1 Integrated Crop and Pest Management

1.1 Introduction

The purpose of this publication is to help growers make informed choices best adapted to the needs of their individual orchard. The best way to use this guide is to become familiar with it as a whole before using it to answer specific questions during the busy growing season.

Integrated Pest Management (IPM) is the guiding philosophy behind this publication. It is a multifaceted approach to maintain pest damage below economically damaging levels.

The word "Integrated" refers to the fact that individual management decisions are not isolated, but as much as possible take into account all aspects of the existing and potential pest situation in relation to the overall farm operation. Integration also applies to combining multiple tactics in a way that reinforces their efficacy. The word "Pest" refers to insects, mites, weeds, pathogens that cause disease, and vertebrates such as deer and voles.

Instead of focusing on how to eradicate pests, IPM considers pest biology and all feasible preventive and curative options, and brings them together into an overall management plan. This approach attempts to minimize problems of pollution and pest resistance while maximizing economic and environmental sustainability for the orchard.

1.2 Practicing IPM

IPM depends on growers, or their pest management advisors, understanding the biology of pests, when they are most active and most susceptible to treatment, and how the host plant, the fruit tree, responds to them. It is a truism in New England that every growing season is different. Staying on top of changes from year to year, or day to day, is critical. Understanding pest biology makes the most of management tools.

An IPM approach combines available management tools (see Figure 1.1.1) in a complementary way to create an overall management plan that is efficient, effective, and sustainable. By using multiple tactics, the chance of successful results is increased, and the chance that a pest population will adapt to a specific tactic is decreased. Horticultural practices, such as sanitation and habitat management, are a first line of defense in preventing many types of pest problems.

Using an IPM approach requires accurate identification and risk assessment of pest threats. Services in New England that provide insect and disease diagnosis and soil and tissue analysis are listed at the end of this publication. An understanding of pest biology and ecology, and of the influence of other factors such as weather and natural enemies on pest abundance, will aid in choosing management tactics.

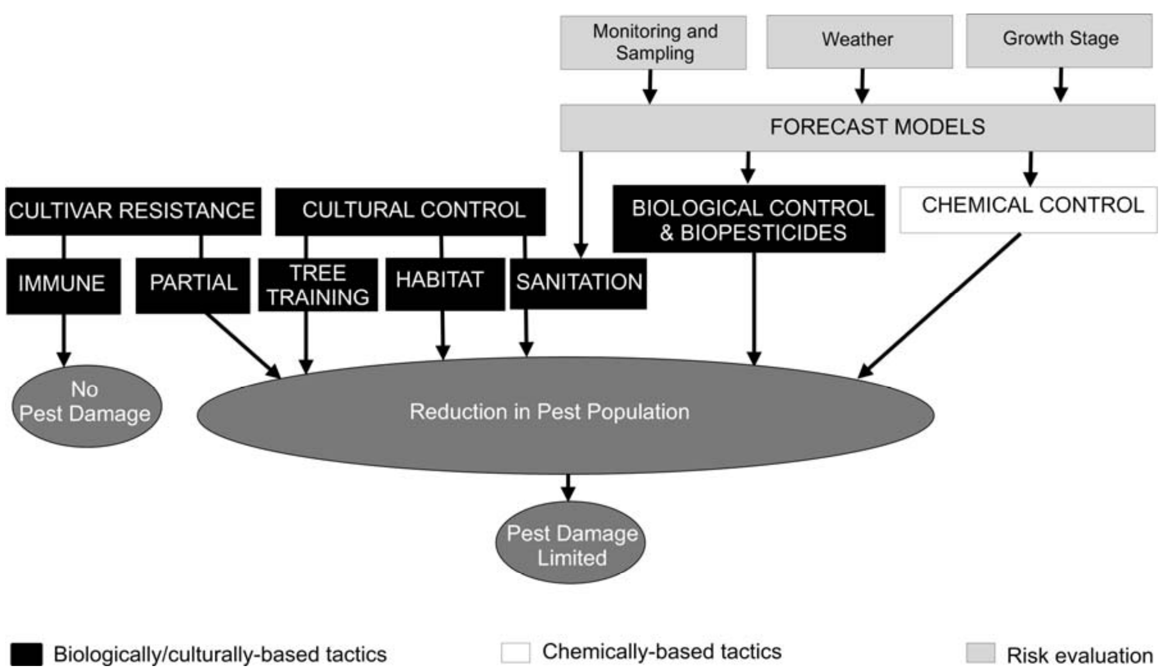

Figure 1.1.1. Diagram showing different management tactics for orchard pests (D. R. Cooley)

Instead of total eradication, the IPM approach stresses suppression of pest populations to levels that do not cause economic damage. Use of pesticide and other pest control options reaches a point of diminishing returns at which additional suppression is exceeded by the additional cost and negative impacts. In the case of insect pests, it may be important to have at least some pests present to ensure that natural enemies will remain in the orchard to suppress subsequent pest infestations.

Generally, IPM follows this process:

- Determine how much, if any, damage may be acceptable.
- Identify pest problems that are most significant from year to year, the key pests.
- Know when and how to monitor for these pests, and do it.
- Treat with an appropriate management tactic at an appropriate time.
- Monitor during the season and at harvest for results.
- Adjust tactics if needed to improve results.

1.3 Components of IPM

1.3.1 Monitoring (Scouting)

Scouting is making observations to identify and measure pest populations. Traps are available for some pests that can be used to indicate population density to compare against treatment thresholds and to identify optimum timing for control measures. For diseases, weeds and some insect pests, inspecting foliage, fruit, or groundcover is required. Monitoring individual orchard blocks throughout the season is the most effective way to assess the insect, disease, and weed situation and, therefore, the need and timing for chemical treatment. Scientifically-based and efficient monitoring methods are available for many tree-fruit pests. Brief descriptions of recommended monitoring methods are included in the “General Pest Management Consideration” notes for each crop in this publication.

1.3.2 Pest Models and Forecasting

Weather-based pest development models for some pests can be used to estimate the best timing for monitoring, prevention, or control. A record of daily maximum and minimum temperatures and rainfall can provide useful input for pest models and to estimate depletion of protective residue from a previous pesticide application. Alternatively, site-specific weather data are available from private companies (see IPM Resources).

An on-line tool called **Orchard Radar** processes weather data through IPM models, and is available through the **PRONewEngland.org** website. Information on the potential for pest outbreaks can also be obtained from Cooperative Extension newsletters and regional crop advisors.

Another on-line tool is the Network for Environment and Weather Awareness (**NEWA).** Some New England states send weather data to NEWA for use in pest forecasts. NEWA provides automated local weather information and the results of pest forecasts on a daily basis. Access NEWA online at newa.nysaes.cornell.edu.

1.3.3 Action Thresholds

A pest threshold is an estimate of the population density at which treatment is justified because the cost of economic damage is likely to outweigh the cost of prevention/control. Thresholds have been determined for some pests based on field studies of the relationship between pest population density and subsequent crop damage. For other pests, generally accepted “best guess” thresholds are used. By comparing pest monitoring observations with thresholds, tree fruit growers have been able to reduce pesticide use by as much as 50% without jeopardizing crop quality or yield. The risk of damage can be decreased by early detection and evaluation of pest threats. The term ***suggested action threshold*** in this publication denotes situations in which the decision to apply a pesticide can be made primarily on the basis of a properly timed visual inspection of the orchard. Applying general recommendations to individual orchard situations requires grower judgment. Knowledge and records of block history are very useful in making the best decisions for your orchard.

1.3.4 Management Tactics

Appropriate management tactics to prevent or control pests include cultural, biological, and physical methods, as well as chemical control (i.e.pesticide) when needed. Chemical control is deferred unless other tactics are not sufficient in order to minimize the social, environmental, economic, and safety concerns associated with pesticide use. Implementing some of the simple and relatively inexpensive non-chemical pest management methods described in this manual can yield significant savings in pesticide use and crop loss. Preventive measures taken before pest damage occurs can be much less expensive than the cost of rescue treatment later.

1.3.5 Recordkeeping

A yearly record of pest monitoring observations, treatment actions, and an end of season damage assessment provides a valuable reference for future decisions. Written records are likely to be more complete and accurate, and are more easily shared than memory. Complete pest management records can improve results and decrease costs, document and justify actions for compliance with regulatory and customer requirements. They also provide useful information for business planning. Post harvest evaluation of the season’s pest management decisions helps you learn from mistakes and build on successes.

1.4 IPM Tactics

Actions taken at planting and before and during each growing season can affect the degree of pest risk and need for pesticide use. Here is an outline of methods that can be integrated into an overall management plan.

1.4.1 Resistant Varieties

There are commercially viable scion cultivars available that are resistant to apple scab and other major apple diseases. Among susceptible cultivars, the degree of susceptibility to different diseases and even some insect pests varies.

Rootstock selection must account for desired horticultural traits, soil conditions and low temperature hardiness, but can also include consideration of the degree of management needed to prevent fire blight and Phytophthora diseases.

1.4.2 Cultural Control

Consider pest pressure in selecting sites to plant trees. For example, low spots that hold fog and dew have increased risk of fungal diseases. Orient orchards to provide maximum air drainage and circulation. If possible, remove hedgerows of wild shrubs and trees immediately adjacent to the orchard. Dense vegetation close to the orchard blocks sunlight and wind, thus keeping foliage wet longer which encourages growth of some disease organisms. In some cases, wild plants provide a source of disease and insects.

Remove disease inoculum from the orchard when possible. Get rid of piles of culled fruit or prunings, and chop prunings and leaves in the spring to speed degradation. Remove materials that provide overwintering sites for pests: dead or dying wood, branch cankers, prunings, mummified fruit, root suckers, and alternate host trees near the orchard.

Use deer fencing and open mesh vole guards, especially for young orchards that are particularly vulnerable to vertebrate pest damage.

Support tree health and regulate vegetative vigor through careful management of fertilizer, water, and groundcover. Avoid stresses such as overwatering, drought, mechanical trunk damage, overcropping or other conditions that may predispose trees or fruit to damage by insects, diseases, physiological disorders or environmental stresses such as rapid temperature changes and low winter temperatures.

1.4.3 Biological Control

Conserve natural enemies of insect and mite pests by only using insecticides, miticides, fungicides, and herbicides when needed. Select pesticides that are effective against the targeted pest(s) with minimal negative impact on predators, parasites, pollinators and other beneficial organisms. Consider the impact of groundcover management decisions on beneficial organisms. Consider "seeding" releases of predator mites if practical.

1.4.4 Chemical Control

Only use pesticides if monitoring and economic thresholds, model forecasts, block history or other information indicates a need.

Many factors need to be considered when selecting a pesticide. Some choices are constrained by third-parties, such as processors or marketers using eco- or organic labels. Additional factors must also be taken into account.

- applicator and worker safety
- required protective equipment
- reentry and preharvest intervals
- pest efficacy
- resistance management
- impact on the environment and natural enemies
- tank mix compatibility
- suitability for the application equipment that will be used

Ensure complete and uniform spray coverage by using recommended pesticide dosage, accurately calibrated equipment, optimum spray pattern, travel speed, droplet size, and sufficient water per acre to insure good coverage for protective surface residue for contact materials, or absorption for locally systemic materials.
Try to time spray applications for maximum impact on pests and minimum off-target impacts, and for weather conditions that allow for optimum coverage and drying.

Do not apply pesticide when wind velocity is more than ten miles per hour to avoid drift to nontarget sites, or when air is completely calm because of the risk of inversion. Avoid making foliar sprays when high temperatures and high humidity can increase the risk of phytotoxicity. Test new tank mix combinations with a jar test or trial application to a few trees.