

## Building Resilience for Pest Management: Lessons from Organic Agriculture

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### Editorial

The practice of modern agriculture is typically considered as unstable. In landscapes occupied by crops, we usually observe only one plant species taking over a huge amount of land. Cereals, fruits and vegetables are cultivated worldwide almost exclusively in monocrops. Under these conditions, pest and diseases outbreaks are more frequent and losses are unavoidable, if control methods were not applied. Pests may reproduce faster, and after crop harvest, these insects, mites and fungi spores, may spread and infect adjacent areas. Synthetic broad-spectrum pesticides are usually used, eliminating possible natural enemies. Simple substitution of inputs (for example, replacement of soluble synthetic chemical fertilization and pesticides by high doses of organic fertilizers and green pesticides) is not a suitable solution. In general, green pesticides or biological control agents demands more time to be effective against pests. In addition, heavy fertilization, even of organic origin, may increase pest populations and incidence or severity of plant diseases. Instead building resilience in agriculture with a complex web of biological interactions may be a sustainable way to manage pests.

Some growers and extension technicians on organic agriculture/agro ecology advocate that "Prevention is better than cure". In other words, attention should be concentrated in prophylactic methods for pests control as plant resistance and crop rotation. However, if these methods fail, curative methods (biological insecticides etc.) may be used [1].

Vegetation management is primary strategy to design balanced agroecosystems. Intercropping is defined as growing two or more plants simultaneously in the same field, which interact biologically among them [2]. Multifunctionality is a high-priority trait when choosing companion plants candidates. Farmers will be more encouraged to use them if they can realize additional benefits. Adaptation and easiness to cultivate must be considered before choosing plant options. These aspects are essential to achieve profitability and enforceability to be accepted on a large scale. In this sense companion plants with commercial value have been used and may act in different ways on phytophagous arthropods: as pest repellent; attractant, arrestant or providing shelter to natural enemies; making host plant more difficult to be found either by masking host plant odour bouquet or masking visual cues. Garlic or onion (Amaryllidaceae) have been included in intercropping system and reduced pest populations on crops [3,4]; coriander have also been successfully included for diminishing whiteflies in vegetables [5]. "Banker" plants may provide shelter for mite predators as those which contains domatia in their leaves, like some varieties of pepper (*Capsicum* spp) [6-8]. Flowers of some cover crop and aromatic plants also may provide feeding and shelter to parasitoids and predators [9].

Suitable soil management also allows opportunities to manage pests. Plant nutrition is more balanced when using organic fertilizers due to slowly liberation of nutrients. Reductions observed on pest infestations and damage on organic broccoli plants was referred to lower levels of free N in the foliage of plants [10,11]. Several agricultural practices also affect soil microorganisms. Organic agriculture prioritizes strategies to warranty microorganism development, as no till, soil coverage, compost addition, crop rotation and cover crops. Mycorrhizae fungi and growth-promoting rhizobacteria (GPR) can thrive and confer resistance to root-feeding insects by a series of mechanisms: improve plant's capacity to take up water and nutrients and compensate damage by root-feeding pests; production of structural materials that strengthen root tissues and antibiotic metabolites [12,13]. Improvements in soil biota contribute to get not only resistance to pests but also to extreme climatic events as heavy rainfalls and droughts.

Emphasis in processes which promotes sustainability and even restauration must be taken in account in all human activity. Organic agriculture is not only a market niche but a showcase to a future widespread sustainable agriculture. Strategies achieved by organic farmers allow reduction or even elimination of insecticides. Smart vegetation and soil management are excellent tools to reach this goal.

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