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Types of Biological Control

Importation

Many pests are exotic and have no natural enemies in Texas. Reuniting pests with their natural enemies often provides the most dramatic and sustainable method of suppressing them. The importation of such natural enemies is classic biological control. The parasite *Neodusmetia* successfully suppressed Rhodesgrass mealybug in Texas after being widely distributed by airplane. The search for exotic beneficial organisms which can control major plant pests in Texas is a major mission of the biological control scientists within the Department of Entomology at Texas A&M University.

Conservation

Pesticides kill beneficial predators, parasites and pathogens as well as pests, and can cause outbreaks of secondary pests or rapid resurgence of pests that were initially suppressed. Using non-chemical control methods, or pesticides which kill only the target pest, protects natural enemies. Some easily seen predators are spiders, lacewings, lady beetles, ground beetles, rove beetles, syrphid flies, flower flies, hover flies, true bugs (including minute pirate bugs, big-eyed bugs and damsel bugs), predatory mites and even fire ants. However, many important natural enemies are rarely seen, such as parasitic wasps and flies (more than 8,500 species), nematodes and pathogenic bacteria and fungi.

Augmentation

The release of natural enemies (predators, parasites and pathogens) to control pests is a type of biological control called *augmentation*. This approach uses commercially available species that are applied in a timely manner to prevent population increases, or to suppress a pest population.

Natural enemies can be released all at once or over time to suppress pests or keep their numbers low. Also, the environment can be enhanced to favor natural enemies. Although research has shown that releases of natural enemies can be very effective in greenhouses and interiorscapes, outdoor releases are affected by unpredictable environmental conditions. Furthermore, if a second pest is unaffected by the released organism, pesticides used to control the second pest often eliminate the natural enemy of the first pest. Specific recommendations for Texas are still being developed.

The application of microorganisms in a manner similar to conventional pesticides is a type of augmentation. These products are referred to as "microbial insecticides." Several products available contain varieties of the bacterium, *Bacillus thuringiensis*, which controls certain caterpillars, beetles and flies but does not affect other arthropods. Microbial insecticides are relatively slow acting and are most effective if applied when pest numbers are low and pests are in early stages of development.

Examples of augmentive biological control products

Commercial products available for use in augmentive biological control include microbial insecticides containing living pathogens (bacteria, fungi and viruses) and multicellular animals (predators, parasites and nematodes). Other products occasionally used with biological control agents include synthetic honeydew, flowers to attract and conserve beneficial insects in and around pest-prone or pest-infested sites, and traps using colors or scents as attractants.

Best use for augmentive products

- Purchasing and releasing natural enemies for pest suppression is a rapidly developing technology but there is still much to be learned to assure effective use of these products. Results are often difficult to evaluate and can be inconsistent because of differing conditions (e.g., environmental, meteorological, etc.). Natural enemies are living and their behavior under different environmental conditions can influence the degree of pest control. Cost-effective use of augmentive releases requires an understanding of the pest(s), natural enemies, economic goals and the environment. Commercial uses often demand intensive monitoring or scouting of the cropping system.
- Augmentive releases are meant to reduce populations at points in time. Releases at low pest densities are more effective than attempts to reduce high pest densities. Action levels or economic thresholds for release of natural enemies and effective release rate(s) have often not been established through scientific research.
- Timing of the release of natural enemies is critical since most require some time to affect the pest population. In addition, many natural enemies attack only certain life stages (e.g., egg or larval stage) of the pest. Multiple releases may also be necessary to maintain pest suppression.
- Biological control using parasites is generally pest-specific. When multiple pests occur (e.g. aphids, thrips, plus beetles), natural enemies are needed for each pest. In cases where natural enemies are unavailable for augmentation, use of a selected pesticide that spares other natural enemies may be necessary.
- Environmental conditions change dramatically and outdoor releases of natural enemies can be negatively affected by high winds, rain, hot or cold weather and other insects in the ecosystem (e.g., red imported fire ants). These factors are often unpredictable and result in erratic results from releases. Release of appropriate natural enemies in greenhouses and interiorscapes often provide more consistent results.
- Insecticide residues on the crop or site, or insecticide drift from adjacent areas, can remain toxic to natural enemies long after the pesticide was applied. Residues should be mitigated prior to releases.

What support can I expect from the companies selling these products?

Companies selling products and promoting their use should provide the consumer with directions on how to use their products, and support their claims of product performance. Insectaries and brokers, the companies producing and marketing parasites and predators, assure the delivery of viable natural enemies of the stated species or strain. They usually do not guarantee results from releases of these biological control agents even when used as directed. Although researchers and Extension faculty at The Texas A&M System are involved in evaluating some of these products, suggestions for their most effective use are still being developed.

Are these products regulated by any laws?

Microbial insecticides (bacteria, fungi, viruses) are regulated like pesticides by the Environmental Protection Agency (EPA) under the Federal Insecticide, Fungicide and

Rodenticide Act (FIFRA). Multicellular animals (arthropod predators, parasites, nematodes, etc.) are NOT registered or regulated by the EPA under FIFRA. Complaints regarding product performance can be reported to the Federal Trade Commission (FTC).

The user of purchase-and-release natural enemies must be aware of legal and biological limitations of augmentive biological control methods. Just restricting frequent use of broad spectrum insecticides often will allow a diverse group of naturally occurring beneficial organisms to survive, sometimes profoundly impacting pest population densities. As the cost of natural enemy products continues to decrease and delivery systems and methods are improved, the economic feasibility of using these methods in commercial pest control will undoubtedly improve.

What is natural control?

Natural (or biological) control, is the use of living organisms to control pest populations.

Increasing trade and travel between countries has increased the number of plants and other non-native species arriving in the UK. The majority arrive without their natural enemies that keep them in check in their native range. In the case of plants almost all the insects, fungal pathogens or nematodes that would normally inflict damage on the plant are lost, giving the plant an unfair advantage over its new neighbours.

Natural control is a means of levelling the playing-field by re-introducing some of the specialist natural enemies that exert control on it in its native range.

A sustainable alternative

The use of self-replicating and co-evolved natural enemies for the long-term management of invasive alien species is a sustainable solution. Once established an effective agent provides control indefinitely without further cost or intervention.

Natural control has been used effectively against invasive species for over one hundred years.

What is known as the 'classical approach' is being proposed for Japanese knotweed. This method involves going back to where the invasive species originated (in this case Japan) and finding the natural enemies that keep the species in check.

Only after intensive research and vigorous safety testing to ensure this is specific to Japanese knotweed, will an agent be considered for release into the newly colonised area. In effect, this method utilises natures own in-built mechanisms to ensure equilibrium.

It is obviously important that potential control agents such as insects or pathogens don’t attack other plants, especially crops or endangered species. Scientists therefore spend considerable time (at least three years) studying the host range of any potential agent within a secure quarantine facility adhering to the International Code of Conduct.
This testing enables them to predict which, if any, other plant species might be at risk. Only once these stringent tests have been carried out to prove the natural control agent is safe, is an application for release made.

Find out more about natural control successes

Natural control - the advantages

Environmental – Natural control is exactly that – natural – and does not rely on the use of man-made chemicals that can impact adversely on the ecosystem in which they are used. Furthermore, the amount of herbicides required for weed control can be reduced.

Cost – After the initial research costs there is virtually no need for further expenditure once the agents are established and having an impact on the weed, bar monitoring activities.

Sustainability – It is permanent and therefore completely sustainable. The weed is continually under attack from an army of natural enemies.

Spread – The control agents, be they insects or pathogens will locate and affect most, if not all, populations of a weed until stopped by physical, environmental or chemical barriers, just as they have done in their native range.

Safety – Natural control agents should pose no threat to human health, crop production or beneficial organisms.

Landscape – Whilst the agents are doing their job on the Japanese knotweed, the native flora, which was previously out-competed, should be able to gradually recover and re-colonise areas without the need for extensive replanting.

Disadvantages

Control not eradication – A successful agent should not eradicate the weed on which it depends, but should reduce it to acceptable levels. There may be costs associated with alternative control methods.

Timescale – It takes time. It can take five to ten years from release to achieve successful control.

(Courtesy by google)