Integrated Pest Management

Decision Making Tools for Farmers – Coping with Pest Variability

What Is Integrated Pest Management

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Integrated Pest Management (IPM) goes beyond calendar-based spraying of pesticides. It is a decision making process whereby growers select from a variety of tactics to keep pests below an economically damaging level, while minimizing environmental impact. Pesticides remain an important method of control, but IPM integrates other tactics where compatible including biological control, cultural practices, and the use of selective and environmentally friendly tactics which are called "biorational". This integration of tactics can be used to manage all categories of pests including insects, mites, weeds, diseases, nematodes and vertebrate animals.

The essential ingredients of IPM are field monitoring or scouting, pest identification, and identifying and encouraging a pest's natural enemies. Growers use information gathered from scouting to select and schedule appropriate control tactics. In most field situations, this means observing and sampling at several sites and recording the data. This field record usually includes a map showing site location and sampling results. The grower now has a record of pest and natural enemy conditions at a particular point in time, a snapshot, which can be compared to previous and subsequent data. This forms the basis for pest management decisions.

"Careful observation of diseases, insect pests, and predators is what IPM is all about. Regular monitoring allows for more efficient use of pesticides. Less trips are made through the orchard and with improved timing of application, pesticide expense is lowered. Fewer sprays also helps preserve natural enemies. IPM means having a working knowledge of the biology within your orchard."

Tom Thornton, Cloud Mountain Farm
Apples
Everson, WA

Why Talk About IPM Now?

It is no secret that fewer pesticides are available every year. One reason for this is that it has become expensive to research, develop, license, and market new pesticides, particularly for minor crops that represent a limited market. By using IPM, the pesticides we still have will be used less frequently, which gives pests fewer opportunities to develop resistance. This extends the effective life span of currently available pesticides.

IPM makes good economic sense. Growers who reduce pesticide use through improved timing and elimination of unnecessary sprays save money. IPM also helps to reduce risk because with regular scouting you know what's happening in your fields.

The 1993 Statewide IPM Report, which summarizes the activities and achievements of the Cooperative Extension IPM Program, estimates that over $667 million in reduced pesticide expenditures was attributable to implementation of IPM systems. Below is a table which includes some examples of economic benefits of IPM from this report.

IPM programs are built around *key* pests, those that cause the most damage and are present each year.

STATE	CROP	IPM ACTIVITIES AND RESULTS	GROWER SAVINGS
Alabama	Pecans	Eliminated six insecticide and five fungicide applications compared to non-users	$132/acre
Delaware	Vegetables	State acreage under IPM increased from 17%in 1992 to 27% in 1993	$16/acre
SW Oregon	Orchards	Adoption of orchard scouting program on 6,000 acres reduced pesticide load by 57%	$100 to $150/acre
Washington	Alfalfa Seed	Reduced insecticide applications for lygus bugs	$800,000 total

The Basic Elements of an IPM Program

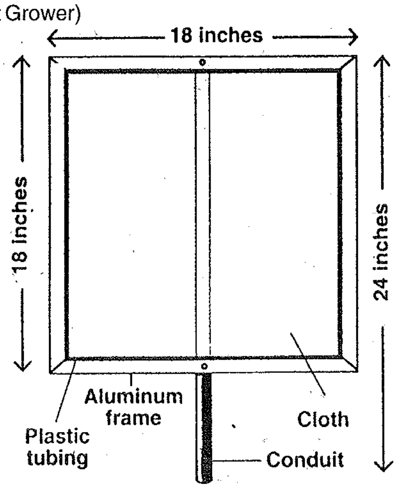
- Understand the biology of the crop or resource.
- Identify the key pests.
- Consider using combinations of methods and materials to manage pests.
- Direct control practices at the weak link in the life cycle of key pests.
- Use control methods that preserve and enhance naturally occurring beneficial organisms.
- Monitor fields regularly and systematically.

IPM growers scout their fields regularly using practical methods that provide valuable crop and pest information.

IPM Monitoring Tools

Most field monitoring for insect and mite pests involves directly counting pests and assessing damage. For example, in berry crops, spider mites are sampled by collecting sets of 10 leaflets from each of four or five sites within a field. Since mites are small, use a *hand lens* to count them accurately. The pest manager also looks for mite eggs and natural enemies such as predatory mites or the small Stethorus beetle. Counts are recorded at each site, and mites and mite predators are reported as number per leaflet.

(Adapted courtesy of The Good Fruit Grower)



Beating trays must be a specified size for accurate counting.

Some insects, for example the adult black vine weevil, are impossible to count this way. Once disturbed, they quickly drop to the ground. These pests are counted using a *drop sheet* or *beating tray*, which is placed under the canopy. Shake the canopy to dislodge insects, which drop onto the tray and are counted. The sheet or tray must be a specified size. *Sweep nets* are also used to dislodge and count insects from plant foliage.

The most common sampling design is the random sample. Usually a minimum of four sites, chosen somewhat at random, are checked in each field. Results are recorded for each site along with a map showing the field and site location. This *record* provides the basis for decision making and can be referred to in later visits. Below is an example of a simple format used to record pest densities and observations in raspberries.

RASPBERRY PEST MANAGEMENT

Field: Delta

Report Date: 5-Aug
Last Sample Date: 25-Jul
Sample Date: 5-Aug

Leafroller Trap Catch Data

Trap ID: (Number Moths/Trap)	1	2	3	4	5	Total	Avg/Trap
Orange Tortrix	0	0	0			0	
OBLR	1	3	0			4	1.3

Insects/Mites (Site)	1	2	3	4	5	6	Total	Avg/Site
Leafrollers (5 min search/site)								
Orange Tortrix								
OBLR								

(#/10 Leaves)	1	2	3	4	5	6	Total	Avg/Leaf
Two-spot Mite	121	65	250	450	80		966	19
Two-spot Mite	numerous eggs at most sites							
Predatory Mites	0	0	0	0	0		0	
Stethorus Adult	none detected							
Stethorus Larvae								
Min. Pirate Bug	1	0	0	3	0		4	

Weevil Notching

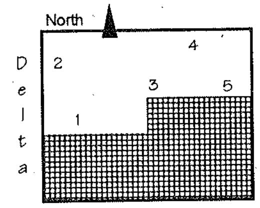
Beating Sheet Samples (10/site)	1	2	3	4	5	6	Total	Avg/Site
Orange Tortrix								
OBLR								
Misc. Worms								
BV Weevil	0	0	0	0	1		1	
Min. Pirate Bug	0	0	0	5	0		5	
Lady Beetles	3	0	0	0	0		3	
Stethorus								
Fruitworm								

Disease

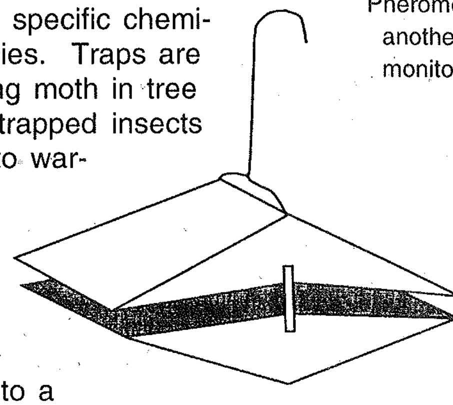
Botrytis	okay
Spur Blight	Lesions present at most sites
Rust	none detected

Recommendations

Large increase in mite population since last visit. Numerous eggs and few predators indicate potential for rapid increase. Post harvest miticide suggested include fungicide for spur blight control. Will check again in about 10 days.



A variety of traps also are used to monitor insects. The most common is the *pheromone trap* which relies on a specific chemical attractant to lure individuals of the same species. Traps are used to monitor leafrollers in raspberry and codling moth in tree fruit in western Washington. Periodic counts of trapped insects determine whether a population is large enough to warrant control and helps growers time pesticide sprays to achieve maximum control.



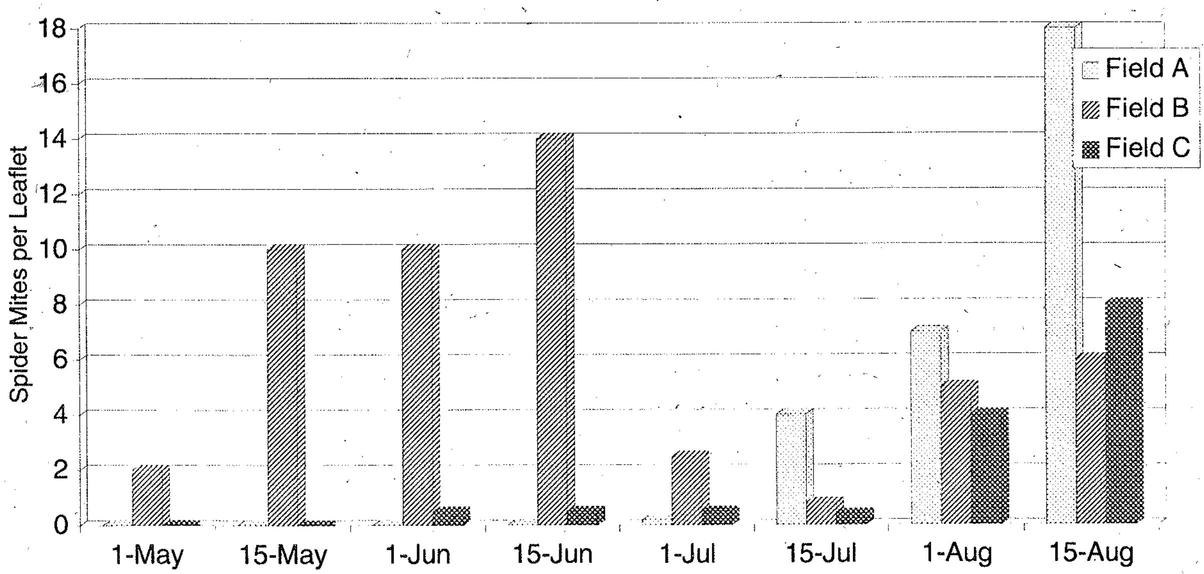
Pheromone traps are another method of monitoring insects

Weather stations help monitor environmental factors such as temperature, humidity, rainfall, and leaf wetness, factors that influence disease development. This information can be entered into a disease prediction model and is used to schedule fungicide applications. Such systems have aided managers in controlling late blight in potato and apple scab in tree fruit in the Pacific Northwest.

Monitoring techniques are integrated into a practical, regular program that forms the basis for decision making. The program reflects the biology and seasonality of the pests. Some pests are monitored throughout a season. Others are evaluated only once or twice a year. The frequency of monitoring is determined by economic considerations and required accuracy. Pest populations vary considerably from one field to the next, even in adjoining fields. For this reason, sampling results from one field cannot be used reliably to make decisions about other fields.

The chart below illustrates the variation in spider mite populations in three different fields of Meeker raspberries during the 1995 season (Source: Braeside Consulting Inc.).

Spider mite populations vary between fields . . .
IPM tells you where and when they are a problem



"IPM helps reduce my pesticide expense by better tracking of pest populations. Many farmers aren't familiar with pest identification and are inclined to take preventative chemical measures that may not be necessary."

John Clark, Clark's Berry Farm
Raspberries and Strawberries
Lynden, WA

Deciding When to Control

Regular monitoring and good record keeping allow growers to continually refine pest management decision-making.

Decision-making in IPM is usually based on a combination of pest and beneficial population estimates, pest life cycle stage, crop stage and susceptibility, availability of and labeling restrictions on pesticides, personal field experience, and specific field history. Regular monitoring is the key ingredient in decision-making, because it provides information on:

- Pest and beneficial population density and trends
- Pest stage of development
- Damage assessment
- Crop vigor
- Weather conditions

Once this information is in hand, it can be used to help make a decision regarding timing, need for control, and selection of a tactic. In theory, a pest is controlled once it reaches a certain density (action threshold) but before it reaches a level that causes unacceptable economic damage (economic injury level). Unfortunately, these threshold levels are not established for most pests; even those that cause direct crop damage.

A grower can usually tolerate insect pests at some density but it depends on the type of damage caused. For example, certain insects in raspberries such as weevils, which directly contaminate fruit are tolerated at much lower densities than spider mites which indirectly damage the plant by feeding on foliage. Treatment guidelines like action thresholds are useful, but they should be adjusted over time based on experience in the field and on the individual grower's tolerance for damage. Decision-making in IPM is based on the consideration of many factors.

"The biggest benefit of IPM is that it allows me to time my sprays, which means better control and dollar savings. Regular scouting shows me there is variation between fields, and if the numbers aren't there, I don't spray. The challenge to further development of IPM is in finding alternative pest control methods that are cost effective and get the job done."

Frank DeVries, Berry Acres
Raspberries
Lynden, WA

IPM Control Options

IPM programs use four basic methods to achieve effective control in the least disruptive manner possible. These methods are:

IPM growers choose synthetic pesticides based on certain desirable properties.

- Cultural Practices

  IPM growers adjust cultural practices in order to make the environment less favorable for pests.

- Biological Control

  Conserving existing beneficial insects by reducing disruptive pesticide applications is the most widespread form of biological control used in IPM.

- Biorational Tactics

  These are tactics that are narrow-spectrum; effective against target pests while leaving other animals and also plants virtually unharmed. Included are microbial pesticides (viruses, fungi and the bacterial pesticide, B.t. [Bacillus thuringiensis]), insect growth regulators, and pheromones which can be used for monitoring, trapping out insects, and for mating disruption.

- Chemical Control

  Synthetic pesticides are frequently used, effective methods of pest control. IPM growers choose pesticides based on certain desirable properties including:

  - low acute toxicity to humans;
  - effectiveness in controlling the target pest;
  - minimal impact on natural enemies and pollinators; and
  - low potential for ground water contamination.

  Other things to consider when using pesticides are:

  - apply spray when the pest population is in the most susceptible stage of development;
  - direct spray to infested areas only - partial field spray;
  - use lower rates where practical; and
  - make sure spray equipment is properly calibrated

"IPM means considering all of my options for pest control. It may be a release of natural enemies for mite control, the use of a cover crop for weed suppression, or a conventional pesticide. It makes my day when we can use something that's safer for workers and the environment, and leaves no residue on the fruit."

Brian Cieslar, Tri-Fruit
Raspberries, Strawberries, and Blueberries
Lynden, WA

Summary

IPM employs all appropriate control strategies to reduce pest populations below economically damaging levels while minimizing negative impacts on the environment. Most growers who have tried IPM, like it and are continuing to use an IPM approach. Benefits typically include dollar savings to the grower, an extension of the effective use period of pesticides, and protection of resources such as ground water from pesticide contamination. Regular monitoring is the key component of IPM and is the basis for improved decision-making regarding timing and selection of appropriate control strategies. The use of IPM will expand as more research into alternative methods is completed and as more people realize that it is a sensible, cost-effective approach to pest control.

"Integrated pest management includes monitoring, identification, and recommending the best solution for grower profitability. Our field men monitor for insect pests before recommending a spray. That's their job; identification of the problem, and then choosing a pesticide that will do the job with the least effect on the environment. Our field men provide a solution that will maximize grower's returns."

Rich Stipe, Whatcom Farmer's Co-op
Agricultural Product Dealer
Lynden, WA

Further reading on IPM available from WSU Cooperative Extension

- Extension Bulletin 1786 "Integrated Pest Management: Effective Options for Farmers" - 1995
- Extension Bulletin 0753 "Concepts of Integrated Pest Management in Washington" - Reprint 1995
- "Puget Sound Pest Management Guidelines . . . A Guide for Protecting our Water Quality" - 1993
- PNW 343 "Beneficial Organisms Associated with Pacific Northwest Crops" - 1993
- Extension Bulletin 1388 "Small Fruit Pests, Biology, Diagnosis and Management" - 1988
- The Disease Compendium Series of the American Phytopathological Society
    - "Apple and Pear Diseases" - 1983
    - "Raspberry and Blackberry Diseases and Insects" - 1991
- "Orchard Pest Management, A Resource Book for the Pacific Northwest" published by Good Fruit Grower - 1993

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