

For Immediate Release: March 18, 2025

Research Story

Minimizing Pesticide Use Through Enhanced Spread: A Pioneering Research Initiative at IIT (ISM) Towards Sustainable Agriculture, Balancing Effective Pest Control with Minimal Environmental Impact

Pesticides play a crucial role in controlling pests in agricultural fields, greenhouses, and gardens. However, their toxic nature poses significant risks to human and animal health due to crop consumption and water contamination in surrounding areas. Given these concerns, it becomes imperative to minimize pesticide usage while maximizing their effective spread on crop surfaces.

To address this challenge, a research study is being conducted by Prof. Deepak Kumar Mandal from the Department of Mechanical Engineering at IIT (ISM). The study, funded by the Science and Engineering Research Board (SERB) with a grant of Rs 33,94,640, is titled “*Impact of Pesticide Drops on a Leaf: Minimization of Pesticide Use through the Study of Spread.*” This research, initiated in 2022, aims to optimize pesticide application by understanding the dynamics of droplet impact and distribution.

Key Findings and Insights

The study reveals that pesticides are typically applied in liquid form, either as a solution of powdered pesticides in water or as an emulsion that dries upon contact with the leaf surface. Prof. Mandal explains, “When larger solution or emulsion drops impact a mesh, they get atomized, producing smaller droplets that spread more efficiently on the leaf surface. The greater the atomization and spread, the lower the pesticide quantity required.”

Optimizing Application Techniques

- **Mesh Design & Droplet Size:** A mesh with the smallest possible opening size is preferred, ensuring optimal atomization of the pesticide drops.
- **Impact Height:** Drops falling from greater heights result in better atomization and spread, thereby minimizing wastage.
- **Spread and Evaporation Characteristics:** The study also focuses on understanding how the pesticide solution behaves after impacting the leaf, including its evaporation time and distribution.

Environmental and Economic Benefits

Once the research findings are fully analyzed, the pesticide quantities can be optimized to ensure minimal wastage. The primary beneficiaries of this study include:

- **Farmers:** Reduced pesticide usage leads to cost savings and more effective pest control.
- **Environment:** Decreased contamination of soil and nearby water bodies, ensuring safer ecosystems.

This pioneering research at IIT (ISM) is a step toward sustainable agriculture, balancing effective pest control with minimal environmental impact. By refining pesticide application techniques, this study holds the potential to revolutionize farming practices while safeguarding human health and the environment.

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