

Insect Growth Regulators (IGRs)

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Insect Growth Regulators (IGRs) are one of the fastest developing chemical classes of insecticides in the past ten years. The first IGRs were developed in the 1960's but most that are used today are new products. Most IGRs are labeled "reduced risk" by the U.S. EPA so there are definite advantages to adding them to the grower's arsenal of insecticides.

Why should I use IGRs?

They are considered a "reduced risk" pesticide because they are soft on beneficial insects and primarily are target specific for juvenile stages. These products do not work on the insect nervous system like classic insecticides and are therefore more worker-friendly within closed greenhouse environments. Odor in many cases is reduced compared to classic insecticides and thus applicators have minimal exposure to dermal inhalation. They can be either foliar or soil applied (label dependent) and can be used alone or in combination with an adulticide (kills the adult insect).

How do IGRs work?

There are three types of insect growth regulators: Hormonal, enzymatic, and chitin synthesis inhibitors. Juvenile hormone analogs and ecdysone inhibitors both disrupt the ratio of hormones with the young insect. For an insect to molt to the next stage, the correct ratio of juvenile hormone and ecdysone must be present. Ecdysone is a primary molting hormone that is necessary for insects to go from the larval to pupal stage. If you change the ratio of one to the other, the insect will not become an adult---thus reducing reproduction and population increase. With some IGRs, adults will form but fail to produce viable eggs.

This class of chemistry is 'slower' than classic knockdown insecticides and therefore must be a part of a combined insecticide management program. Hormonal IGR's may take as long as one generation (3-10 days depending on the insect and the weather) to work so they are best utilized early in the crop when populations are low and are not a good rescue treatment when outbreaks are severe.

Azadirachtin is the active ingredient of many IGRs is the primary chemical that is so close to ecdysone that the natural hormone is blocked. Adding horticultural oils to the spray will make azadirachtin work better. Short-lived insects like whiteflies are controlled best.

The last type of IGR is the chitin synthesis inhibitor. Since insects molt many times, the ability to create chitin is vital to form the insect's exoskeleton. Without the proper cuticle (exoskeleton), the insect will die. Chitin synthesis inhibitors affect insects for a longer period of time than the hormonal types of IGRs. These are also quicker acting but can affect predaceous insects, arthropods and even fish.

The most effective way to incorporate IGRs in a Pest Management program is to start early or tank mix with a “knock-down” insecticide (adulticide) like a pyrethroid. If there is a high population of pests, especially if they are adults, use the adulticide then the IGR a week later. It is a good idea to rotate within the IGR class since many insects will be affected by all three modes of action and as with other insecticides, rotation will help control possible resistance.

	Juvenile Hormone Mimics	Ecdysone Inhibitors	Chitin Synthesis Inhibitors
Mode of Action	Interferes with molting process which causes premature molting. Also causes deformations of wings and reproductive parts. Ovaries produce infertile eggs.	Blocks ecdysone which signals the insect to molt. This causes pupae to die.	Disrupts the creation of chitin, which is a main building-block of the exoskeleton, causing death. Also suppresses egg-laying.
Positives	Decreases the number of generations. Narrow range of insects is affected so is often compatible with beneficials. Some have residual effect.	More broad spectrum than JHM and affect both larvae and pupae. Also deters feeding in some insects.	Precise timing is not required since insects molt for a long period of time. Often quicker acting.
Negatives	Correct timing is essential to affect juvenile insects at the right time. Takes 3-10 days to work.	May require the addition of horticultural oil to be most efficient.	Can negatively affect predaceous insects as well as arthropods and some fish.
Brands/Active Ingredient	Distance- pyriproxyfen Esteem- pyriproxyfen Enstar II- kinoprene Preclude- fenoxycarb Precision- fenoxycarb Corfirm- tebufenozide Intrepid- methoxyfenozide	Azatin- azadirachtin Ornazin- azadirachtin Aza-Direct- azadirachtin	Adept- diflubenzuron Dimilin- diflubenzuron Citation- cyromazine TriGard- cyromazine Pedestal- novaluron Talus- buprofezin
Insects Controlled	Enstar 2- mealybugs, whitefly, scales Distance- aphids, whitefly, fungus gnats, shore flies, scales, leafminers Precision/Preclude- fungus gnat adults, aphids	Azatin/Ornazin/Aza-Direct- thrips, aphids, scales, whitefly, fungus gnats, shore flies, mealybugs, caterpillars, leafminers	Pedestal- thrips, whitefly, caterpillars, leafminers Adept- shore flies, leafminers, fungus gnats, whitefly caterpillars Citation- leafminers