

## Use of Drones in Pesticide Application: Emerging Trends in Chhattisgarh

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### Introduction

Rapid technological advancements over the past decade have significantly transformed agricultural practices, particularly in the domain of crop protection. Among these innovations, drones, also referred to as Unmanned Aerial Vehicles (UAVs), have emerged as a promising tool for precision agriculture. Initially developed for aerial surveillance and large-scale farm operations, drone technology has gradually evolved through miniaturization and cost reduction, making it increasingly accessible to small and marginal farmers. In India, systematic experimentation and field-level demonstrations of agricultural drones began around 2018, leading to broader institutional recognition. A major milestone was achieved in 2022 with the launch of the Kisan Drones Scheme by the Ministry of Agriculture and Farmers Welfare, which permitted drone-based spraying of registered agrochemicals under defined standard operating procedures. This marked a transition from experimental trials to regulated operational use.

Drone-assisted pesticide application addresses several persistent challenges in conventional agriculture, including labour shortages, rising costs of manual spraying, health hazards due to chemical exposure, uneven spray coverage, and excessive use of water and pesticides. Equipped with GPS, automated flight paths, and precision nozzles, drones enable uniform and targeted spraying while minimizing drift and resource wastage. Consequently, this technology aligns well with the principles of precision farming, environmental sustainability, and occupational safety. The present article reviews the applications, efficiency, and comparative advantages of drone-based pesticide spraying over manual methods, with particular emphasis on adoption status, regulatory frameworks, and recent initiatives in Chhattisgarh. By synthesizing research evidence and field experiences, the study highlights the

transformative potential of drones in enhancing pest management and improving farm productivity.

#### Application of drones in agriculture:

- **Crop monitoring and Disease detection:** An efficient technique for estimating disease, pest infestation, nutrient deficiencies, and crop loss.
- **Field Mapping and Land survey:** Slow gradients, soil variation, and boundaries can all be found using GIS, mapping, elevation and water irrigation management, field boundary mapping, and 2D and 3D farmland maps. The design of drainage irrigation facilities and resource planning can both benefit greatly from this comprehensive information, which can also aid in land use management.
- **Crop Insurance and yield estimation:** The rapid survey after damages like flood, drought or pest outbreak helps the quick assessment for insurance.
- **Drones-as-service:** The facility is drawn as a service, according to the service model. They give small landowners access to financial and religious resources.

#### Comparison between manual and drone spray

Parameter	Manual Spraying	Drone Spraying
Time Required per Acre	4 to 6 hours	8 to 10 minutes
Labour Requirement	2 to 3 workers	1 trained operator
Health Risk	High (direct exposure to chemicals)	Very low (no direct exposure)
Chemical Efficiency	Significant wastage	Up to 30 per cent chemical savings
Application Rate	490 Liter/ha	27 Liter/ha
Field Capacity	0.08 ha/hour	4.04 ha/hour
Coverage Uniformity	Non-uniform and inconsistent	Highly uniform and precise
Terrain Adaptability	Limited (mainly flat areas)	Excellent (works in hilly and waterlogged fields)
Long-term Cost	Higher due to labour and inputs	Lower after initial investment
Water Usage	Very high	Reduced by up to 90 per cent
Precision Level	Low accuracy	High accuracy with GPS/AI integration

## Status of drones in Chhattisgarh

In addition to raising awareness of drones across the country and their use in agriculture, Chhattisgarh has taken a number of significant steps to incorporate the new technology into the state.

- **MOU by IGKV, Raipur:** A memorandum of understanding was signed by the state's Indira Gandhi Krishi Vishwavidyalaya and the Catalyst Foundation to train farmers, students, and young people in drone operations. The local drone facilities were encouraged by this initiative.
- **Workshop boosts tech skills in Dhamtari:** A five-day hands-on drone training workshop was organised from July 7-11 (2025) at the Technology Village Centre, Sirri Village, Dhamtari district. The initiative aimed to introduce modern technology and practical skills to students from rural backgrounds. The International Institute of Information Technology, Naya Raipur (IIIT-NR) and Chhattisgarh Council of Science and Technology (CGCOST) jointly conducted the workshop.
- **Kisan Drone Yojana (Sub-Mission on Agricultural Mechanization-SMAM):** This scheme provides subsidies for drone purchases:
  - Small and marginal farmers, SC/ST, women, and North Eastern state farmers: Up to 50% subsidy (max ₹5 lakhs).
  - Other farmers: Up to 40% subsidy (max ₹4 lakhs).
  - Cooperative societies, FPOs, and rural entrepreneurs: Up to ₹4 lakhs for Custom Hiring Centres (CHCs).
  - Agricultural graduates establishing CHCs: Up to 50% subsidy (max ₹5 lakhs).
  - Institutions like ICAR, Krishi Vigyan Kendras (KVKs), and State Agricultural Universities: Up to ₹10 lakhs or 100% of drone cost.
- **NAMO Drone Didi Scheme:** In Rajnandgaon district, the village of Achholi in Dongargarh is showcasing a unique example of women's empowerment through agricultural innovation. This initiative empowers women's Self-Help Groups (SHGs) by providing drones at an 80% subsidy (up to ₹8 lakhs) and training for drone operation. In Chhattisgarh, this scheme is fostering rural entrepreneurship and women's economic empowerment.
- **Bank of India's Akashdoot Scheme:** Offers loans up to 85 per cent of drone cost (max ₹25 lakhs) for custom hiring activities, with a repayment period of 5 years and a 6-month moratorium.

These schemes are complemented by state-level efforts to establish drone service centers and provide free training through KVKs and agricultural colleges.

### **Beyond Farming: Public Services and Safety**

- **Durg Police** have inducted advanced surveillance drones for crowd monitoring, traffic management, and disaster response, showcasing how drones can support public safety and smart policing.
- In forest areas such as the **Udanti-Sitanadi Tiger Reserve**, drones are aiding wildlife protection, helping staff monitor encroachments, forest health, and rapid response to emergencies like fires.

### **Regulatory Requirements**

- All drones above 250 grams must be registered on India's Digital Sky Platform and display a Unique Identification Number (UIN).
- Drone pilots must follow airspace colour codes: green zones allow unrestricted flights, yellow zones require permissions, and red zones are no-fly areas.
- Anyone using drones for commercial purposes—including agriculture and pesticide spraying, must hold a Remote Pilot Certificate obtained by completing DGCA-approved training and exams.
- Violations such as unauthorized flights, operating in restricted areas, or flying unregistered drones can result in heavy penalties or confiscation.
- New laws, like the Civil Drone (Promotion and Regulation) Bill, 2025, allow the central and state governments to issue further rules, so local restrictions may also apply.

### **Future Recommendations**

1. **Expand Agricultural Drone Integration:** Chhattisgarh's economy is deeply rooted in agriculture. Drones should be further integrated to enhance crop monitoring, precision spraying, and soil health assessment. Subsidized schemes and pilot programs can help farmers adopt drone services, especially smallholders who lack capital.
2. **Strengthen Regulatory and Policy Frameworks:** Clear, forward-looking policies will accelerate drone adoption while ensuring safe airspace usage, which includes local drone policy guidelines and data privacy laws.

3. **Boost Capacity Building and Skill Development:** To support the growing drone ecosystem, Chhattisgarh needs a skilled workforce, which includes training hubs and streamlined centres, Youth engagement programs, and upskilling for public servants.
4. **Promote Innovation and Local Manufacturing:** Supporting local innovation will reduce dependence on imports and strengthen the state's industrial base, which includes Innovation grants and incubators, supporting start-ups and Drone testing zones.
5. **Enhance Public Service and Emergency Applications:** Drones can significantly improve government service delivery and emergency management, which includes Disaster response and management, Healthcare logistics and Infrastructure monitoring.
6. **Foster Data Ecosystems and Analytics:** Drones generate vast amounts of data that can be transformed into actionable insights, which include Centralized data platforms and AI & geospatial tools.
7. **Raise Awareness and Public Engagement:** Building trust and understanding among citizens and stakeholders is crucial for the widespread adoption of awareness campaigns, success stories and other initiatives.

## Conclusion

Drone technology represents a significant advancement in precision agriculture, offering clear benefits over manual pesticide spraying in terms of time efficiency, labour reduction, input savings, and operator safety. The growing adoption of agricultural drones in Chhattisgarh, supported by government schemes, institutional initiatives, and training programs, reflects the state's commitment to modernizing farm practices. While challenges related to cost, skills, and regulatory compliance remain, continued policy support, localized research, and service-based models can accelerate adoption. Overall, drone-assisted spraying has strong potential to enhance pest management efficiency, improve farm productivity, and support sustainable agricultural development in Chhattisgarh.

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