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# Reducing Input Costs with Drone Spraying

Delivering measurable savings in pesticides, fertilizers, and water for Indian agriculture through precision technology.

## SERVICE FOCUS

 Pan-India Coverage

## KEY BENEFIT

 90-95% Water Savings

## COST IMPACT

₹ ~₹2,000/ha Net Gain

## PREPARED FOR

Farmers & FPOs

Custom Hiring Centers (CHCs)

State Agri Depts

Agri-Input Companies

# Why Change Now?

Critical Headwinds Facing Indian Agriculture

# 8-15%

## YoY Input Cost Rise

Pesticides and fertilizers represent a rapidly growing share of production costs, squeezing farm profitability margins annually.

Source: Industry Market Reports 2024



## Chemical Wastage

Manual & boom spraying leads to overuse due to runoff and drift. Inefficient application increases resistance risks.

**30-40% Chemical Loss**



## Labour Crisis

Severe shortage of skilled farm labour during peak seasons. Manual spraying is slow, hazardous, and physically demanding.

**4-5 Hours/Acre (Manual)**



## Water Scarcity

Traditional spraying consumes massive volumes of water, a critical constraint in rain-fed and groundwater-depleted regions.

**200-500 Liters/Ha Required**



## Yield Impact

Uneven coverage leads to pest breakthroughs and crop damage from trampling during manual operations.

**5-10% Potential Loss**

# How Drone Spraying Changes the Equation

Transforming Agriculture with Precision, Speed, and Safety



## Ultra-Low Volume (ULV)

Advanced atomization technology reduces water usage drastically while maintaining potency through concentrated application.

**10-25 L/ha**

VS 500L CONVENTIONAL



## Uniform Coverage

Rotor propwash pushes droplets deep into crop canopy, ensuring underside leaf coverage and better penetration.

**Deep Penetration**

EVEN IN TALL CROPS



## Speed & Access

Rapid deployment over large areas. Operates effectively over lodged crops, muddy fields, and difficult hilly terrain.

**6+ Acres/Hour**

HIGH EFFICIENCY



## Safety & Automation

Minimal human exposure to hazardous agrochemicals. Features automated route planning, terrain following, and geofencing.

**Zero Contact**

OPERATOR SAFETY

# Core Quantified Benefits

Proven Impact Across Indian Agricultural Landscape



## Pesticide Savings

**25-30%**

Reduction in chemical usage due to precise application and reduced drift compared to manual spraying.



## Fertilizer Efficiency

**20-40%**

Savings in foliar fertilizer inputs while maintaining comparable or better crop nutrient uptake levels.



## Water Conservation

**90-95%**

Drastic reduction in water volume (ULV technology) crucial for drought-prone regions across India.



## Labour Cost

**40-50%**

Significant reduction in operational costs with 60-70% time saved per acre compared to traditional methods.



## Yield Uplift

**5-10%**

### Productivity Enhancement

Improved yield attributed to timely application, uniform coverage preventing pest outbreaks, and reduced crop damage from manual foot traffic.



# Economics Snapshot: Service vs Conventional

Comparative Per-Acre Cost Analysis for Paddy Cultivation



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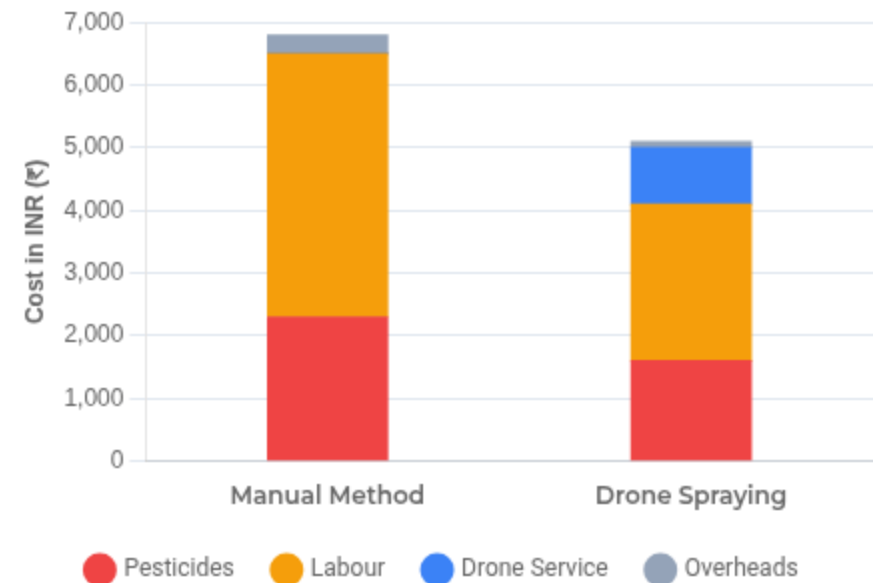
COST COMPONENT (PER ACRE)	MANUAL METHOD	DRONE SPRAYING	DIFFERENCE
Pesticides / Chemicals	₹2,300	₹1,600	-₹700 (30%)
Labour / Application	₹4,200	₹2,500	-₹1,700 (40%)
Drone Service Fee	-	₹900	+₹900
Operational Overheads	₹300	₹100	-₹200
<b>TOTAL COST</b>	<b>₹6,800</b>	<b>₹5,100</b>	<b>SAVE ₹1,700</b>

**Net Saving: ~₹800 - ₹1,700 / Acre**

Plus gains from 10% yield uplift and 95% water conservation.



Cost Structure Comparison (Per Acre)



**Typical Drone Service Fee:** ₹300–₹700 per acre depending on region, payload capacity, and job mix complexity.

# Case Study: Paddy (Chhattisgarh, 2025)

Real-World Economic Impact Analysis vs Traditional Methods

## ₹2,000 / ha

Total Cost Reduction (~11.4%)

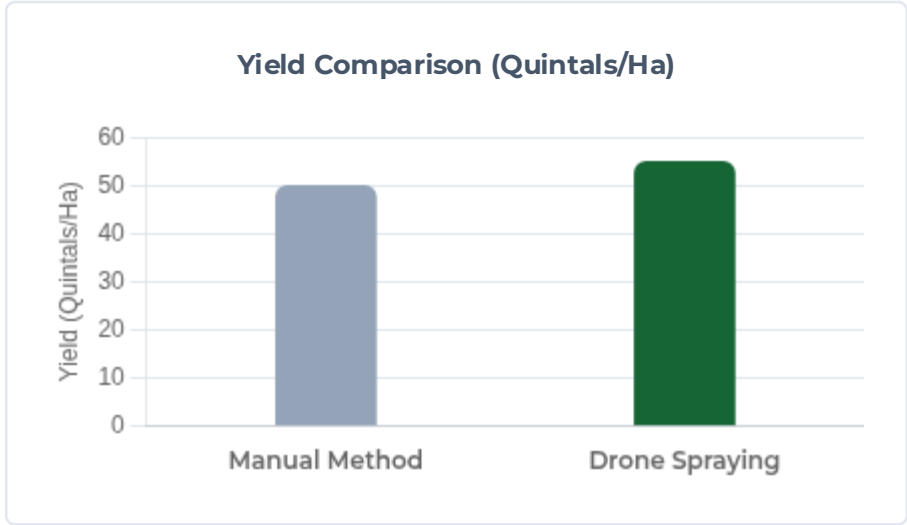
Cost Efficiency

**-31.82%**  
Pesticide Usage Reduction

**-40.48%**  
Labour Requirement Drop

**1.5-2 hrs**  
vs 4-5 hrs Manual (Per Acre)

**+10%**  
Yield Uplift (50→55 q/ha)



## 5.5

**Short-Run Marginal Return (SRMR)**  
For every ₹1 saved/invested, farmers gained ₹5.5 in return value

**Source:** "Farmer perception and economics of drone use in paddy farming: An exploratory study", International Journal of Agriculture Extension and Social Development, 2025. Available at extensionjournal.com.

# Case Study: Maize Foliar Application (ICAR-CIAE)

Drone vs Tractor Gun Sprayer: Nano-Urea Efficiency Comparison



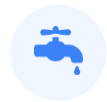
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## 95% Saved

Water Usage Reduction (25 L/ha vs 500 L/ha)



Resource Efficiency



### 25 L/ha

Ultra-Low Volume Application



### ~2,928 kg

Maintained Yield per Hectare



### Minimal

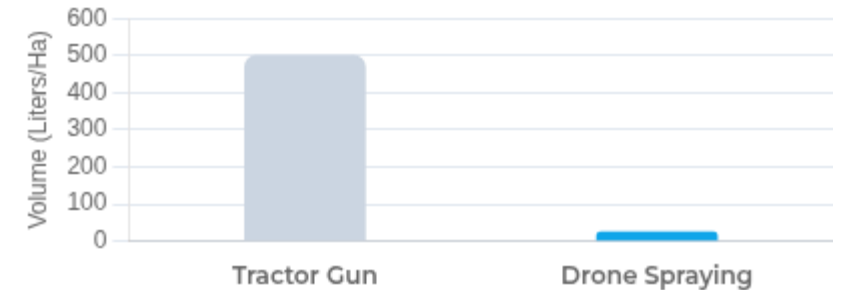
Operator Chemical Exposure



### 3x Faster

Operational Speed vs Tractor

#### Water Consumption (Liters/Ha)



#### Performance Metrics

NDVI / SPAD (Health)

Statistically Similar

Canopy Penetration

High (Propwash)

Soil Compaction

Zero (Aerial)









Source: "Comparative Assessment of the Efficacy of Drone Spraying and Gun Spraying for Nano-Urea Application in a Maize Crop", MDPI Drones 2024. Available at mdpi.com.

# Crop-wise Benefits Across India

Applicability and Expected Savings for Major Crops

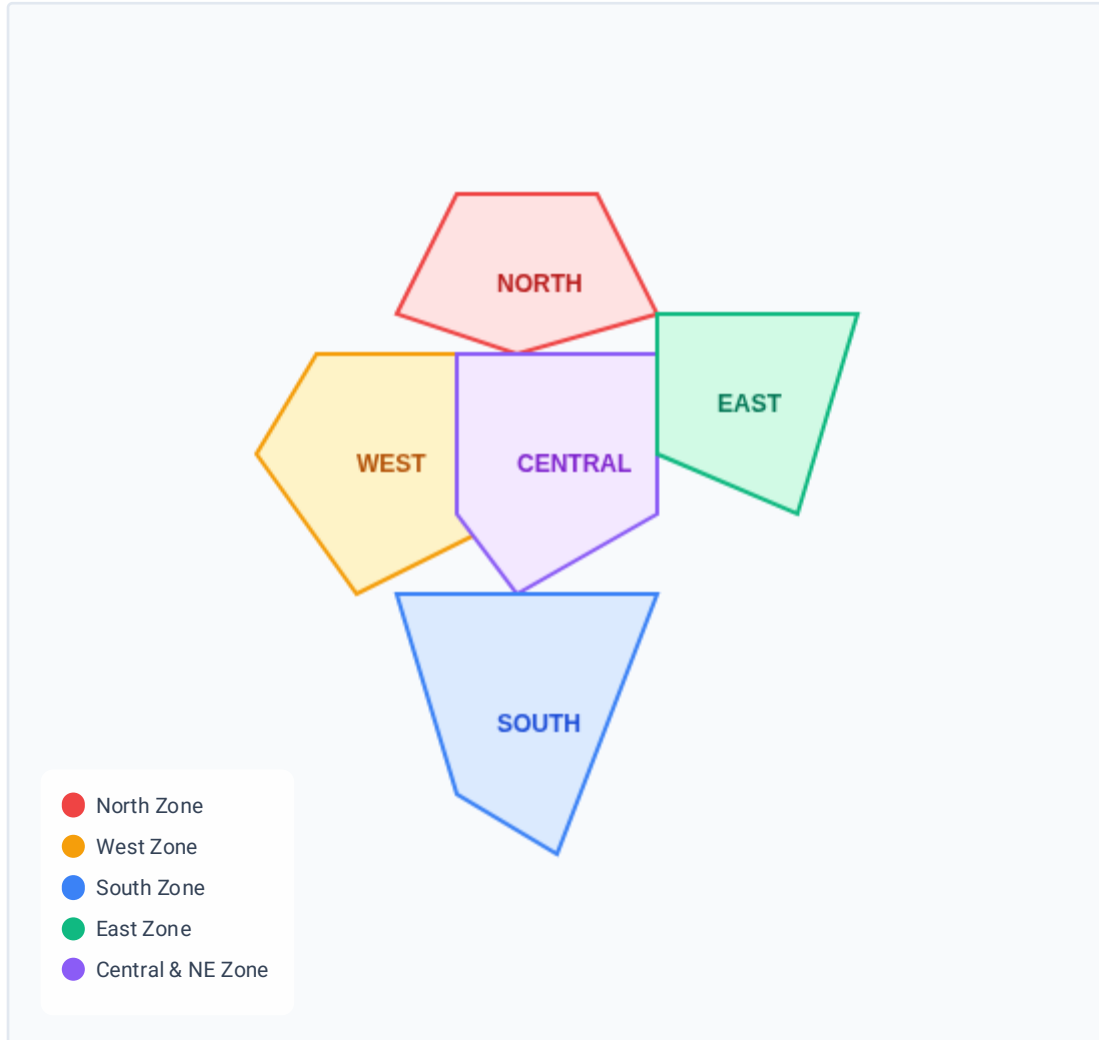


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CROP	SPRAYING CHALLENGE	WHERE DRONES WIN	EST. SAVINGS	DATA SOURCE
 <b>Paddy / Rice</b>	Water-logged fields, manual labor difficulty, high pest incidence (BPH/Stem borer).	Aerial access over mud; <b>propwash</b> penetrates canopy <b>base</b> for BPH control; 50x faster.	<b>25-35% Pesticides</b>	IGKV / Ext. Journal 2025
 <b>Cotton</b>	Tall canopy, dense foliage, Pink Bollworm/Whitefly, health risk to sprayers.	Uniform top-down coverage; <b>defoliant application efficiency</b> ; reduced chemical exposure.	<b>20-30% Inputs</b>	CICR / Industry Trials
 <b>Sugarcane</b>	Inaccessible height (6-8ft); impossible for manual sprayers in late stages.	Only viable method for late-stage <b>foliar nutrition &amp; pest control</b> ; zero crop damage.	<b>40%+ Labour</b>	VSI / Sugar Mills
 <b>Wheat</b>	Narrow weed control window (Yellow Rust); timing critical for fungicides.	Rapid coverage during short weather windows; <b>precise herbicide application</b> (no skip/overlap).	<b>15-20% Chemical</b>	IIBWR / Punjab Agri
 <b>Maize</b>	Fall Armyworm (FAW) control requires whorl application; rapid growth height.	Targeted <b>nano-urea &amp; pesticide</b> delivery; 95% water saving vs gun sprayer.	<b>95% Water</b>	ICAR-CIAE 2024
 <b>Pulses / Soy</b>	Pod borer attacks; dense low canopy; rain-fed areas with water scarcity.	ULV technology critical for <b>rain-fed regions</b> ; timely intervention stops outbreaks.	<b>20-30% Overall</b>	IIPR / State Depts
 <b>Vegetables</b>	Frequent spraying needed; high residue concern; pest resistance issues.	Precise dosage reduces residue; <b>spot spraying capability</b> ; lower worker toxicity.	<b>30% Labour Time</b>	IHR / KVK Demos
 <b>Horticulture</b>	Tree height (Mango/Coconut); difficult terrain; inefficient manual spraying.	Variable rate application; <b>reaches tree tops</b> ; efficient for micronutrients.	<b>Variable High</b>	CISH / NRC

# India Regional Coverage & Crop Suitability

Strategic Deployment Zones and Seasonal Operational Windows



## 🌾 North India (PB, HR, UP)

Peak: Oct-Nov / Apr-May

Focus: Wheat, Paddy, Sugarcane, Vegetables

Critical for narrow wheat herbicide windows and managing stubble/residue in paddy-wheat rotation.

## 👕 West India (GJ, MH, RJ)

Year-round (Cotton/Hort)

Focus: Cotton, Groundnut, Soybean, Grapes

High CHC adoption; effective against Pink Bollworm in tall cotton and mildew in vineyards.

## 🌊 South India (AP, TG, TN, KA)

Multi-season / Continuous

Focus: Paddy, Chilli, Cotton, Banana

Addresses severe labor shortages; ideal for high-value commercial crops like chilli and turmeric.

## 🌊 East India (WB, OD, BR, JH)

Monsoon / Post-Monsoon

Focus: Paddy, Jute, Maize, Vegetables

Drones operate over water-logged paddy/jute fields where manual labor is difficult and slow.

## 🌱 Central & NE (MP, CG, AS)

Kharif Peak / Plantation

Focus: Soybean, Wheat, Tea, Paddy

Early adoption via FPOs in MP/CG; terrain advantage for tea plantations in North East.

# Operational Productivity & Metrics

Field Performance Benchmarks and Standard Operating Procedures



## ~6 Acres/Hr

FIELD COVERAGE RATE

Based on 10-30L payload capacity. Varies by field geometry, crop type, and refilling efficiency.



## 2-3 Persons

STANDARD CREW MODEL

1 Pilot + 1 Co-pilot/Spotter + 1 Helper for rapid chemical mixing and battery management.



## 1.5-3m AGL

OPTIMAL FLIGHT HEIGHT

Ultra-Low Volume (ULV) application at 10-25 L/ha ensures uniform deposition and minimal drift.



## 10-15 Mins

FLIGHT DURATION / SWAP

Rapid hot-swapping capability minimizes downtime. continuous charging cycle supports non-stop operations.



## SOP-Driven

QUALITY ASSURANCE & COMPLIANCE

- ✓ Pre-flight calibration & nozzle check
- ✓ Digital route planning with geofencing
- ✓ Water sensitive paper tests for coverage
- ✓ Automated flight logs & post-spray reports

# Government Support & Subsidies (SMAM)

Financial Assistance for Drone Adoption Under Kisan Drone Scheme



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ICAR / KVK / SAU / State Depts

## 100% Grant

Up to ₹10 Lakh per drone

- ✓ For purchase of drones for demonstration purposes
- ✓ Includes contingency expenditure for demo flights
- ✓ Target: Research institutes & agricultural universities



Farmer Producer Organizations (FPOs)

## 75% Grant

For demonstration on farmers' fields

- ✓ Reduces cost barrier for community adoption
- ✓ Additional contingency support for hiring drones
- ✓ Promotes widespread technology exposure



Custom Hiring Centers (CHCs)

## 40% - 50%

Up to ₹4 Lakh - ₹5 Lakh

- ✓ 40% (max ₹4L) for general CHCs & rural entrepreneurs
- ✓ 50% (max ₹5L) for Agriculture Graduates establishing CHCs



Individual Farmers

## 40% - 50%

Based on category & region

- ✓ 50% (max ₹5L) for SC/ST, Small/Marginal, Women, NE States
- ✓ 40% (max ₹4L) for other farmers

# Implementation Playbook

5-Step Standard Operating Procedure for Seamless Drone Services



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1



2



3



4



5



## Planning & Selection

Identify crop stage and spray window. Verify chemical label compatibility for ULV application and drone suitability.



## Pre-Site Survey

Map field boundaries. Establish buffer zones near water bodies/habitats. Locate water sources and mixing station setup points.



## Calibration & Testing

Set flow rate, flight speed, and height. Conduct test pass with water sensitive paper to verify droplet spectrum and coverage.



## Mission Execution

Execute automated flight plan. Manage battery swaps and chemical refills. Monitor weather conditions and drift continuously.



## Post-Op Reporting

Generate digital report covering area sprayed, dosage applied, and inputs saved. Provide advisories for next spray cycle.

# Risk Management & Best Practices

Ensuring Safety, Compliance, and Efficacy in Drone Operations



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## Weather Windows

- ✈️ Maintain operations only when wind speed is **< 3-5 m/s** to prevent drift.
- 🌡️ Avoid high temperatures (>30°C) and strong thermal currents to reduce evaporation losses.
- ☔ Cease operations if rain is forecast within 2-3 hours post-spray.



## Equipment & Chemistry

- 🧪 Match nozzle type to chemistry: **Coarse** for herbicides, **Fine/Medium** for fungicides.
- 🌿 Use drift reduction adjuvants for high-risk applications near sensitive crops.
- 🔄 Conduct compatibility jar test before tank mixing multiple inputs.



## Flight Parameters

- 📏 Optimal Height: **1.5 - 3.0m AGL** (Above Ground Level) for canopy penetration.
- 📏 Lane Overlap: Set to **10-20%** to ensure uniform deposition without striping.
- 📏 Plan cross-wind flight paths where possible to minimize operator exposure.



## Safety & Regulatory Compliance

- 🚫 **Buffer Zones:** Establish strict no-fly zones near water bodies, schools, and habitation.
- 🧑 **PPE Mandatory:** Full protective gear for ground crew during mixing and loading (highest risk phase).
- 📄 Ensure Pilot holds valid Remote Pilot Certificate (RPC) and drone has UIN plate.
- ⚠️ Post warning flags at field entry points during and after spraying.



## Accountability

- 📄 Maintain digital flight logs: Date, Time, Location, Chemical, Dosage.
- 📄 Log battery cycles and maintenance schedules to prevent hardware failure.
- 📄 Upload mission reports to Digital Sky platform as per DCA norms.

# ROI Scenarios: Service & Ownership

Financial Impact Analysis for Farmers and Entrepreneurs



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## Farmer Service Model

Pay-Per-Acre Hiring (No Capex)

Base Pesticide Cost	₹2,000 / acre
Pesticide Savings (25%)	+ ₹500
Labour Cost Avoided	+ ₹300
Drone Service Fee	- ₹500

### NET BENEFIT PER ACRE

**₹300** / acre Immediate Cash Positive

### 10-Acre Job Example:

- ₹3,000 Net Benefit per round
- + Plus 5-10% Yield Upside (Timely Spray)



## CHC / FPO Ownership Model

Asset Investment with Subsidy

Drone Cost (10L/16L)	₹8,00,000
Subsidy (40-50%)	- ₹3,20,000
Net Investment	₹4,80,000

### OPERATIONAL INCOME POTENTIAL

Margin per Acre **₹200**      Seasonal Volume **4,800 Acres**

**₹9.6 Lakh** / season ROI < 1 Season

*\*Based on 80 acres/day × 60 days utilization*

# Why Partner With Us?

Your Trusted Partner for Precision Agriculture Solutions



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## Pan-India Pilot Network

Certified, locally-trained operators available across all major agricultural zones ensuring rapid deployment.



## SOP-Led Compliance

Full adherence to DGCA regulations, safety protocols, and drift management guidelines for every flight.



## Chemistry-Agnostic Expertise

Specialized ULV application knowledge for pesticides, herbicides, and foliar nutrients across diverse crops.



## Seamless Integration

End-to-end support for FPOs & CHCs including subsidy documentation, pilot block planning, and digital reporting.

## Ready to Optimize Your Input Costs?

Let's plan your season with a customized demonstration and pilot program.

 [Schedule a Demo](#)

 [Get Pilot Proposal](#)

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 [www.etherealflights.com](http://www.etherealflights.com)

# References & Resources

Data Sources, Policy Documents, and Technical Guidelines



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## GOVERNMENT POLICY

### PIB: SMAM & Kisan Drone Subsidies

Official press release detailing financial assistance for drone adoption under Sub-Mission on Agricultural Mechanization (SMAM).

[pib.gov.in/PressReleaseIframePage.aspx?PRID=1909215](http://pib.gov.in/PressReleaseIframePage.aspx?PRID=1909215)

## FIELD RESEARCH

### Paddy Economics Study (Chhattisgarh 2025)

Comparative economic analysis of drone vs traditional spraying in paddy cultivation, highlighting cost reduction and yield benefits.

[extensionjournal.com/8-12-46-826.pdf](http://extensionjournal.com/8-12-46-826.pdf)

## TECHNICAL STUDY

### Maize Nano-Urea Drone Efficacy (ICAR-CIAE)

MDPI published study on drone efficacy for nano-urea application in maize, demonstrating 95% water savings with comparable yields.

[mdpi.com/2504-446X/10/1/1](http://mdpi.com/2504-446X/10/1/1)

## AGRONOMY

### Foliar Fertilizer Efficiency Study

Research documenting 20-40% savings in fertilizer usage through precision drone spraying technology compared to conventional methods.

[biochemjournal.com/.../S-10-1-78-262.pdf](http://biochemjournal.com/.../S-10-1-78-262.pdf)

## INDUSTRY REPORT

## STANDARD GUIDELINES