

ROLE OF SOME SELECTED INSECT REPELLENT PLANTS IN ORGANIC AGRICULTURE

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Modern agriculture emerged with the Green Revolution. Thereafter majority of the farmers followed commercial scale agriculture with following main components such as, use of high yielding crop varieties, farm mechanization, use of inorganic fertilizer and use of agrochemicals to control pests and diseases. Continuous usage of agrochemicals for controlling pest and diseases will create number of problems for every living organisms as well as to the environment. Therefore we have to identify the problems correctly and find out environment friendly solutions as much as possible.

Disadvantages of chemical pest control

1. Destroys non – target beneficial organisms such as pollinators, favorable microorganisms etc.
2. Pollution of air by release of vapor of harmful chemical compounds.
3. Pollute water streams causing damages of aqueous biota.
4. Addition of harmful compounds to the soil that harms plant growth and soil microbiological population
5. Diminish biodiversity.
6. High residual impacts causing accumulation of toxic compounds in environment and bio magnification.

Organic Agriculture is one of the best solutions for sustainable agriculture with minimum /zero toxic compounds.



What is Organic Agriculture?

“Organic Agriculture is defined as plant and animal production systems managed with an emphasis on sustainable and renewable biological processes”.

What is Organic Pest Management?

“Organic Pest Management is defined as a method of growing or maintaining ornamental or food plants without the aid or application of synthetic chemicals (fertilizers, pesticides, hormones, etc.) but with natural agents such as botanicals and beneficial macro and microorganisms.”

Organic Pest Control Methods

Most plants contain compounds for preventing attack from phytophagous insects. Major chemical categories of such components are, nitrogen compounds (primarily alkaloids), Terpenoids, Phenolics, Proteinase inhibitors, and Growth regulators.

These chemicals fall into several pest controlling categories as follows

1. Repellents - Repel the pests by using characteristic odors and specific actions.
2. Feeding deterrents - Prevents the moth larvae from feeding thus cause starvation.
3. Growth regulators - Disrupt the hormones that control molting and other processes.
4. Toxins

Poisoning by Ingestion – The pests consume the plant parts containing toxic compound and are poisoned.

Contact poisoning – Extracts of pesticide compounds kill the pests by entering through their skin or other tissue.

What are Pest Repellent Plants?

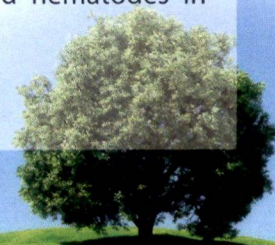
- Plants which have ability to repel insects, nematodes, and other pests are called as pest repellent plants.
- These types of plants are ideal to be used as companion planting for pest control in organic agriculture.
- The essential oils of many plants are also well known for their pest-repellent properties.
- Currently, pest repellent plants are used to control pests in organic farming instead of chemical pesticides.

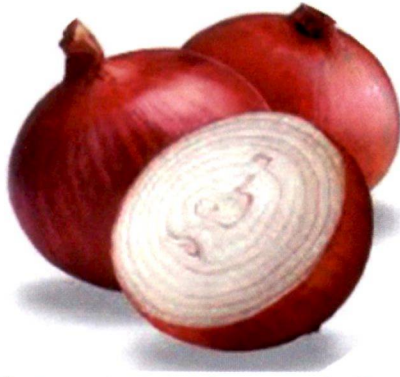
Repellent Plant	Pest	Crop
Chrysanthemum	Ants, Ticks, Silverfish, lice, root-knot nematodes	Tomato
Citronella grass	Insects	Cinnamon
Cloves	Aphids, Wireworms	
Coriander	Aphids, Mites	Potato
Eucalyptus	Aphids, Cabbage looper caterpillar	Cabbage, Potato
Garlic	Root maggots, Cabbage looper, Aphids	Tomato, Eggplant, Cabbage
Lavender	Moths, Scorpions, water scorpions, Flies	
Marigold	Bean beetles, Nematodes	Potato, Tomato, Pepper, Eggplant
Onion	Potato beetles, Potato bugs, Carrot rust flies	Most vegetable except beans
Radish	Cucumber beetles	Beans, Carrot, Cucumber, Onion
Tobacco	Carrot fly	Carrot
Tomato	Asparagus beetle	Asparagus
Neem	Mites, White flies, Thrips	Cabbage, Tomato
Mint	Aphids, Spider Mites, Flea Beetles, Cabbage worms	Cabbage
Basil	Aphids, Japanese beetle, Leaf hopper	



Marigold Plant (*Tagetes erecta*)

Volatile oils of marigold plant (Active compounds- α -terthienyl) interfere pests to identification of host plant location, feeding, distribution and mating, resulting in decreased pest population and attack on the desired crop. Some organic growers plant marigold for its pollen and nectar, which increase natural enemy fecundity and survival. This plant naturally repels aphids, thrips and nematodes in chili as well as cabbage crops.





Onion (*Allium cepa*) - Active Compound-Allicin

- Onion contains a broad-spectrum natural insecticide. Repels organisms such as Slugs, aphids, carrot flies and cabbage worms. Onion can easily intercropped with Tomatoes, Peppers, potatoes, and cabbage
- Once Onion is incorporated with above mentioned main crops benefits such as lowest leaf damage, increased yield and highest fresh leaf mass etc can be easily obtained.



Garlic (*Allium sativum*)

Active Compounds

Allicine, Ajoenen, Diallylpolysulfides, vinylthiins, S-allylcysteine, enzymes, saponins. Repels Root maggots, Cabbage looper, Mexican bean beetle, Peach tree borer, Rabbits, Aphids, Codling moth, Japanese beetle.

Mechanism of Pest Control

Garlic bulbs contain an amino acid that converts in to a substance called Allicin when crushed, blended or chopped and that pungent odour simply makes the plants undesirable for feeding or laying eggs.

Uses

Garlic-derived polysulfide product is used as a nematicide and insecticide for cabbage root fly and red mite.

Farmers plant Onion and Garlic on the middle of the main crops so that pests are not able to invade the fields because of the smell of onion and garlic. Research revealed that Exposure of potato plants to volatile organic compounds from undamaged onion plants significantly alter the volatile profile leading to avoidance by aphids. Abundance of aphids was low in potato onion intercropping than in potato grown in pure stand.



Chrysanthemum (*Chrysanthemum indicum*)

Active Compounds

Pyrethrum derived from dried chrysanthemum flowers is a neurotoxin that kills insects but does not harm mammals or birds.

Target Pests :

Aphids, Leaf hoppers, Spider mites, Ticks, Pickle worms, Root nematodes, Cabbage worms.

Formulating Pesticides from Chrysanthemum

Pick the flowers when they are at fullest stage and leave them undisturbed in a cool dark place with good air circulation until dry. Grind them up to powder and sprinkler at around the garden to kill and repel insects.

Steeping the flowers in hot water allowing it to cool and then sprinkling it on the plants.



Neem (*Azadirachtaindica*)

Active Compounds

Azadirachtin, Nimbin, Gampesterol, Beta-sitosterol, Stigmasterol.

The main product is the oil extracted from the seeds. Oil is considered a contact insecticide, presenting systemic and translaminar activity with a broad spectrum of action.

Bio repellent active compounds present in Neem extract

Azadirachtin - Inhibit the insect metamorphosis process and it blocks microtubule formation in actively dividing cells. Interfere in mitosis. Has a direct histopathological effect, resulting in restricted movement and decreased flight activity. Causes number of problems for insect fertility.

Traditional use

In Asia, the traditional farming system employed neem extracts for pest management and to supply nutrients to plants.

Importance for Organic Agriculture

Do not generate chemical residues. It helps to maintain soil productivity, ensuring longer production times and do not generate waste.

Advantages of using Bio Repellent Plants Instead of Chemical Treatments

1. No detrimental effects on biodiversity.
2. No adverse effects on soil life.
3. Absence of easily available plant nutrients reduces the selective enhancement of fast-growing microorganisms.
4. Least toxic to humans.
5. Very low toxicity to beneficial organisms.
6. Offer more targeted activity toward desired pests.
7. Effective in very small quantities, thereby offering lower exposure.
8. Rapid decomposition, leaving virtually no harmful residues.
9. Can be used in rotation with conventional pesticides when used in Integrated Pest Management (IPM) programs to obtain high yields with least environmental damage.

10. Development of insect resistance would be virtually impossible.

Disadvantages of using bio repellent plants and their extracts in pest control

- High selectivity over host specificity.
- Requirement of additional control measures.
- Delayed effect.
- Storage problems of extracts.
- Difficulty of culturing in large quantities.

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