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A Mathematical Model for Insect-Crop Dynamics: Optimizing Control via Pesticides and Biological Agents*

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Abstract. This study develops a mathematical model to analyze insect-crop interactions and optimize pest control strategies. The model incorporates pesticides and predator species to minimize crop damage while maintaining ecological balance. It also examines the economic and environmental impacts of these control measures, highlighting the trade-offs between immediate protection and long-term sustainability. The findings offer insights into Integrated Pest Management (IPM) strategies, promoting more sustainable agricultural practices and resilient systems in response to environmental challenges.

AMS Subject Classification (2020): 92D25, 92D30, 49N90, 34H05

Keywords: Insect-crop dynamics, pesticides, biological control, mathematical modeling, optimal control, sustainable agriculture

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