

Modern Agriculture: Impact and Consequence on Natural Enemies

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Abstract:

Natural enemies that are essential for controlling pests, including as parasites, viruses, and predators, are greatly impacted by modern agriculture. These beneficial creatures can be harmed by practices that disturb the delicate ecological balance, such as overuse of pesticides, habitat change, and monoculture or monocropping. This action reduces the ability of natural enemies to control the number of pests. To lessen these adverse consequences and guarantee a robust and balanced ecosystem, sustainable agriculture methods that prioritize habitat preservation and less reliance on chemicals are crucial.

Introduction:

Natural enemies are essential parts of ecosystems, helping to keep the environment healthy and in balance. These organisms provide an alternate and sustainable method of pest management in the agricultural setting, making them invaluable friends in the continuous fight against pests. Predators, parasites, and diseases are the three primary types of natural enemies. Predators like ladybugs and spiders aggressively hunt and devour pests, lowering their populations in the delicate balance of ecosystems. Certain wasps and other parasitoids lay eggs on pests, which kills the host and reduces the number of pests over time. Because they infect pest populations with illnesses, pathogens—which include bacteria and fungi—act as natural enemies. By utilizing these viruses' innate capacity to manage pests, biological insecticides provide a sustainable approach to agriculture. Deforestation, urbanization, and the alteration of natural habitats are examples of modern farming practices that significantly alter landscapes and decrease the number of habitats that natural enemies—which are crucial for pest control—need (Lenteren, 2012). The delicate balance between predators, parasites, and diseases is at danger due to this habitat change, which might compromise their ability to effectively control pests. Adopting sustainable farming methods that put habitat preservation first becomes essential to maintaining effective pest management in agricultural ecosystems and preserving the resilience of natural enemies.

Practices Affecting Beneficial Organisms:**Modification of Habitate:**

The availability of appropriate habitats for natural enemies is impacted by the substantial changes in landscapes caused by agricultural practices including deforestation, urbanization, and the conversion of natural ecosystems into agricultural land. The delicate balance of viruses, parasites, and predators is threatened by this habitat alteration, which also reduces their ability to control pests.

Excessive Application of Pesticide:

Although chemical pesticides are widely used in contemporary agriculture to control pests, there are worries about the direct and indirect harm they do to beneficial creatures. To put it plainly, these pesticides have the potential to kill vital organisms that are vital to controlling the number of pests, including parasites, diseases, and predators. By reducing the availability of food, which is many natural enemies' main source of nutrition, the chemicals have the potential to indirectly disturb the delicate ecological balance. Furthermore, pesticides may change the behavior of beneficial species, affecting their ability to reproduce and forage (Desneux et al., 2007). The ability of natural enemies to maintain a healthy and sustainable ecosystem is seriously threatened by these two effects.

Monoculture:

Although chemical pesticides are widely used in contemporary agriculture to control pests, there are worries about the direct and indirect harm they do to beneficial creatures. To put it plainly, these pesticides have the potential to kill vital organisms that are vital to controlling the number of pests, including parasites, diseases, and predators. By reducing the availability of food, which is many natural enemies' main source of nutrition, the chemicals have the potential to indirectly disturb the delicate ecological balance. Furthermore, pesticides may change the behavior of beneficial species, affecting their ability to reproduce and forage (Desneux et al., 2007). The ability of natural enemies to maintain a healthy and sustainable ecosystem is seriously threatened by these two effects.

GM Crops:

Genetically modified crops' effects on natural enemies include a complicated interaction between the potential harm posed by toxins and the decrease in the usage of pesticides. To reduce unforeseen effects on beneficial species, GM crop farming must be carefully considered (Romeis et al., 2008).

Heavily use of Fertilizers:

The ecology is threatened by the overuse of fertilizers in agriculture. Despite being designed to increase plant development, the excess nutrients may have negative effects on the quality of the plants as well as the species in the ecological network. Given that an oversupply of resources can upset the delicate balance between prey and hosts, this effect is especially important for natural enemies. Overuse of fertilizers can change the chemistry of plants, making them less suited or even dangerous for beneficial organisms' hosts or prey.

Mechanical Practices:

Tillage, a conventional technique for manipulating soil in agriculture, affects ecosystems in both good and bad ways. Beyond only altering the soil, tillage disturbs habitats and the larger ecosystem, impacting natural enemies such as parasites, diseases, and predators. Population declines may result from the disruption of vital habitats and supplies for these species caused by changes in soil structure and plant cover. The necessity for sustainable methods to preserve a resilient and balanced agricultural environment is highlighted by the growing awareness of the ecological effects of tillage (Altieri, 1999).

Sustainable Agriculture Solutions:

A variety of methods are recommended for maintaining natural enemies and cultivating a healthy environment in the field of sustainable agriculture. A key component in promoting the health of beneficial creatures and protecting their habitats is organic farming, which is distinguished by the avoidance of synthetic chemicals. Another sustainable tactic is agroforestry, which skilfully integrates trees into agricultural systems to create a variety of ecosystems that benefit natural enemies. Additionally, the thoughtful application of cover crops creates an environment that is conducive to the growth of beneficial organisms while also improving soil health. One crucial element that supports ecologically conscious agricultural practices is integrated pest management, or IPM. When combined, these methods highlight how important it is to promote a coexistence in which agricultural operations harmoniously coexist with the environment.

Conclusion:

A deliberate, multifaceted strategy is required to address the intricate interaction between natural enemies and contemporary farming. Selecting sustainable solutions is essential for problem-solving and long-term agricultural resilience. This shift emphasizes the necessity



of a well-rounded strategy in which agricultural practices such as agroecology and precision farming complement the environment. Using effective methods supports the vital function that natural enemies play in reducing pests while also helping to fulfill the expanding demand for food. Despite its complexity, there is promise for a sustainable and prosperous agricultural future thanks to continuing research and technological developments.

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