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Ornamentals & Row Crop Pest Management

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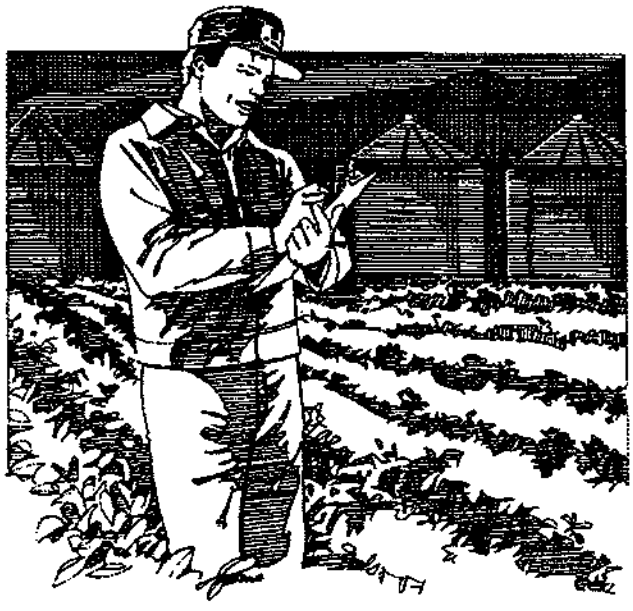

No. 8

Scouting Programs for Ornamental Crops

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IPM Information Series

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Scouting Programs for Ornamental Crops

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Introduction

Integrated pest management (IPM) is a strategy for minimizing pest and disease damage. It relies on a variety of techniques including biological control, insect exclusion, attention to cultural practices, as well as conventional pesticide applications.

Interest in IPM has dramatically increased in recent years for several reasons. Insects are clearly developing resistance to chemicals, and it is increasingly difficult to obtain control by relying on pesticides alone. Concern for the environment and worker safety issues are other important reasons. With increased government regulation of chemical pest controls, growers are losing pesticides faster than new ones are becoming available. This is especially true in ornamentals which are often considered minor use crops, not worth the registration costs.

While ornamental growers are interested in IPM, many still follow the standard practice of applying pesticides based on the calendar. Pesticides are often applied 1-2 times a week, whether the crop needs it or not. That practice may be easy for the grower, but it often results in spray applications that miss the target pest. Poor timing of pesticide applications wastes chemicals and is not economical. For example, if no scouting is done, the exact stage(s) of the insects in the life cycle is not known. Adulticides might be applied when most of the population are larvae, resulting in minimal effectiveness, wasted labor and pesticide. If timing is mismanaged, insect populations can get so large that more applications are necessary to bring them under control. Or if pests are localized, in small areas only, and the entire nursery is sprayed, chemicals (and money) are wasted. In addition, with calendar spray programs, nursery workers and the environment are often unnecessarily exposed to toxic substances.

Monitoring: The Backbone of IPM Programs

A basic requirement for IPM, whether for vegetables, fruits or ornamental crops, is a procedure for monitoring insects, also called sampling or scouting. Monitoring is the regular inspection of plants and tools, such as sticky traps, in order to obtain data used to decide on appropriate pest management actions. It involves gathering, recording, summarizing and evaluating data.

Monitoring provides much useful information. It gives an early warning of insect and disease presence, allowing use of slower acting methods which are more environmentally friendly and safer for workers. It locates specific sites of infestation. It tells the grower the kind of pests, stage in the life cycle, and numbers. And it helps determine the amount and type of control action needed, as well as timing the application. In addition, information as to tolerable threshold levels can be very helpful in deciding when to spray.

Collecting and graphing data on insects over a season is very useful in predicting future populations... especially if correlated with greenhouse or weather conditions. Accurate records can be used to determine treatment costs and effectiveness of treatments. In addition, monitoring can produce a higher quality product. The reason is that there is less stress or phytotoxicity than with conventional spray programs, and also because the grower is less likely to miss a crucial application, there is less insect damage.

The IPM Scout

The IPM scout is the person who does the monitoring, records and summarizes the field data and reports to the grower. Often growers prefer to have existing employees do the scouting rather than hiring a professional scouting consultant. Existing employees do have the advantage of being on site every day and knowing the nursery. The disadvantages are that they must have training in pest and natural enemy recognition and in data collecting techniques. They may not have the ability or desire to do the job well. The most important problem with employee scouts is that their job responsibilities often include other areas in addition to pest management. Therefore, when things get busy in the nursery, scouting does not get done.

Professional scouts are therefore recommended because they are more likely to monitor at regular intervals. Data from IPM demonstrations where scouts were trained and hired by the University of California have shown that

scouting programs reduce pesticide use and that this results in significant savings to the grower. This savings can offset the expense of a professional scout. However, even when a professional consultant is hired to do the scouting, it is wise to have as many employees trained to recognize pests as possible. Even the best scouts cannot see everywhere. Irrigators, pickers, and other employees can be trained to communicate any problems they see in the course of day-to-day activities to the appropriate personnel, so that this information can also be used in making pest management decisions.

Scouting Tools

Essential tools for scouting include:

1) clipboard, record-keeping forms, notebook, pencils, calculator
2) 10-15x hand lens, optivisor (a visor-like magnifier which leaves the hands free for writing.)
3) sticky traps; clothespins or clips (to secure traps); stakes (to delineate boundaries of scouted areas in the field, to mount traps); string, wire or chain (to hang traps); waterproof marking pens
4) flagging tape (to mark infested plants, to delineate boundaries of scouted areas in the field); measuring or survey tape

Other items which may be required include pheromone traps (to monitor moth pests), potato corer for making potato disks (for fungus gnat monitoring), pocket knife, soil-sampling tube, trowel, disease diagnostic kits, petunia indicator plants (for tospovirus monitoring), and moisture sensitive paper to evaluate spray coverage. Plastic bags, vials and an ice chest may be necessary if samples need to be taken from the field; saran wrap is useful if traps are removed for counting. A dissecting microscope can be invaluable, especially in identifying life stages and specific species when biological control is used. A pocketed apron for keeping tools handy and hands free is also useful.

Scouting Activities

The scout begins working in the planning stage of the crop - before the crop is planted. It is important to gather specific background information. What was the previous crop and its pests? What is the new crop, and its potential problems? It is a good idea to walk the field or growing area to look for possible trouble spots -- e.g. dripping hoses that could result in poor drainage and root rot; weeds that could encourage pests; crop debris and other poor sanitation practices.

The scout's first responsibility is to develop a written monitoring plan which delineates what sampling methods are to be used and how they will be employed. It is important that the site is sampled the same way each week to make results comparable among sample dates so that it can be determined if populations are increasing or decreasing.

Propagation areas should be intensely monitored to insure that plants are free from pests and diseases when they are planted out. If the grower does not produce their own propagation material (plants, plugs, seedlings, cuttings), incoming shipments from other nurseries should be examined for potential problems before spacing plants in the field. Control is made easier in a smaller space.

After the crop is planted, the scout begins routine inspections - a minimum of one time per week. Much of the scout's job at this point involves data collection and record keeping. This data is summarized by the scout and presented at least once a week to the grower and/or others involved in pest management decision making. The data is used to determine control actions and ultimately to evaluate the effectiveness of the IPM program.

Monitoring Techniques

Field and greenhouse areas are often too large to handle the scouting data on one form only. It is therefore important to delineate scouting areas, called pest management units (PMUs) within a greenhouse or field. A PMU is a contiguous area for which monitoring results are summarized each time the area is scouted. If there is just one crop and the plants are of a similar age, PMUs may be arbitrarily divided. However, if several crops are growing, or different ages of the same crop are planted, divide into PMUs by crop, age, or even by variety (e.g. yellow rose varieties often host more thrips than other color varieties). PMU boundaries can be delineated by greenhouse structures

(e.g. by greenhouse peaks in a greenhouse range) or by stakes and flagging tape in the field. If a crop is very high value, or is very susceptible, more intensive scouting may be needed. Dividing the growing area into smaller PMUs will allow for more intensive sampling and smaller treatment areas for spot treatments.

Yellow sticky traps are used to monitor adult pests e.g. aphids, thrips, leafminers, fungus gnats, and shoreflies. They can also be used to monitor adult parasite populations in biological control programs. Blue sticky traps are sometimes used on crops where western flower thrips are the only significant pest.

A minimum of one sticky trap for every 10,000 ft^2 of growing area is recommended. (Although for whiteflies, which do not fly very far, one trap for every 1,000-2,000 ft^2 is best.) The sticky traps should be positioned vertically just above the crop canopy, and raised as the crop grows.

To minimize the labor cost involved in scouting, especially when sticky traps are heavily infested, it is useful to take counts from a 1" central strip on both sides of the cards. Use sticky traps which are sold with grids, or make a 1" template to do the counting. UC studies have shown that this rapid technique gives accurate data and can be extrapolated to whole trap data. (For example, if a 1-inch strip equals 1/4 of the card area, multiply the count by 4 to determine insect counts on the whole trap.)

Counting the insects from sticky cards in the field vs. taking them back to a laboratory to view with a microscope saves time, and facilitates meeting with the grower on the same day to review the results. Microscope work may be necessary, however, in some situations such as in biological control programs. Access to a microscope at the site, in a head house or office, for example, may be crucial in these instances.

Sticky cards provide information concerning adult insect populations but they cannot be used to determine the size of immature populations or to monitor disease presence. For this, plants are visually inspected - examining foliage for pests by using a hand lens or optivisor.

How many plants do you sample? The number can be different for each crop. More sampling is done for very high value crops or those that are very susceptible to insect and disease problems. If the crop is blooming, it is important to also sample flowers. It may be necessary to beat flowers over white paper to dislodge and count insects, such as western flower thrips, which may reside in the flowers.

Scout the entire growing area in a consistent, uniform manner, inspecting some plants from each location. Although it is important to randomly select some or most plant samples, it helps to also target areas where pests tend to be a problem (e.g. near vents, doors, edge of rows, by susceptible cultivars, or in warmer areas of the greenhouse). Data is usually taken on 1-2 leaves per plant since inspecting entire plants is too labor-intensive (except when they are small). Be sure to examine the underside of leaves or inner plant parts where many pests prefer to reside. Poor sanitation during scouting can spread pathogens, so wash your hands after handling diseased plants, or wear disposable gloves.

Record the specific location of infested plants using maps and flags so that control actions can be clearly targeted based on monitoring results. Reinspect these plants after taking action to determine if control was effective.

Indicator Plants

Indicator plants can be used to time control actions and evaluate treatment effectiveness. For insects, such as whiteflies, where it is important to know the pest life stages to utilize effective control actions, indicator plants can be especially helpful. Tag several infested plants with flagging tape and inspect these plants, recording the number of each life stage that is present on 1-2 leaves or on terminals. Reinspect these plants after treatment to compare numbers and determine the effectiveness of a control action.

Record Keeping

Written records are essential to effective IPM programs. Forms should be developed and utilized which incorporate background information (see sample form #1), site plans of the nursery with PMUs in each greenhouse or field identified (see sample form #2), and plot maps of each PMU with sticky card locations identified (see sample form #3).

The scout collects information on one data sheet for each PMU. Raw data sheets can be made that show insect counts from foliage, flowers and sticky cards on the same form. Monitoring data should include the number of plants inspected, a measure of the damage or infestation, and pest abundance (see sample form #4). Record indicator plant data on a separate form (see sample form #5).

Growers are usually too busy to examine specific information from each PMU. Therefore, the scout must summarize data from each PMU on another form. Information such as type and abundance of pests, percent infested plants, location of hot spots, and up or down trends in insect populations are recorded (see sample form #6).

To evaluate the cost effectiveness of the scouting program for individual growers the number of hours involved in scouting, labor for pesticide applications, prices of chemicals or beneficials, etc. should be collected (see sample form #7). Examine the pest control reports to ensure that the recommended actions are being taken and are having the desired results.

Organizing all this information into a notebook is another scouting activity. The notebook is kept in the nursery so that the data is accessible to all involved.

Pest Management Decisions Based on Scouting Records

The scout meets weekly on a face- to- face basis with the grower, pesticide applicators, and/or others involved in pest management decision making to review the weekly summary sheets as a team. The summary results from at least the two most recent monitoring dates are compared to determine whether the pest populations or damage are increasing or decreasing and to evaluate the effectiveness of previous management actions. The entire pest management team evaluates the situation and decides the action required. Records are periodically analyzed and used to evaluate and modify the IPM program.

There are two necessary requirements for a successful IPM program: (1) a commitment by all members of the IPM team to basing pest management decisions on monitoring data and (2) good communication skills between all team members.

Cost and Quality of IPM Scouted Crops

The major benefits of regular insect monitoring are more profit, a healthier environment, and better crops. This has been documented in a statewide University of California IPM project funded by UCIPM/ USDA Smith-Lever, the American Floral Endowment, the California Cut Flower Commission, the California Association of Nurserymen, the Hansen Trust, and the Department of Pesticide Regulation. Scouts were intensively trained and hired for this project by the University of California and worked in sites in major ornamental production areas in California, including San Diego, Ventura, Santa Barbara, Santa Cruz and San Mateo Counties. Each site was scouted at least once a week and included regular meetings with the grower and/or other pest management decision makers. Records were kept of the amount of labor used, amounts and choices of pesticides and natural enemies used, and the quality of crops produced in the scouted plots and in plots representing the growers' standard practices.

Results from the first year on potted nursery plants, poinsettias, cut chrysanthemums and roses show that pest management costs can be reduced up to 39% using the scouting program. These reduced costs are the result of reduced pesticide applications, for example in roses there was a 35% reduction in pesticide sprays applied to the scouted plots (see fig 1).

This IPM demonstration project is continuing on a wide variety of ornamental crops, including cut flowers and foliage, potted plants, bedding plants, flower seed crops, and outdoor nursery stock. The scouting programs are reducing pesticide use, and as a result continue to be less expensive than conventional programs.

In addition to the reduction in costs, data from blind sampling comparing conventionally managed pest programs versus IPM scouted programs show that quality is equal or superior in the IPM scouted programs. Less insect and disease damage and less phytotoxicity from repeated pesticide use result in healthier crops.

Figure 1. Comparison of pest management costs per month per acre using the grower's standard practice and IPM scouting.

Comparison of potted nursery pest management costs.

	Standard Practice	*IPM Scouted*
Spray Gal Applied	705	545
Scouting Tools		$ 11
Scouting Labor		$ 77
Application Labor	$ 82	$ 64
Pesticide Costs	$ 426	$ 183
Total	$508	$ 335

Comparison of poinsettia pest management costs.

	Standard Practice	*IPM Scouting*
Cultivar: 'V-14'		
Scouting Tools		$ 10
Scouting Labor	$ 16	$ 62
Application Labor	$ 857	$ 605
Pesticide Costs	$ 77	$ 43
Total	$ 950	$ 720
Cultivar: 'Freedom'		
Scouting Tools		$ 10
Scouting Labor	$ 16	$ 62
Application Labor	$ 997	$ 562
Pesticide Costs	$ 85	$ 40
Total	$1098	$ 674

Comparison of cut chrysanthemum pest management costs.

	Standard Practice	*IPM Scouted*
Scouting Tools		$ 10
Scouting Labor		$ 84
Application Labor	$ 78	$ 45
Pesticide Costs	$ 302	$ 143
Total	$ 380	$ 282

Comparison of cut rose pest management costs.

	Standard Practice	*IPM Scouted*
Spray Gal Applied	2,468	1604
Scouting Tools		$ 7
Scouting Labor		$ 110
Application Labor	$ 84	$ 48
Pesticide Costs	$ 491	$ 394
Total	$ 575	$ 559

Floriculture IPM Program

Form 1

BACKGROUND DATA

IPM CODE # (_____) (_____)
Country Code Grower #

GREENHOUSE (Business) Date_____

Name _____

Address _____

Grower(s) _____ Tel _____

" " _____ " _____

Directions to Greenhouse

_____

_____

_____

_____

_____

Can the grower provide a map of the greenhouses? Attach or complete form 2.

GREENHOUSE

PMU #	NAME	Area ft²	Crop	Area	# Plants	Date Planted	Prev Crop

Pesticide Application Equipment _____

_____

Comments _____

_____

_____

_____

_____

_____

Floriculture IPM Program

Form #2

GREENHOUSE LOCATIONS

Date _____

1. Draw a site plan of the greenhouse complex (aerial view). Locate all greenhouses and physical features (Buildings, etc.).
2. Identify and label pest management units (PMU). Include name or number for each greenhouse.

MAP

Floriculture IPM Program

Form #3

PLOT MAP OF AREA SCOUTED

Greenhouse/PMU # _____ Date _____
(One map per greenhouse/PMU)

1. Draw the greenhouse or section of greenhouse to scout.
2. Draw doors, vents, coolers, heaters, benches.
3. Designate where plants are grown, F=floor, B=bench, H=hanging.
4. Locate and number the placement of yellow sticky cards.

MAP

Floriculture IPM Program

FORM #4

FLORICULTURE IPM SCOUTING DATA

House/PMU_____ Scout_____ Date_____

Plant Stage/Week Number_____ Time: In_____ Out_____

Site (Plant)	PESTS					Other
# 1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
TOTAL						

Clean Plants (✓)

Total # Clean:

Total # plants inspected:

Avg: | | | | | | |

*including clean plants

Greenhouse Map (_____ X _____)

COMMENTS: _____

Pest Controls since last scouting:

YELLOW STICKY TRAP COUNTS

Card #	Days up	WF	Thrips	Aphid	F.G.	S.F.	Misc.

Total						
Average						

Floriculture IPM Program

Form #5

INDICATOR PLANT RECORD

House/PMU #	Date Checked	Eggs	L	D	L	D	L	D	Empty	Adults	Comments
Location in house:											
Plant/Leaf#:											
Variety:											

House/PMU #	Date Checked	Eggs	L	D	L	D	L	D	Empty	Adultos	Comments
Location in house:											
Plant/Leaf#:											
Variety:											

House/PMU #	Date Checked	Eggs	L	D	L	D	L	D	Empty	Adults	Comments
Location in house:											
Plant/Leaf#:											
Variety:											

House/PMU #	Date Checked	Eggs	L	D	L	D	L	D	Empty	Adults	Comments
Location in house:											
Plant/Leaf#:											
Variety:											

FLORICULTURE IPM
SCOUTING SUMMARY REPORTS

FORM #6

Scout_____

Plant Stage/Week Number_____

Date_____

Time: IN_____

OUT_____

House/ PMU	STICKY CARD COUNTS							PLANT INSPECTIONS								Please Note
	No. of Cards	AVERAGE # PER CARD						No. Plants Inspected	% Infested	Avg. # pests / plant						
		WF	Thrips	F.G	Aphid	S.F.	Other									

Comments:

FLORICULTURE IPM PROGRAM
PEST CONTROL RECORD

FORM #7

Date	Location Treated			Target Pests	Material & Formulation	EPA Reg #	Type	Class	Amount mixed		Amount Used	Method/ equip.	Labor Time	Comments
	house	pots	area/vol.						Material	Carrier				
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		
							I A F H					MB G WS S F D A		

TYPE: I = Insecticides
A = Acaricide
F = Fungicide
H = Herbicide

CLASS: B = Botanical
C = Carbamates
CD = Cyclodienes
M = Macrobial
IGR = Insect Growth Regulator
CH= Chlorinated Hydrocarbons (Organochlorines)
OP = Organophosphates
P = Pyrethroid
O = Others (soaps, oils)
ML = Macrocyclic lactone

EQUIP: MB = Mist blower
WS = Wet Spray
F = Fog
A = Aerosol
G = Granular
S = Smoke
D = Drench

PEST INDEX

Arthropod Pests*

Mites	m1	eggs
	m2	motile-live
	m3	motile-dead
Thrips	t1	larvae
	t2	adults
Worms	w1	egg masses
	w2	early larvae
	w3	middle larvae
	w4	late larvae
	w5	pupae
Aphids	a1	young aphids
	a2	adult aphids
	a3	winged aphids
Whiteflies	wf1	eggs
	wf2	early instars
	wf3	late instars
	wf4	pupae
	wf5	emerged pupae
	wf6	adults
Scales	s1	crawlers
	s2	small scales
	s3	large scales
Mealybug	m1	eggs
	m2	young mealybugs
	m3	older mealybugs
Leafminers	l1	stipples
	l2	early mines
	l3	late mines
	l4	pupae
	l5	adults

* List Species

Diseases

Damping Off	DO
Pythium	PY
Phytophthora	PH
Thielaviopsis	TH
Botrytis	BO
Fusarium	FU
Verticillium Wilt	VW
Powdery Mildew	PW
Downy Mildew	DW
Rust	RU
Crown Gall	CG
Crown Rot	CR
Virus	

Other OT + describe

Extent of damage to the plant:

- 0 no damage
- L slight damage
- M moderate damage
- S severe damage

Estimate extent of disease in area as:

- 1-25% of plants damaged
- 26-50% of plants damaged
- 51-75% of plants damaged
- 76-100% of plants damaged

NOTES