors, 25*(15), 4876. https://doi.org/10.3390/s25154876.
6. Government of India, Ministry of Agriculture and Farmers Welfare. (2025). *Implementation of Drone Didi Scheme*. Press Information Bureau, 29 July 2025. Read here.
7. Ategeka, S., & Bai, A. (2026). Advancements of drone utilization in crop production: A systematic review. *Agriculture & Food Security, 14*, Article 58. Read article.
8. Government of India, Ministry of Agriculture and Farmers Welfare. (2026). *Distribution of Agricultural Drones under Namo Drone Didi Scheme*. Press Information Bureau, 13 February 2026. Read here.