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Center for Smart Agriculture

Organic Farming



Module 5: Organic management of field

Session 5: Insect and pest management



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Insect-pest management strategies for organic farming

Under organic farming, pest and disease management strategies are classified into following categories

- Modification of cultural practices including crop rotation, soil health management, use of insect resistant plants, etc.
- The conservation practices to restore the natural enemies through provision of hedge rows, shelter belts, etc.
- Use of biological control agents such as insect predators, parasitoids, insect pathogens by applying or releasing the agents through inoculate and inundated methods.
- Use of pheromones and another attractant.
- Use of organic pesticides and other permissible pesticides



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1. Modification of cultural practices

Use of resistant cultivars: Plant breeders traditionally more focus on creating pests-resistant varieties.

Crop rotation: Crop rotation or sequence is designed to present a no host crop to pest insects.

Planting date and method: The stage of crop development can have a profound effect on a crop's attractiveness to pest insects.

Plant density: Increasing the population density of a crop increases beneficial insects, it can lead to a decrease in pest insects. In some crops, close row spacing proliferate control by beneficial insects.



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Fertility management: Organic production does not allow synthetic fertilizers or sewage sludge. The low nitrogen content in plants due to organic manures leads to increased phenols, tannins and lignins that make the leaf toughness and production of more cell wall related structural compounds which are not desirable for herbivores.

Water management: Irrigation has both direct and indirect effects on pest insects and pathogen. Insect populations can decrease if overhead sprinklers knock insects off plants or raise microenvironment humidity enough to encourage insect disease caused by bacteria or fungi.



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Tillage: The regular disturbance of agricultural soils disrupts ecological linkages and allows adapted pest species to increase without the dampening effects of natural controls.

Sanitation: Good farm sanitation can help to prevent introductions of pest insects from outside sources, slow their movement within the farm and eliminate them when they are discarded with crop materials that may harbor them.

Mulching: All mulches suppress insects in comparison to bare soil. Biodegradable plastic mulches are being developed and may affect pests in a similar way to that of conventional, non-biodegradable mulches.

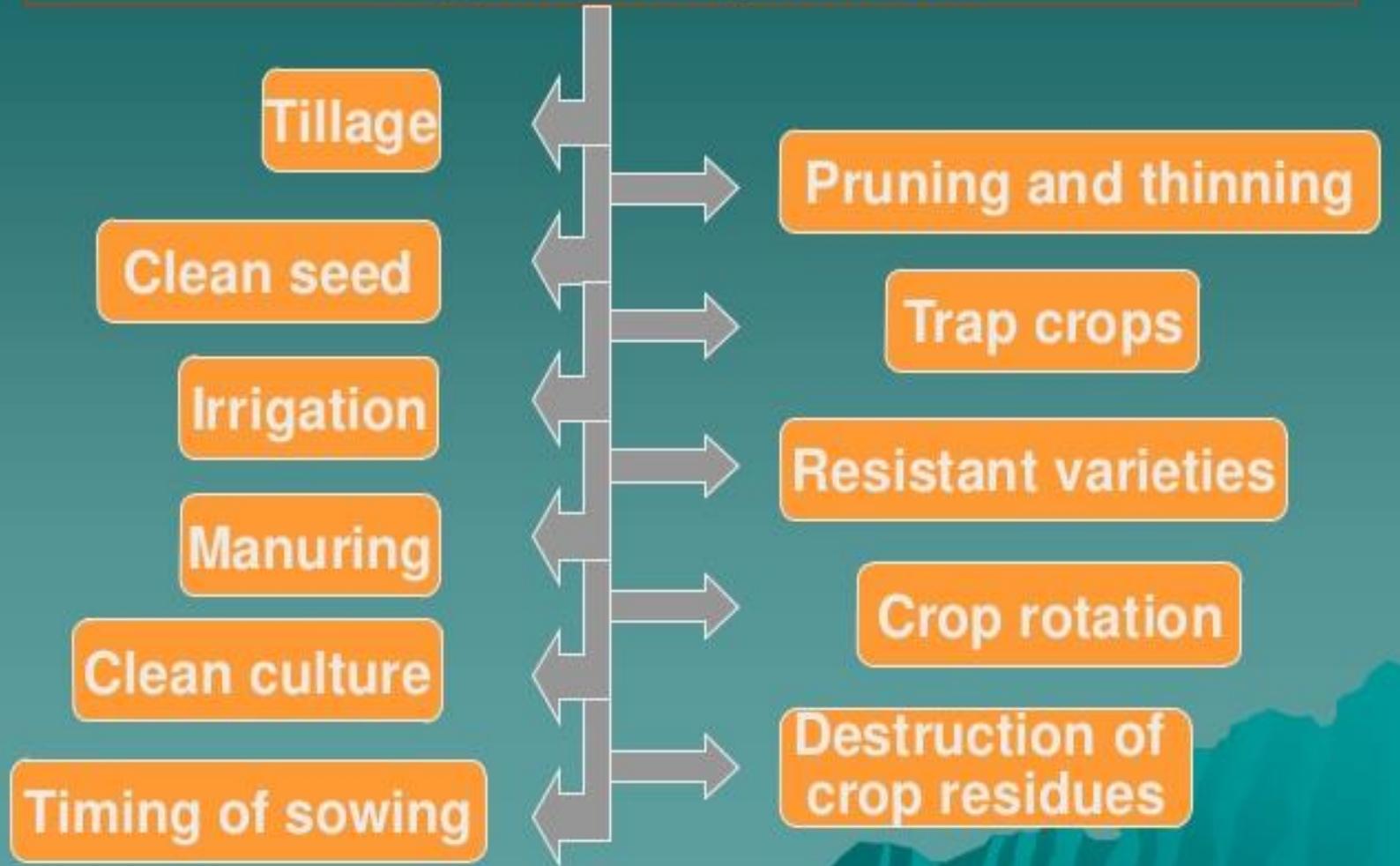


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Cultural control

Control of Insect pests by performing the regular agricultural practices





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Companion planting: The companion planting approach is based on the theory that various plants grown in close proximity to the crop plant will repel or kill pest insects.

Trap crops: Trap crops attract pest species away from the cash crop to be protected and into a specific area where they can be destroyed.

Use of bio-pesticides for natural enemies: Neem products are considered safe to spiders, adults of numerous beneficial insect species and eggs of many predators, such as coccinellids; however, nymphal or larval instars are more or less sensitive, especially under laboratory conditions.



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Use of biological control agents

Inundate and inoculative release or applying biological control agents such as insect predators, parasitoids and insect pathogens will have greater role to play in controlling the insect pests in an insecticide free environment.



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Table: 1. Potential biological control agents for pest management in organic crop production

Biocontrol agents	Effective against	Crops
Bacteria <i>Bacillus thuringiensis</i>	Lepidopteran pests	Cotton, sunflower and vegetables
Entomopathogenic fungi <i>Metarhizium anisopliae</i> <i>Beauveria bassiana</i> <i>Verticilium lecanii</i>	Coleopteran grubs Lepidopteran and coleopteran Aphids and whiteflies	Coconut, cotton, and green house vegetables
Insect predators Lady bird beetles <i>Chrysoperla</i> spp.	Aphids, whiteflies and mealy bugs	Fruits and vegetables
Insect parasitoids <i>Trichogramma</i> spp. <i>Chelonis blackburni</i>	Lepidopterans	Sugarcane and tomato
Entomopathogenic nematodes <i>Heterorhabditis bacteriophora</i> <i>Steinernema carpocapsae</i>	Coleopteran and Lepidopterans	Sugarcane and plantation crops
Entomopathogenic Viruses Nuclear polyhedrosis virus (NPV)Granulosis virus	<i>Helicoverpa</i> and other Lepidopterans	Pulses and vegetables

Source: Kumaranag, *et al.*, 2013



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Pheromone traps: Insect pheromones are essential components of monitoring and management tools targeting pests of agricultural crops. Mating disruption, mass trapping, attract-and-kill, and push-pull are some of the direct pest control strategies that depend on the use of pheromones.



Funnel trap



Plastic moth trap



Delta trap



Normal trap



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Most microbes produce and secrete one or more compounds with antibiotic activity. In some instances, antibiotics produced by microorganisms have been shown to be particularly effective at suppressing plant pathogens and the diseases they cause.



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Some of antibiotics produced by biological control agents

Antibiotic	Source	Target pathogen	Disease	Reference
Bacillomycin-D	<i>Bacillus subtilis</i> AU195	<i>Aspergillus flavus</i>	Aflatoxin contamination	Moyne <i>et al.</i> (2001)
Bacillomycin, fengycin	<i>Bacillus amyloliquefaciens</i> FZB42	<i>Fusarium oxysporum</i>	Wilt	Koumoutsis <i>et al.</i> (2004)
Xanthobaccin-A	<i>Lysobacter</i> spp. strain SB-K88	<i>Aphanomyces cochlioides</i>	Damping off	Islam <i>et al.</i> (2005)
Gliotoxin	<i>Trichoderma virens</i>	<i>Rhizoctonia solani</i>	Root rots	Wilhite <i>et al.</i> (2001)
Herbicolin	<i>Pantoea agglomerans</i> C9-1	<i>Erwinia amylovora</i>	Fire blight	Sandra <i>et al.</i> (2001)
Iturin-A	<i>B. subtilis</i> QST713	<i>Botrytis cinerea</i> and <i>R. solani</i>	Damping off	Paulitz and Belanger (2001), Kloepper <i>et al.</i> (2004)
Mycosubtilin	<i>B. subtilis</i> BBG100	<i>Pythiumaphanidermatum</i>	Damping off	Leclere <i>et al.</i> (2005)

Source: Jan *et al.*, 2013



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