

RESEARCH LABORATORY TECHNICAL REPORT



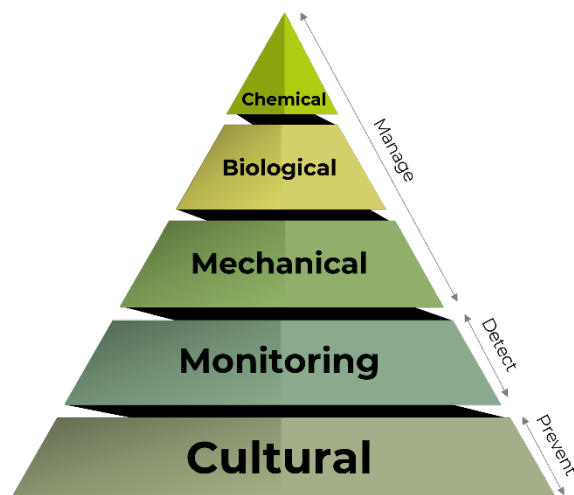
MoniTor® Rx IPM Program

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The MoniTor® Rx Integrated Pest Management (IPM) Program is designed to manage plant pests with a strong focus towards promoting plant health, protecting the environment, and reducing the impact of pesticides. MoniTor® Rx programs emphasize overall plant health care and regular monitoring for pest activity by a skilled pest management specialist to minimize pesticide inputs. Improving plant health can increase vigor, but also aims to reduce plant stress, making plants less attractive to pests. When pest management is necessary, specialists use a variety of management tactics (cultural, mechanical, biological, chemical). Chemical options prioritize naturally occurring or biologically derived compounds or products that are considered reduced risk while still being effective when used correctly. In some cases, certified organic (OMRI) products can be used.

MoniTor® Rx incorporates various monitoring, prevention, and pest and disease management techniques into a comprehensive management plan to promote plant health. The IPM pyramid (Figure 1) helps to visualize the possible courses of action and their magnitude of impact. Options at the top of the pyramid signify more intervention and are considered when other options are deemed insufficient. In the context of each pest, the IPM pyramid is used to assess plant health to determine the most appropriate management strategy.

Figure 1: IPM pyramid



Prevention

A major goal of MoniTor® Rx is to prevent a pest or disease outbreak from occurring in the first place. Optimally, this goal begins by planting a well-selected tree or shrub in the appropriate region and area within the landscape. Each plant has a unique set of environmental factors that are required for optimal survival and health. Improper placement of a landscape plant can increase stress and compromise plant defense mechanisms, leading to an increased likelihood of pest or disease outbreaks and plant decline.

Urban soils are often severely altered and may lack the soil structure, nutrients, and moisture moderation that are necessary for plant development. Plant health and growth starts with the roots; therefore, practices that promote optimal soil conditions and encourage root growth are a priority. These conditions may vary greatly by plant species and different approaches may be necessary for plants throughout the landscape.

MoniTor® Rx programs address essential soil nutrient (Prescription Fertilization) and organic matter or compaction concerns (Bartlett's Root Invigoration™). In these programs, the Bartlett Tree Research

Laboratories develops a specific prescription based on soil analysis results, the needs of the tree or shrub, and the client's landscape goals. Overfertilizing is an often overlooked but potentially serious concern, so only the nutrients that are required are applied. Stable organic matter and other amendments can also be incorporated into the soil with the use of air tools. Soil pH correction often requires a long-term treatment program that may be integrated with fertilization to ensure optimal root conditions and nutrient availability. A specialist can correct nutrient deficiencies using organic and natural fertilizers (e.g., Boost Natural and other granular organic fertilizers) where appropriate.

Detection

For most landscapes, MoniTor® Rx will require frequent inspections to be successful. Early detection of pest outbreaks is particularly important with MoniTor® Rx. For the reduced-risk, less persistent products used in this program to be most effective, the trained specialist focuses on detection and precise timing. Further, managing pest populations before they reach outbreak levels often requires fewer interventions to mitigate plant damage.

Specialists will scout for symptoms of stress or signs of pests (e.g., leaf discoloration, premature leaf drop, insect waste, sooty mold) and make recommendations accordingly. In some cases, a specialist may set up traps with pheromone lures or sticky traps to monitor pest density or presence (Figure 2).

Inspection timing is often based on growing degree days, a measurement of accumulated heat units based on local, daily temperatures over time. Growing degree days are linked to specific pest life stages, allowing early detection of difficult-to-manage insects through appropriately scheduled visits and interventions. Additional inspections are added on an “as needed” basis only. Pests requiring targeted or timely monitoring may include spongy moth, Japanese beetle, and lace bugs.

Figure 2: Sticky traps for detection of potential pests



Management

If a problem is identified during monitoring that requires intervention, the MoniTor® Rx program incorporates several reduced risk management options, including mechanical removal of the pest or disease, biological control, and chemical application. By using a combination of management strategies, MoniTor® Rx reduces the reliance on chemical applications and minimizes secondary pest outbreaks that may occur because of excessive chemical intervention.

Mechanical Control

Physically removing or cleaning woody tissues that have an insect, mite, or disease problem can reliably reduce pest pressure, inoculum sources, and plant damage. In some cases, a specialist may remove a borer by inserting a metal probe into insect galleries in stems or branches. Another mechanical option is pruning to remove heavily infested or diseased portions of the plant, which would persist and worsen. A specialist may also scrub plant stems with a soft brush to remove pests like scales, dramatically improving plant aesthetics in some situations. Localized pest problems are often easier to address with mechanical options.

Biological Control

Biological control is another method that can be incorporated in some MoniTor® Rx Programs.

Beneficial insects, also known as natural enemies, include a variety of species that help to suppress pest populations (Figure 3). These commercially available species include predators, parasitoids, or entomopathogens, which must be carefully selected to suppress the target pest. Although many of these species are considered generalists and may feed on a variety of other insects, they may not be effective against every pest species or even life stage of a pest. Considerable skill and planning are needed to use these organisms effectively.

Figure 3: Predatory green lacewing larva with a captured aphid



In some circumstances, urban landscapes do not provide a suitable environment for beneficial insects to thrive and establish. By creating suitable conditions for naturally occurring beneficial insects and/or releasing commercially available biological control agents, pest populations may remain suppressed to levels where host plants are able to maintain defense mechanisms and vigor.

Chemical Control

When mechanical and biological control measures are insufficient to manage a given pest or disease, chemical control can be used as a last line of defense. Products included in the MoniTor® Rx Program are derived from natural sources or are considered reduced risk due to their low environmental persistence and minimized impacts to non-target species. Your Bartlett Arborist Representative can review this product list and customize your program to use only those products that you prefer. If pest management cannot be achieved with these products, your Arborist

Representative will provide information about alternatives. Only with your consent will these alternatives be applied.

Horticultural Spray Oil

Horticultural spray oil has been successfully used in pest suppression for more than 100 years. This highly refined mineral oil is approved by the National Organic Standards Board for use by organic farmers. Spray oils effectively control a wide range of pests including scale insects, mites, aphids and adelgids. These oils are considered very low risk to humans, pets, and the environment. In addition, horticultural oil will not leave persistent residues that would be harmful to beneficial insects and pollinators.

Horticultural oil treatments performed during the dormant period of some pests are an important component in the success of MoniTor® Rx programs. Applications made in the fall, winter, or early spring target eggs or overwintering pests before they become active and cause damage. Specialists may make additional applications of horticultural oil for aphids, adelgids, and other pests as needed during the growing season.

Neem Oil Extracts

Neem oil, which comes from seeds of the neem tree, contains naturally occurring insecticides. It has been used for centuries for medicinal, cosmetic, and pesticidal purposes. Clarified hydrophobic extracts of neem oil, which are certified organic, are used to control many soft-bodied insect pests. This product is also known to help prevent certain fungal diseases, including powdery mildews and rusts. Residues of neem oil extract degrade naturally in the environment and pose minimal risk to beneficial insects or pollinators when applied correctly.

Pyrethrins

Pyrethrins are natural insecticides extracted from the flowers of chrysanthemum daisies. They are effective against many pests but rapidly biodegrade once applied. Pyrethrins are approved by the National

Organic Standards Board for use by organic farmers and are EPA-registered for use on most food crops. The formulation used by Bartlett contains piperonyl butoxide (PBO), which improves the effectiveness of pyrethrins. PBO is synthesized from an oil extract of sassafras and several related aromatic plants.

Abamectin

Abamectin is a naturally derived compound from the soil microorganism *Streptomyces avermitilis*. This material breaks down fairly rapidly in the environment and, when applied systemically, will have low impact on beneficial insects. Abamectin is absorbed by plant foliage and is highly effective against spider mites.

Spinosad

Spinosad is created from the fermentation of a naturally derived soil microorganism. Formulated products with spinosad are highly effective at low use rates and quickly stop the feeding of target pests. Spinosad offers some residual efficacy after application but breaks down following exposure to sun or rain. This compound binds strongly to soil and does not pose a threat to groundwater. It provides excellent control of caterpillars, sawflies, thrips, and leaf beetles.

Insect Growth Regulators

The insect growth regulator, pyriproxyfen, mimics a hormone specific to insects and exposure to it disrupts their life stage development. This product prevents insect eggs and immature stages from maturing into adults. It is especially effective against scales, whiteflies, and other sucking insects. Researchers investigating the impact of pyriproxyfen on biological control species found that populations of beneficial insects were conserved compared to applications of conventional insecticides.

Insecticidal Soaps

Insecticidal soaps are formulated to reduce potential phytotoxicity to plants while increasing efficacy against insects. While similar in name, insecticidal soaps are not the same as the dish soaps that you have

in your home, which are much harsher on plants and are not intended for pest management use. Insecticidal soap products must contact target pests directly as there is no residual efficacy following applications. Most beneficial insects are tolerant of soap applications, but these products can have a negative impact on predatory mites.

Fungicides

The principal fungicides used in MoniTor® Rx are based on naturally occurring anti-fungal compounds. One key active ingredient is in a class of fungicide compounds known as strobilurins. These chemicals are produced by wood decay fungi to eliminate competition by other fungi. Strobilurins are very active against fungal disease at extremely low rates of application, and have minimal effects on people, pets, non-target organisms and the environment. Strobilurins are degraded by sunlight and microbes within weeks. Studies show that the potential mobility in the soil is very low. Strobilurins are systemic fungicides, meaning they are absorbed by plant cells rather than acting solely as a surface barrier, and are active against a broad range of plant disease fungi.

A second key group of active ingredients are copper-based compounds. Often used in organic agriculture, these mineral-based products are both fungicidal and bactericidal, making them a valuable tool for bacterial diseases such as fire blight. The copper compounds used by Bartlett are carefully selected to minimize plant damage while maintaining activity on the plant surfaces to help prevent disease infection.



Founded in 1926, The Bartlett Tree Research Laboratories is the research wing of Bartlett Tree Experts. Scientists here develop guidelines for all of the Company's services. The Lab also houses a state-of-the-art plant diagnostic clinic and provides vital technical support to Bartlett arborists and field staff for the benefit of our clients.