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Usage Possibilities of Insecticide Effective Biocidals in Organic Agriculture

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Abstract: In conventional agriculture it is aimed that mainly increase in the amount of products, synthetic chemicals and fertilizers are used extensively to provide it. Today, terms such as safe food, human and environment health have become more important. Therefore, it is necessary to increase the share of organic agriculture which have less negative impacts to human health and environment, and sustainable use of natural resources. Herein environmentally insecticide effective biocidals to pest control in organic agriculture the use possibilities of these were discussed.
In terms of human and environmental health, environmental preparations used in organic agriculture and biocidal products are similar. Herbal based Azadirachtin, microorganism based Bacillus thuringiensis, Spinosad, Beauveria bassiana fungi are commonly used in organic agriculture. And also pyrethrum, rotenone, nicotine, ryania, quassine, sabadilla, potassium soap, gelatin, paraffin oil, viruses, metaldehit, kaolin are used in organic agriculture. Also it varies in different countries of the recommendation of organic insecticides and studies are being made to obtain new insecticides Insecticides used in organic farming are limited according to conventional agriculture. Due to the philosophy of organic agriculture, in the control of the pests cultural measures and biological control are very important. The plant-based insecticides should be used in the final stage. Although being organic based, it is not mean that these insecticides are reliable. The side effects of insecticides to beneficial insects are known. The side effects of insecticides to beneficial insects should be searched in detail. Results of these researches, the insecticides such as Bacillus thuringiensis, showing the minimum side effects, should be advised to be used in organic agriculture and development studies of the new insecticides used in organic farming should be carried on.

Keywords: Organic agriculture, environment, biocidal, pests

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1. INTRODUCTION

Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Organic agriculture lands in Ocenia 17.3 million ha, in Europe at 11.5 million ha, in Latin America 6.6 ha, in Asia 3.4 million ha, in Northern America 3 million ha and in Africa 1.2 million ha. Organic agriculture increases with development, improvement an economy of publics. The percentage of organic agriculture to total agriculture is %2,17 in Turkey. This percentage is very important to show situation organic agriculture in Turkey.

2. BOTANİCAL BASED INSECTİCİDES

Botanical insecticides are made from plants that have insecticidal properties. Botanical insecticides are restricted-use materials. They may be used for pesticidal purposals only if nonchemical practices documented in the Organic System Plan are insufficient to prevent or control pests. These materials have several common characteristics:

- They are broad spectrum insecticides.
- They break down rapidly in the environment and so provide little, if any, residual control.
- They are less toxic to mammals than synthetic insecticides in most, but not all, cases.

Some botanicals, however, are very toxic to fish, other wildlife, and humans. Some have potential user and off-site problems that require careful safety precautions. The botanical insecticide rotetone is prohbited for use in organic systems. Petitions have been made to the National Organic Program to prohibit the use of other botanicals. Always check with your certifier to determine if the botanical pesticide that you plan to use is allowed. [1]

Pyrethrum. This is the generic name of a plant-based insecticide derived from the powdered flowers of a *chrysanthemum* species. Synthetic pyrethroids are not allowed in organic production. Most pyrethrum is imported from Africa. It is a contact poison that acts quickly as a "knockdown." Pyrethrum is a broad-spectrum insecticide that used against true bugs, caterpilars, beetles, aphids, flies, whiteflies, thrips, leafhoppers, and mites. Some insects may be able to recover after the initial knockdown if the dose is too low. Pyrethrum is highly toxic to honeybees, other beneficial insects, and fish, and moderately toxic to birds.

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Pyrethrin degrades rapidly and offers little residual control. [1]

Neem. In addition to its categorization as a botanical, neem is also a plant-derived horticultural oil. The neem tree is native to India and is the source of hundreds of products, including insecticides made from the extracts of the seeds and bark. The primary insecticidal extract is azadirachtin. When azadirachtin is used for pest management, it can act as an insect repellant, an anti-feedant (interferes with feeding), and growth regulator (interferes with molting and growth). [2]

When neem oil or neem soap is used, it poisons upon contact much like other soaps and oils. In some cases, neem can also be a systemic insecticide (when applied to the soil, the active ingredients are absorbed into the plant and transported to the growing tips and leaves). Neem insecticides are effective against many caterpillars, flies, whitefly, and scales, and are somewhat effective against aphids. Neem may not show signs of efficacy for 3–7 days, and it can degrade within 3–4 days. Multiple applications are generally needed to obtain good management of the targeted pests. Neem is regarded as nontoxic to vertebrate animals and has been shown to minimally affect many beneficial insects such as bees, spiders, and ladybugs. [3]

Ryania comes from the stems of a tropical plant. It does not kill quickly, but it can cause pests to stop feeding relatively quickly. Ryania can be effective at controlling caterpillars and some thrips. It should be tested on a small scale before use because it is ineffective on some species. It is considered slightly toxic to mammals.

Sabadilla comes from a South American lily. It is not acutely toxic to mammals but must be carefully used because it is a powerful irritant and, if inhaled, may result in circulatory and respiratory problems. It may be used in a spray or dust and acts as a contact material, but it has some activity as a stomach poison. Sabadilla has some activity on the group of insects known as the true bugs. True bugs are insects in the order Heteroptera that have two pairs of wings and needle-like mouthparts for sucking fluids from plants (squash bugs, for example). This material deteriorates rapidly when exposed to light, so it offers little or no residual control. Always check with your certifier to detemine if the botanical pesticide that you plan to use is allowed. [1]

3. MİCROORGANİSM BASED INSECTİCİDES

Bacillus thuringiensis (*Bt*). This product contains a bacteroa; toxin that kills insects. It is derived from a naturally occurring soil bacterium and is harmless to other animals, including man. *Bt* must be ingested to work. After the bacterium is eaten, the toxin causes midgut paralysis in insects, which stops their feeding, usually within 24 hours. Next, the midgut lining is perforated, allowing leakage between the gut and the insect body cavity. The insect

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dies in two to four days. *Bt* will not kill other pests, such as aphids, mites, or thrips. Not all formulations of *Bt* are allowed in organic production. Check with your certifier to determine which formulations are currently allowed. Thousands of *Bt* strains have been discovered and usually have more activity on specific groups of insects—beetles, caterpillars and worms, or flies and mosquitoes. This varying toxicity is apparently due to different toxins and different midgut environments within species. *Bt* toxins have a third name associated with them to differentiate the various strains. For example, *Bt* kurstaki and *Bt* aizawai are more active on caterpillars and worms, whereas Bt tenebrionis and *Bt* san diego work better on beetle pests. For this reason, it is very important to match the product with the target pest. Even within strains that demonstrate activity on similar insect groups, there can be differences in control among species. For example, *Bt* aizawai is more active than *Bt* kurstaki on army worms. Some weaknesses of these products must be considered before use:

• *Bt* products have a short residual period because the ultraviolet radiation in sunlight breaks down the toxin. Farmers traditionally have extended residual effectiveness by spraying just before dark.
• Timing of application should be matched to the pest's feeding habits. *Bt* must be consumed to work. An insect that hatches, feeds for a short time, and then bores into the plant or fruit will probably not ingest enough toxin to be affected. For boring insects, applications must be made at or just before egg laying and thoroughly cover the plant. [1]

Spinosad. Spinosad is composed of spinosyns A and D. The fermented product is very toxic to caterpillar pests such as cabbageworm, cabbage looper, diamondback moth, armyworm, and cutworm, as well as fruit flies such as spotted wing drosophila. Spinosad can act on a susceptible insect's stomach and nervous system. It is primarily ingested by feeding insects but can have some efficacy when sprayed directly on insects. Affected pests cease feeding and undergo partial paralysis within minutes upon exposure to spinosad, but it may take up to two days for the insects to die.[4]

Spinosad is systemic in some plants. Depending on the fermentation process and formulation, some spinosad insecticides are considered organic. Spinosad has low toxicity to many beneficial insects that prey on pests, and is nontoxic to mammals and other vertebrates, with the exception of some fish (e.g., slightly toxic to trout). Spinosad is toxic to bees for three hours after application, so do not apply to blooming plants during the day. Because it is selectively toxic for many pest species and relatively safe to nontarget species, spinosad has become highly desirable as an organic insecticide. However, its popularity raises concerns about the development of pest resistance. Therefore, alternate the use of spinosad with other products.[3]

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Beauveria bassiana. This common insectpathogenic soil fungus has been formulated into an insecticidal product. Fungal insecticides have two advantages. First, they are contact insecticides. The insect does not have to ingest them to become infected. Spores land on an insect, germinate, and penetrate the exoskeleton. Once inside, the fungus proliferates, adsorbs nutrients, and emits toxic compounds. After the insect is dead, the fungus grows out to the surface of the exoskeleton and forms millions of spores. Second, fungi can initiate an epizootic (a widespread, self-sustaining disease of insects) which can be very effective at controlling insects at high population levels. Beauveria has been formulated into several commerically available products to control insects, such as aphids, whiteflys, thrips, mealybugs, mites, and various caterpillars. These products are sold under different tradenames, such as BotaniGard, Naturalis, and Mycotrol.[1]

4. OTHER INSECTİCİDES

Kaolin. Kaolin is a fine clay that is sprayed on plant foliage or fruit to deter feeding and egg laying of insect pests such as apple maggot, codling moth, and leafhoppers. It can also have some repellant properties that cause irritation to insects upon contact [5]

Soap Natural soaps are derived from plants (coconut, olive, palm, cotton) or animal fat (whale oil, fish oil, or lard) and have been used since the 1700s to control certain soft-bodied insects such as aphids. [6]

Diatomaceous Earth. This is a restricted material that can be used as a pest lure, repellent, or as part of a trap, or as a disease control. It may be used for other pesticidal purposes only if nonchemical practices documented in the Organic System Plan are insufficient to prevent or control insect pests. This product, which is silicon dioxide, is the finely milled fossilized remains of singlecelled organisms (diatoms). The milling process produces a glass-like product that can scratch an insect's exoskeleton or puncture gut linings. When used as a desiccant, it is dusted or placed around plants to be protected. The dust scratches away the thin, waxy, waterproof layer on the exterior of insects, making them less tolerant of environmental conditions. Care should be taken to protect workers from the dust generated during mixing and application.[1]

5. CONCLUSİON

Due to the philosophy of organic agriculture, in the control of the pests cultural measures and biological control are very important. The plant-based insecticides should be used in the final stage. Although being organic based, it is not mean that these insecticides are reliable. The side effects of insecticides to beneficial insects are known. The side effects of insecticides to beneficial insects should be searched in detail. Results of these researches, the insecticides such as

Bacillus thuringiensis, showing the minimum side effects, should be advised to be used in organic agriculture and development studies of the new insecticides used in organic farming should be carried on.

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