

***ORNAZIN<sup>®</sup> 3% EC***

***ECOZIN<sup>®</sup> 3% EC***

***AMAZIN<sup>®</sup> 3% EC***



## **An IGR\* from Nature...*Naturally!***

For centuries, the neem tree (*Azadirachta indica* [A. Juss]), a tree belonging to the mahogany family (*Meliaceae*), has been revered for possessing remarkable healing as well as pest control properties. The tree is native to the Indian subcontinent, but is widespread throughout the tropics.

The neem tree is hardy and very drought resistant and its deep tap root system enables it to grow in very arid climates. In order to protect itself from insect attack, the neem tree has, over evolutionary time, mastered the production of many triterpenoid and limonoid-type compounds. However, it is the presence of azadirachtin (the active ingredient in **Ecozin**, **Ornazin** and **Amazin**) that is responsible for the unique repellent and insect growth regulator properties (IGR). During a severe locust attack in Africa, only the neem tree escaped defoliation in an otherwise denuded forest.

\* ***Insect Growth Regulator***

## SOURCE OF AZADIRACTIN

The azadirachtin (AZA) technical is extracted from the seeds of the neem tree. Every year, thousands of tons of neem seed are gathered by AMVAC's business partner, Fortune Biotech India Limited. Using state-of-the-art seed cleaning and patented extraction technologies, a technical grade material containing around 14% AZA is produced.

The AZA content in the seed varies naturally from 0.05% to 0.2%. Therefore, to produce a consistent grade technical, the extraction process must be versatile. The large-scale manufacturing capabilities of Fortune Biotech Ltd. allows it to blend multiple batches to produce a uniform-grade technical product which, in turn, assures a stable shelf life and consistent efficacy of the formulated products.

## AZADIRACTIN—MODE OF ACTION

Structurally, AZA resembles the molting hormone, ecdysone. Research has shown that the presence of AZA in the insect body causes hormonal imbalances, which result in unsuccessful molts (i.e., death), or heavily deformed immature stages. Therefore, the mode of action is that of a classical Insect Growth Regulator (IGR). In addition, AZA in some adult insects causes sterility and reduces egg-laying in females. AZA has also been shown to slowly paralyze the mouthparts of many species of insects, which causes them to die slowly of starvation (anti-feeding effect).

Since it targets the molting process, AZA takes four to ten days to kill an insect, depending on the life cycle. However, insects refrain from feeding long before they die. Growers who spray AZA and then are puzzled to still see adults flying around need to remember—AZA does not kill adults! However, AZA also works by repelling adults from feeding on treated crops. Typically, repellency is short-lived. **Ecozin** and **Ornazin** are effective for repelling adult Japanese beetles on many plant species.

### AZADIRACTIN BENEFITS

- Broad spectrum activity
- Non phytotoxic
- Compatible with other agrichemicals
- Excellent for IPM/resistance management programs
- Repels adult insects
- Unique mode of action
- Stable formulation
- Low use rates
- Environmentally compatible
- Can be used on food crops to day of harvest
- OMRI listed
- No odor formulation

## THE AZA PRODUCTION PROCESS

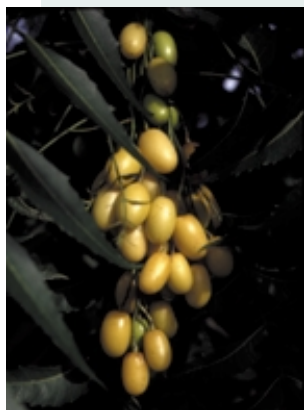
Careful attention is given to the procurement of seed. Upon arrival at the factory, they are immediately fed through a cleaning system that removes dirt, stones and other foreign objects. In the next step, the seeds are mechanically dried to a moisture level of around 11%.

The seeds are stored in an aerated silo for processing throughout the year. Improperly stored or processed seed can lead not only to rapid breakdown of the AZA content, but also to the production of fungi such as *Aspergillus flavus* resulting in aflatoxin contamination. Improperly produced extracts have dangerously high levels of aflatoxin and produce problematic formulations that give inconsistent results. AMVAC's end-use formulations match aflatoxin levels allowed for peanut butter in grocery stores and are of the highest quality.

During the extraction process, the neem seeds are lifted out of the silo, decorticated (hulls removed), and then the resulting kernels are "soft pressed" to yield some neem oil. This mashed kernel matrix is then subjected to a series of proprietary solvent extraction steps that yield the technical grade material (Fortune AZA Technical) containing 10% to 18% azadirachtin. Various batches are blended to produce a 14% grade technical product that is exported to the United States.

The technical grade AZA is then formulated into a proprietary AMVAC formulation (an AMVAC patent is pending approval). Technical grade active ingredient and end-use formulation labels were approved by EPA during late 1999 and AMVAC's product line consisting of **Ecozin** (vegetable and fruit tree crops), **Ornazin** (for the greenhouse ornamental/ nursery market) and **Amazin** (specialty and *Agaricus* mushrooms) and have been marketed ever since.

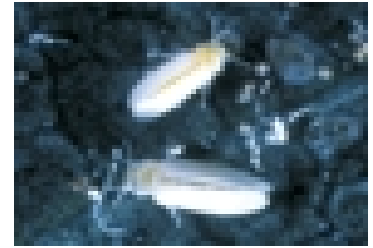
Neem oil is not present in any of AMVAC's AZA formulations.



**Neem fruit**

# LIFE STAGES TARGETED BY AZADIRACTIN

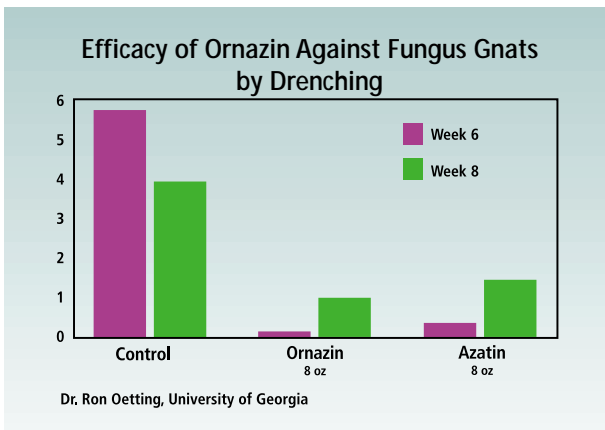
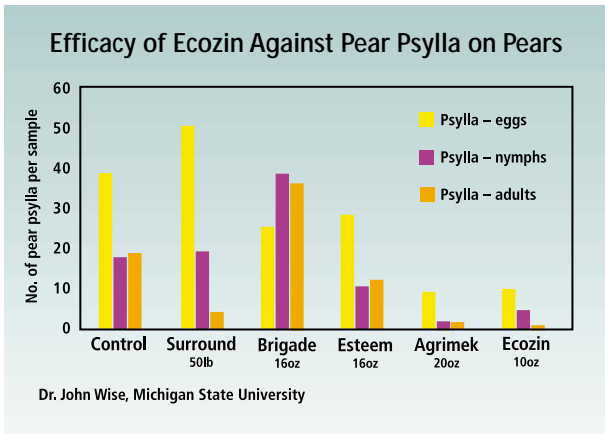
When sprayed onto the plant, AZA is adsorbed onto the leaf surface and insects are quickly repelled and refrain from active feeding.



Nymphs and larvae pick up AZA through direct contact of the spray solution or dried spray residue. Death is observed typically between larval-larval (or nymphal-nymphal), larval-pupal, and during adult eclosion. AZA is also active in the quiescent pupal stage when traditional insecticides have no effect. This unique window of control can be exploited by including **Ecozin, Amazin** and **Ornazin** in pest management and resistance management programs by targeting the pupal stage and widening the pest control window.

## RECOMMENDED USE RATES

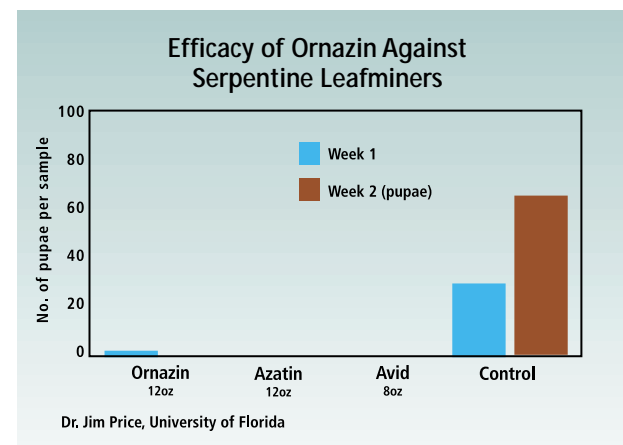
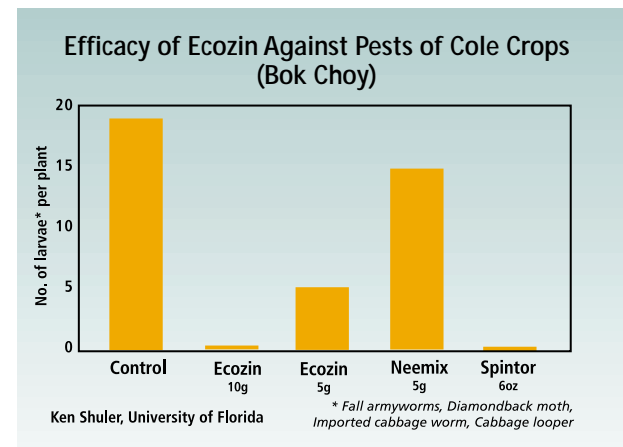
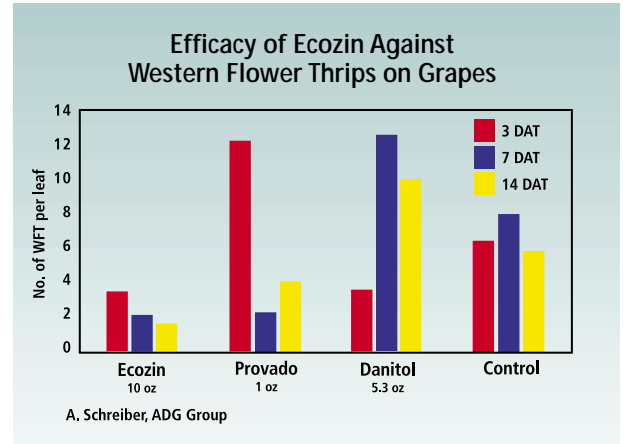
Use **Ecozin** at the rate of 8 to 10 oz per acre to control key pests such as aphids, cabbage loopers, Colorado potato beetles, diamondback moths, Japanese beetles, *Lacania*, leafhoppers, leafminers, leafrollers, maggots, mealybugs, pear psylla, Western flower thrips, whiteflies, etc. Always add a non-phytotoxic oil at the rate of 0.25% to 1.0% to enhance control (the addition of oil is not necessary for Japanese beetle repellency). Make at least two applications seven to ten days apart to obtain consistent control.

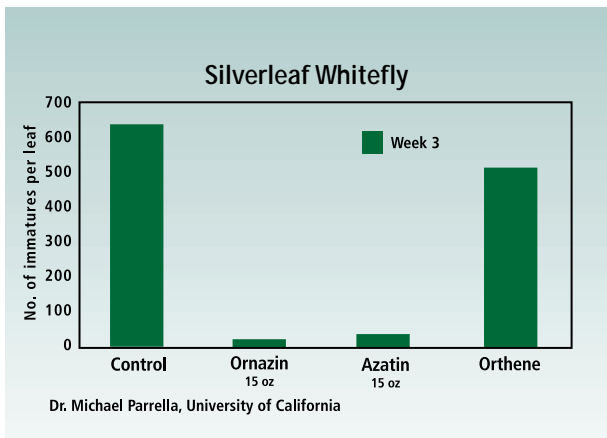


**Ornazin** is recommended to be used at the rate of 8 to 10 oz per 100 gallons (adjust the gallonage to achieve thorough coverage) for controlling pests such as aphids, armyworms and other caterpillars, beetles, fungus gnats, leafminers, mealybugs, sawflies,



**Ornazin 3% EC is distributed exclusively by SePRO Corporation (Carmel, Indiana) into the greenhouse, nursery and turf & ornamental markets**





scales, thrips, whiteflies, etc. For fungus gnat control, media needs to be drenched with adequate spray solution. Make two to three applications seven to ten days apart to obtain consistent control.

**Amazin** is recommended to be used at the rate of 4 oz per 8000 sq. ft. in mushroom houses for controlling nematodes, phorid flies and sciarid flies. It can be applied directly onto compost or drenched at casing and post-casing. For specialty mushrooms, **Amazin** can be diluted at the rate of 8 oz in 50 gallons of water and sprayed onto media, such as logs, or fogged in mushroom houses to repel adult flies.



Do not exceed 22.5 oz per acre per application. Consult product labels for complete information. Always follow label directions for use.

## RESIDUAL ACTIVITY

The biological efficacy of **Ecozin**, **Ornazin** and **Amazin** generally lasts for about seven days. Under hotter conditions, it can be shorter. As a rule of thumb, two applications every seven to ten days are required to get consistent results. The addition of a non-phytotoxic oil for vegetable/tree crop pests (0.25% to 1% v/v) helps enhance efficacy and prolong the residual activity. High pH (>7.0) rapidly degrades the activity of AZA. When spraying, always ensure that the water pH is between 5.5 and 6.5 by adding buffering agents to the water. Never allow diluted spray to sit overnight and avoid tank-mixing highly alkaline materials.

When applied to the soil or media, AZA is taken into the plant system through the roots. Pests such as nematodes, fungus gnats, whiteflies and thrips can be controlled in this fashion. Residual activity in the soil lasts five to seven days.

## SPRAY VOLUME AND APPLICATION METHODOLOGY

Generally speaking, high volume applications provide good coverage on the foliage. If, however, a low-volume (LV) or ultra-low volume (ULV) system is being used, ensure that coverage is adequate. For aerial applications, a good carrier/delivery system is important. When drenching, all three products can be applied through a drip system equipped with metered injection devices. **Ecozin**, **Ornazin** and **Amazin** can be chemigated and applied through many different types of delivery systems. Read the chemigation section of the label prior to use.

## FOOD TOLERANCES, PREHARVEST AND REENTRY INTERVALS

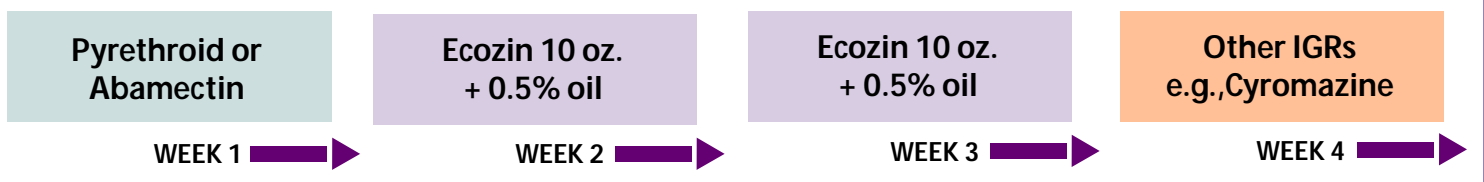
**Ecozin**, **Ornazin** and **Amazin** can be applied up until the day of harvest. EPA has exempted AZA from food tolerance requirements (40CFR, 180.1119) on food crops at rates up to 20 g a.i. per acre per application (22.5 fl oz of **Ecozin**, **Ornazin** or **Amazin** per application). There is no limit on the number of applications per year or crop. **Ecozin** is labeled for use on a wide range of food crops and insect/crop combinations.

## INCORPORATING ECOZIN, ORNAZIN AND AMAZIN INTO YOUR PEST CONTROL PROGRAMS

Generally, it is best to incorporate **Ecozin**, **Ornazin** and **Amazin** into insecticide rotation programs. In greenhouses, where multiple applications on crops are common, it is always best to start off a program with an adulticide (such as pyrethroids, organophosphates or abamectin) to kill the adults and minimize egg laying. Follow-up with at least two sequential applications of **Ornazin** (or in combination with other “softer” products) is required. This will allow multiple exposure in both the larval and pupal stages—effectively breaking up the pest life cycle. Growers can then switch to other adulticides and/or other IGRs before returning to the **Ornazin** program. **Ornazin** can also be tank-mixed with other insecticides. It is always best to test new tank-mix combinations on a small area (a few plants) before large-scale use.

For vegetable and fruit crops, a similar rotation program with **Ecozin** is suggested.

### *Sample Rotation Program with Ecozin*

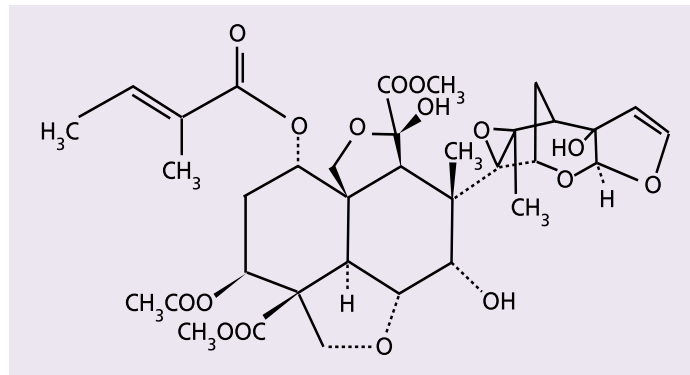
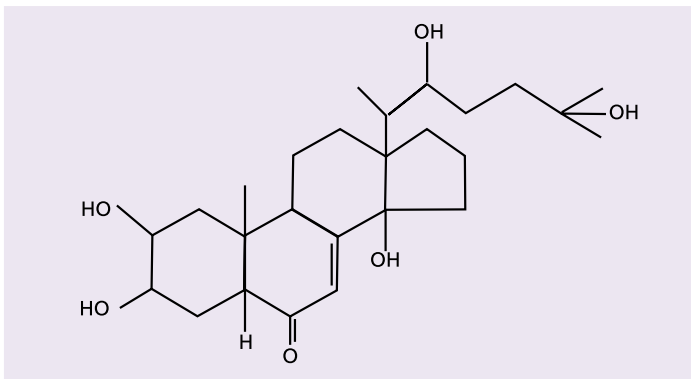


**Amazin** can be rotated with cyromazine (Armor®) and Apex® (methoprene) for larval/pupal control of flies in mushroom or poultry houses (UT and ID only).

## COMPATIBILITY WITH BENEFICIAL ARTHROPODS

Natural or introduced populations of insect parasites and predators form an effective first line of defense against injurious insects. Traditional “hard” insecticides indiscriminately kill all insects—including the beneficial species. AZA, in general, has no effect on mites and spiders. For this reason, predatory mites and spiders are not affected by AZA. Adult predators (e.g., lacewings) and parasites (e.g., *Encarsia*) are not impacted either because AZA has minimal effect on adult stages. Larval predators (such as the ladybird beetle larvae) show some sensitivity to AZA. Parasitoid larvae generally develop inside of a prey host, and are largely protected from the AZA IGR effects.





**Structures of the insect-molting hormone Ecdysone (top) and Azadirachtin (right)**

## CHEMICAL AND PHYSICAL PROPERTIES

Chemical name:	Azadirachtin
Molecular weight:	720
Empirical formula:	C <sub>35</sub> H <sub>44</sub> O <sub>16</sub>
Chemical class:	Nortriterpenoid
CAS number:	11141-17-6
Mode of action:	Ecdysone antagonist
Insecticide type:	Natural IGR
Formulation type and A.I.:	3.0%EC (0.27 lb ai/gallon)
Spectrum of activity:	Broad spectrum activity against caterpillars, beetles, leafminers and flies
Insecticide resistance risk:	Negligible
Signal word:	Warning
Environmental impact:	Low (but toxic to fish)
Toxicology (LD <sub>50</sub> values):	Oral- Rat =5050mg/kg Inhalation -Rat =2.6mg/kg Skin - Rabbit =>2000mg/kg
Eye irritation:	Slight irritant
Organic certification:	OMRI listed
Persistence in the environment:	Non-persistent
Worker safety and re-entry:	Non-hazardous, 12-hr reentry; 0 day PHI
EPA registration number:	5481-476



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