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ECOLOGICAL PLANT PROTECTION USING BIOLOGICAL SURVEILLANCE IN CROPPING SYSTEMS

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Purpose: Sustainable plant protection is increasingly important as agricultural systems face greater pest pressure, biodiversity loss, and climate variability. This study proposes an ecologically integrated framework for protecting crops by combining biological surveillance with preventive agronomic practices. The objective is to demonstrate how ecosystem-based management can reduce dependence on synthetic pesticides while maintaining crop productivity, environmental quality, and long-term agroecosystem resilience.

Materials and Methods: A conceptual framework was developed from internationally accepted principles of integrated pest management and ecological crop protection. The proposed approach incorporates systematic field scouting, disease diagnosis, pest population monitoring, conservation of natural enemies, crop rotation, sanitation, resistant cultivars, habitat diversification, and threshold-based intervention. Ecological observations are combined with routine agronomic assessments to guide evidence-based decision-making. Preventive measures are prioritised over curative pesticide applications to minimise environmental risks while maintaining effective protection against economically important pests and diseases.

Results: The integrated strategy is expected to reduce pest outbreaks through early detection and improved biological regulation. Conservation of predators, parasitoids, pollinators, and beneficial soil microorganisms strengthens natural ecosystem functions that suppress pest populations. Reduced pesticide use lowers production costs, minimises environmental contamination, and preserves biodiversity. Improved crop health, enhanced soil quality, and greater resilience to climatic stress contribute to more stable agricultural production. The framework also supports environmentally responsible farming practices consistent with sustainable development objectives.

Conclusions: Ecological plant protection based on biological surveillance provides a practical and scientifically sound pathway for sustainable crop management. Integrating preventive agronomic practices with ecological monitoring strengthens resilience against emerging pests while protecting natural resources. Wider adoption of this framework can improve food security, enhance biodiversity conservation, and promote environmentally sustainable agricultural production in diverse farming systems.

Keywords: plant protection; surveillance; resilience; biodiversity; sustainability. sustainable agriculture inspired the development of this conceptual study.

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