AGRI MAGAZINE
(International E-Magazine for Agricultural Articles)
Volume: 02, Issue: 10 (October, 2025)
Available online at http://www.agrimagazine.in
©Agri Magazine, ISSN: 3048-8656

Strategies to Manage Locust in India

Bhaswati Saikia[1], Sneha Katherine[2], B. Sukumar[3] and *Shivam Dinkar[4]
[1]M.Sc. (Ag) Entomology, College of Agriculture, AAU, Jorhat, India
[2]M.Sc. Entomology, CCS Haryana Agricultural University, Hisar, India
[3]Undergraduate Student (B.Sc. [HONS] Agriculture), Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram, Cuddalore, India
[4]Ph.D. Scholar, Department of Silviculture and Agroforestry, College of Agriculture, Raipur, IGKV, Chhattisgarh, Raipur, India
*Corresponding Author's email: shivamdinkar1997@gmail.com

Locust outbreaks represent one of the most severe threats to agriculture, capable of destroying vast areas of crops and pasture within a short period. India, being part of the traditional locust invasion belt, faces recurrent challenges primarily from the Desert Locust (*Schistocerca gregaria*), especially in northwestern regions. Locust upsurges are closely linked to climatic variability, wind patterns, and vegetation dynamics in desert habitats. Effective locust management demands a multidisciplinary approach, integrating surveillance, early warning, ecological management, chemical and biocontrol strategies, and regional cooperation. This article reviews India's locust management framework, technologies, and recent innovations, emphasizing sustainable and environmentally safe approaches for locust control.

Introduction

Locusts are polyphagous, migratory, and gregarious grasshoppers that can devastate agricultural landscapes within days. Their capacity to change behavior and physiology under favorable conditions—known as phase polymorphism—enables solitary individuals to transform into highly mobile swarms. India is periodically affected by invasions from breeding areas in eastern Africa, the Arabian Peninsula, and Pakistan, especially during years of heavy rainfall in desert regions. The Desert Locust (*Schistocerca gregaria*) is the most destructive species in the Indian context, followed by occasional outbreaks of Bombay Locust (*Patanga succincta*) and Tree Locust (*Anacridium sp.*). Effective management of locust outbreaks requires timely detection, forecasting, and coordinated response mechanisms involving national and international stakeholders.

Locust Occurrence and Distribution in India

Locusts primarily invade the Thar Desert region of Rajasthan and Gujarat, occasionally extending into Punjab, Haryana, and Uttar Pradesh. The key factors influencing outbreaks include:

- Rainfall and vegetation growth in desert areas promoting breeding.
- Wind direction and monsoon flow, determining swarm migration.
- Transboundary movement from Iran and Pakistan during favorable weather conditions.

India maintains extensive locust monitoring and control operations through the Locust Warning Organisation (LWO) under the Directorate of Plant Protection, Quarantine and Storage (DPPQ&S), Faridabad, with field stations across Rajasthan and Gujarat.

Locust Management Strategies

Surveillance and Early Warning Systems

Early detection and prediction are the backbone of locust control.

- Ground Survey: Field teams under the LWO regularly monitor vegetation, soil moisture, and locust population stages in desert regions.
- Remote Sensing and GIS Tools: Satellite-based monitoring of Normalized Difference Vegetation Index (NDVI) and rainfall patterns helps forecast potential breeding sites.
- FAO's Locust Information Service (DLIS): India collaborates with the Food and Agriculture Organization (FAO) for regional early warning and data sharing through the SWAC (Southwest Asia Commission) platform.
- eLocust3 System: Digital field data collection and transmission tools (GPS, cloud-based dashboards) enable near real-time surveillance and decision-making.

Preventive Control Measures

Preventive management aims to contain locusts at their breeding sites before they form large swarms.

- Barrier and Perimeter Spraying: Targeted insecticide applications at early nymphal stages (hopper bands) reduce population buildup.
- Eco-friendly Insecticides: The use of Malathion 96% ULV, Chlorpyrifos 20% EC, and Lambda-cyhalothrin 5% EC is standard practice under Indian locust control operations, following FAO guidelines.
- Vehicle- and Aircraft-mounted ULV Sprayers: Advanced spraying technologies ensure uniform coverage of infested areas.
- Buffer Zone Management: Coordinated control near Indo-Pak border regions minimizes cross-border infestation risks.

Biological and Biotechnological Control

Biological control represents a sustainable alternative to chemical pesticides.

- Entomopathogenic Fungi: *Metarhizium acridum*, a locust-specific fungal pathogen, has been successfully tested under Indian desert conditions for eco-friendly locust management.
- Biopesticides and Botanicals: Neem-based formulations (azadirachtin) exhibit antifeedant and growth-inhibitory properties against locust nymphs.
- Genetic and Molecular Studies: Understanding locust pheromones and population genetics helps design novel strategies such as pheromone traps and RNA interference (RNAi)-based biocontrols.

Ecological and Habitat Management

Maintaining the ecological balance of locust-prone ecosystems can mitigate outbreak risks.

- Vegetation and Soil Moisture Monitoring: Preventing excessive vegetation growth in arid zones following unusual rainfall can restrict breeding grounds.
- Grazing Management: Regulated livestock grazing prevents over-vegetation, which supports locust multiplication.
- Desert Afforestation and Land Rehabilitation: Promoting drought-tolerant vegetation reduces sand dune mobility and modifies the microhabitat, discouraging locust breeding.

Regional and International Cooperation

Locust control is inherently transboundary. India's collaboration with Pakistan, Iran, and Afghanistan under the FAO Desert Locust Commission for South-West Asia (SWAC) ensures:

- Data sharing on locust movements.
- Coordinated surveillance and joint control operations.
- Technical training, simulation exercises, and capacity building. These collaborations strengthen regional preparedness and minimize outbreak risks across borders.

Emergency Response Framework

During large-scale invasions (e.g., the 2019–2020 locust upsurge), the Government of India activated a multi-agency response involving:

- Real-time control operations across 12 affected states.
- Deployment of drones for aerial spraying, marking India's first large-scale drone-based pest control.
- Utilization of artificial intelligence (AI) and machine learning models for predicting swarm movement and population hotspots.

Innovations in Locust Management

Technology	Purpose	Implementing Agency/Tool
Drone-based ULV spraying	Rapid and safe chemical application	DPPQ&S, MoA&FW
eLocust3 and RAMSES GIS	Data collection and spatial mapping	FAO & LWO
NDVI and Rainfall Modelling	Forecasting breeding potential	ISRO & IMD collaborations
IoT Sensors & Mobile Apps	Real-time reporting by farmers	ICAR and State Departments

Such technological integration has greatly enhanced India's locust preparedness and reduced response times.

Challenges in Locust Management

- Climate Change Impacts: Altered rainfall and temperature patterns may expand locust breeding zones eastward.
- Cross-border Coordination: Political and logistical barriers occasionally hinder timely control operations.
- Pesticide Resistance and Non-target Effects: Repeated use of organophosphates risks ecosystem contamination.
- Data Gaps: Limited fine-scale ecological data constrain predictive modeling accuracy.

Future Perspectives

- Adoption of AI-Driven Predictive Models integrating climate data, soil moisture, and vegetation indices for real-time risk assessment.
- Development of RNAi-based and pheromone-mediated biocontrol tools for species-specific management.
- Enhanced farmer participation through mobile-based locust alert systems and awareness programs.
- Integration of climate-resilient agricultural planning in locust-prone regions to mitigate potential losses.

Conclusion

Locust management in India has evolved from reactive to preventive and technology-driven approaches, emphasizing early detection, sustainable control, and international cooperation. The integration of remote sensing, drones, biocontrol, and AI-based forecasting has modernized locust surveillance and suppression. Strengthening cross-border collaboration, promoting eco-friendly management practices, and investing in predictive research are essential to safeguard Indian agriculture against future locust invasions.