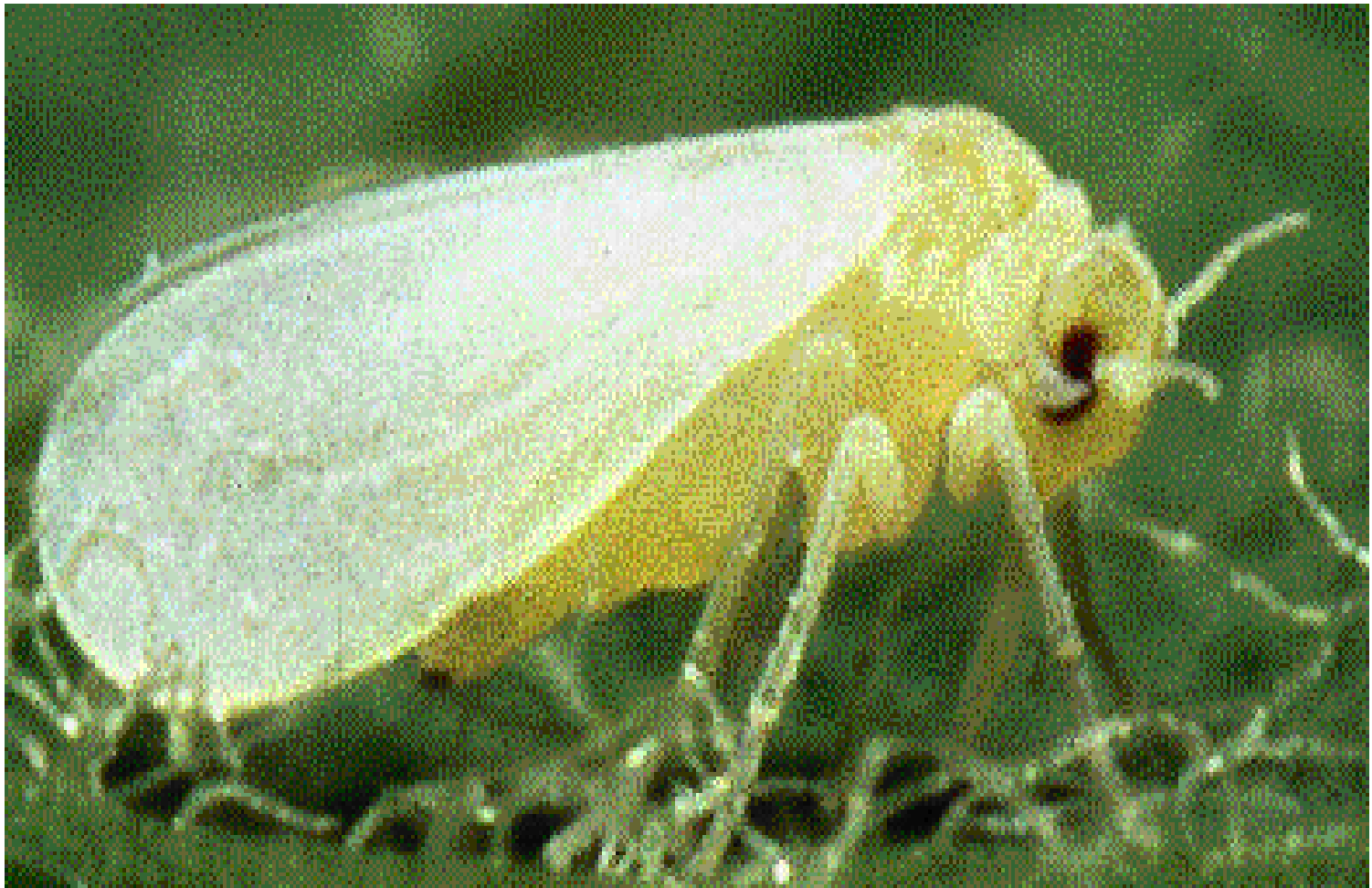


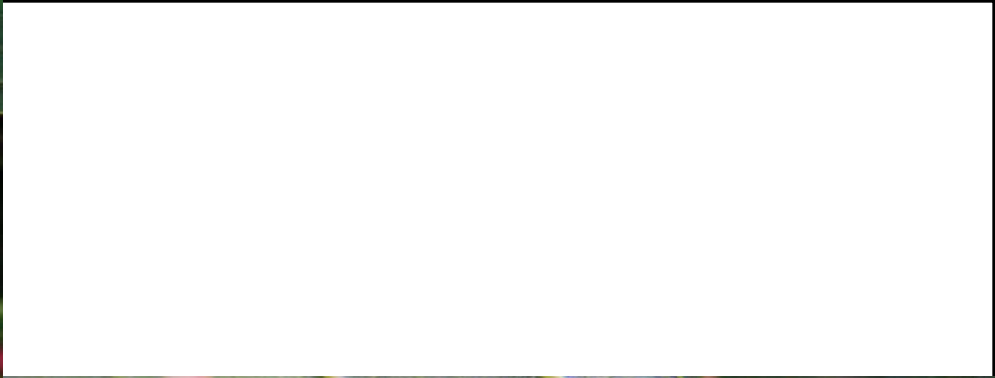
Biology and Insecticide Management for Whiteflies

James A. Bethke

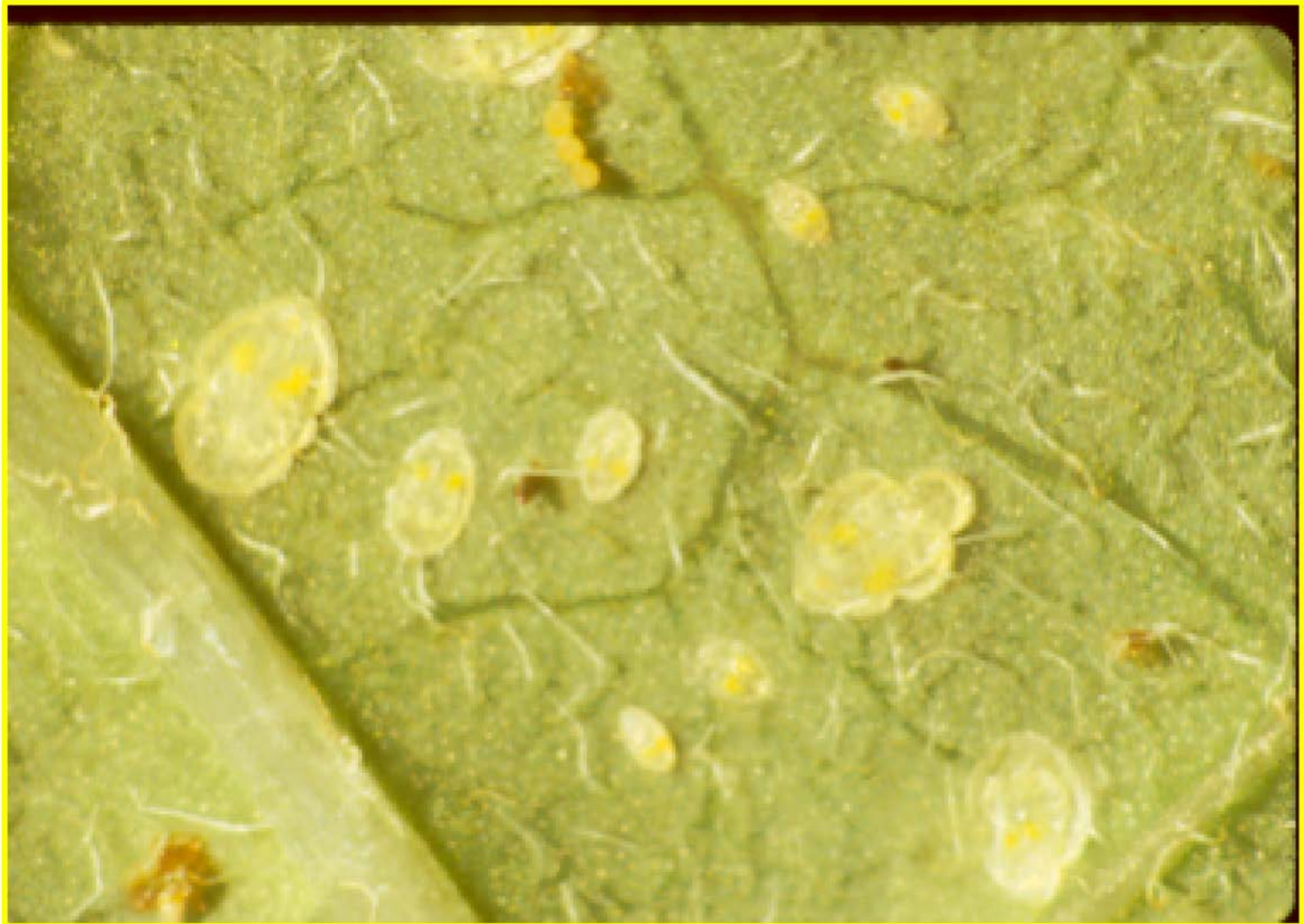
University of California

Cooperative Extension

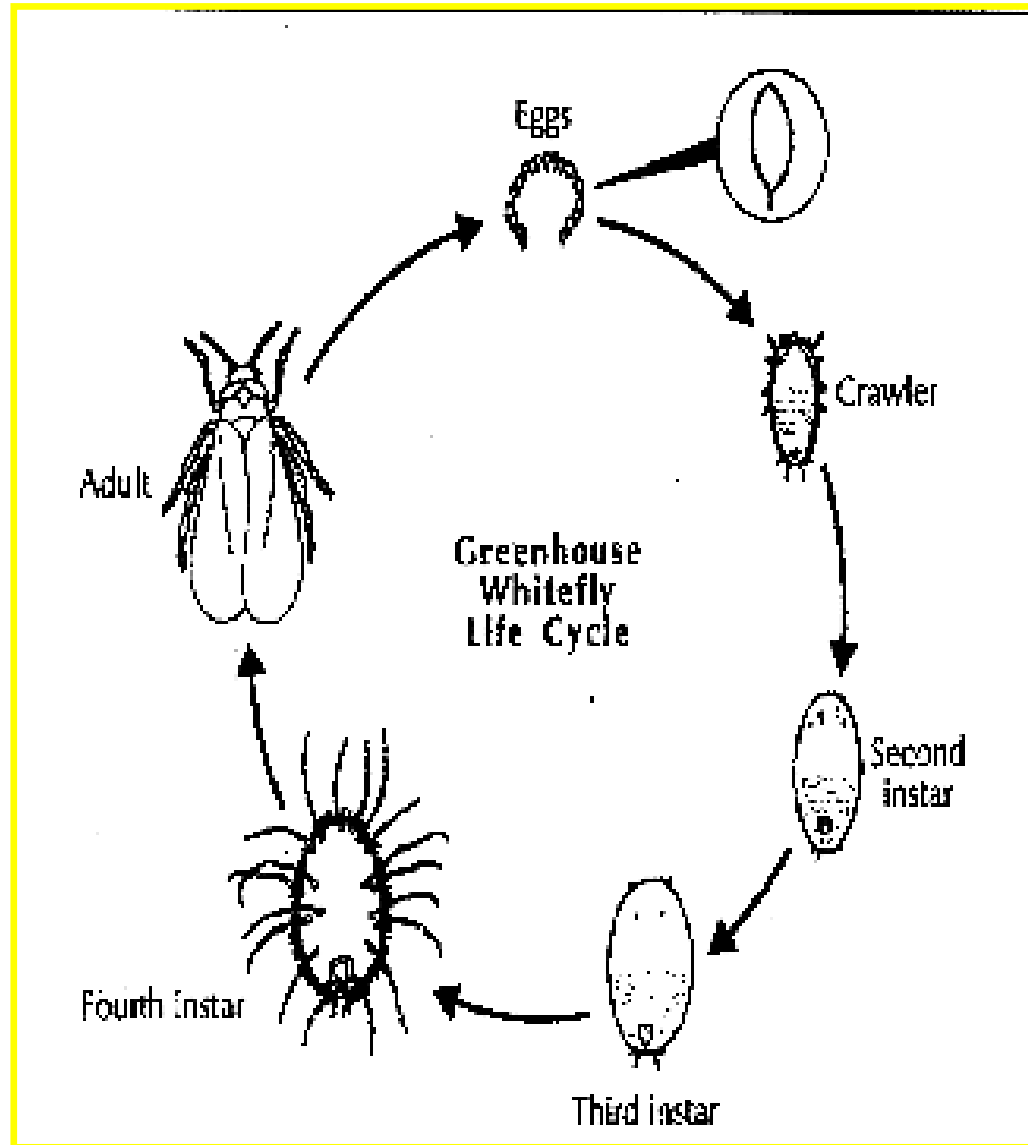




Whitefly Life Cycle



Whitefly Life Cycle



Life Cycle of Sweetpotato Whitefly on Poinsettia

- **Eggs hatch in 8 days**
- **Nymphal development takes 21 days**
- **Adults live an average of 22 days**
 - **Can begin to lay eggs in 24 hours**
 - **Unmated females produce male offspring**
- **Total Generation time is about 30d**

Whiteflies

All stages are commonly found on the undersides of the leaves, including adults.

Sooty mold means a heavy infestation.

Infestations are usually spotty.

Whiteflies

- **Piercing sucking mouthparts, Phloem feeder**
- **All stages are commonly found on the undersides of the leaves, including adults.**
- **Sooty mold means a heavy infestation.**
- **Infestations are usually spotty.**

IPM

- **It starts with IPM - Monitoring**
- **Cultural**
- **Physical**
- **Environmental**
- **Mechanical**
- **Biological**
- **Etc, etc**
- **Chemical**

Benefits of Monitoring

- **Early warning system**
- **Locates specific sites of infestations**
- **Identifies the pest, numbers, stage of development**
- **Evaluate control measures**
- **Collecting and graphing monitoring data over time is useful in anticipating future pest populations**



Treatment or Action Thresholds

- **Should be quantitative. Example: data shows that 1-2 thrips per rose flower per week can be tolerated without visible injury and this corresponds to 25-50 thrips per sticky card.**
- **Very few action thresholds have been developed for ornamental crops, so scout has to collect data**
- **Use published thresholds only as a guideline, develop your own based on experience and economics**

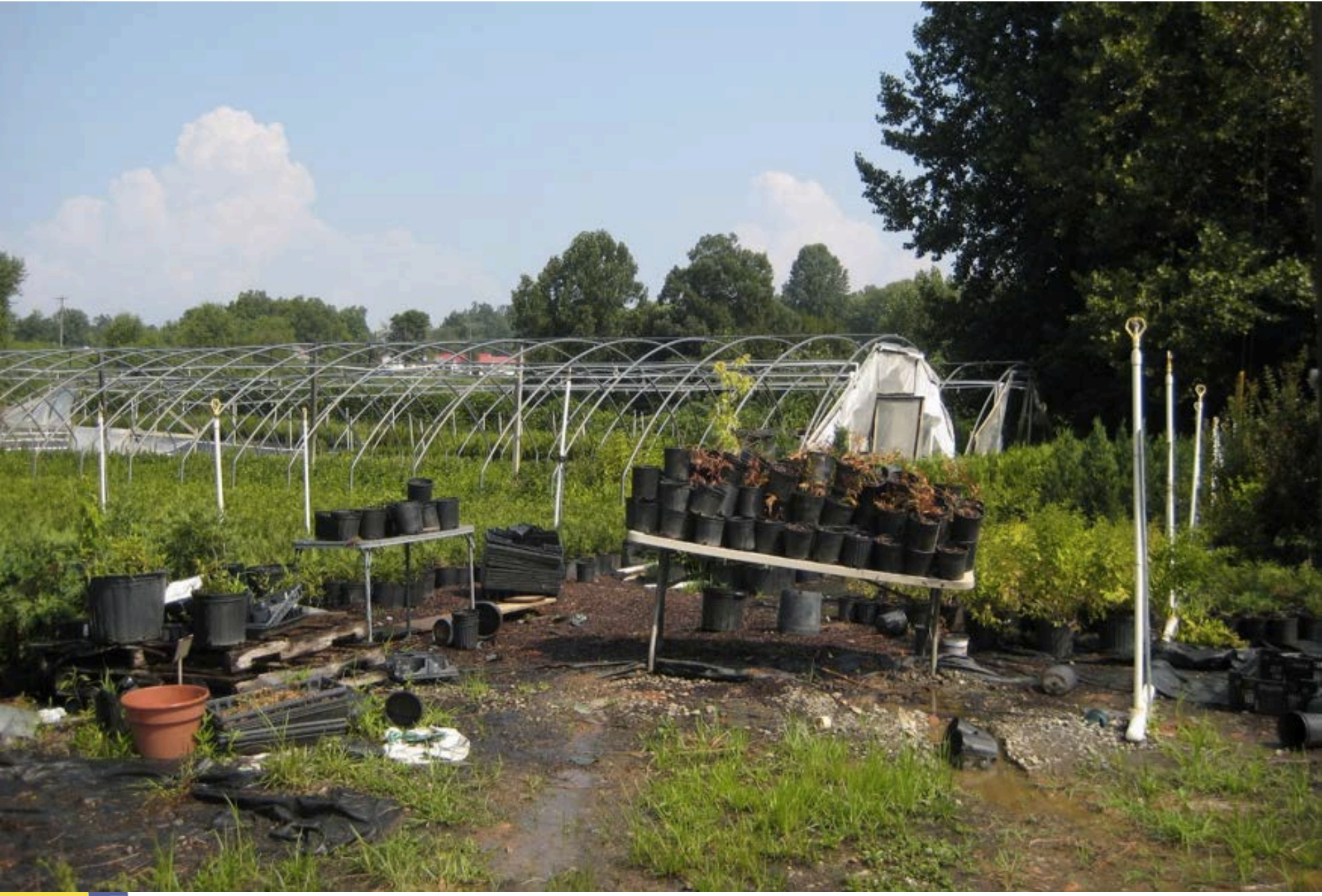
PEST EXCLUSION

Making sure the pest or disease does not make it into the facility in the first place will significantly reduce pest damage and disease infection.

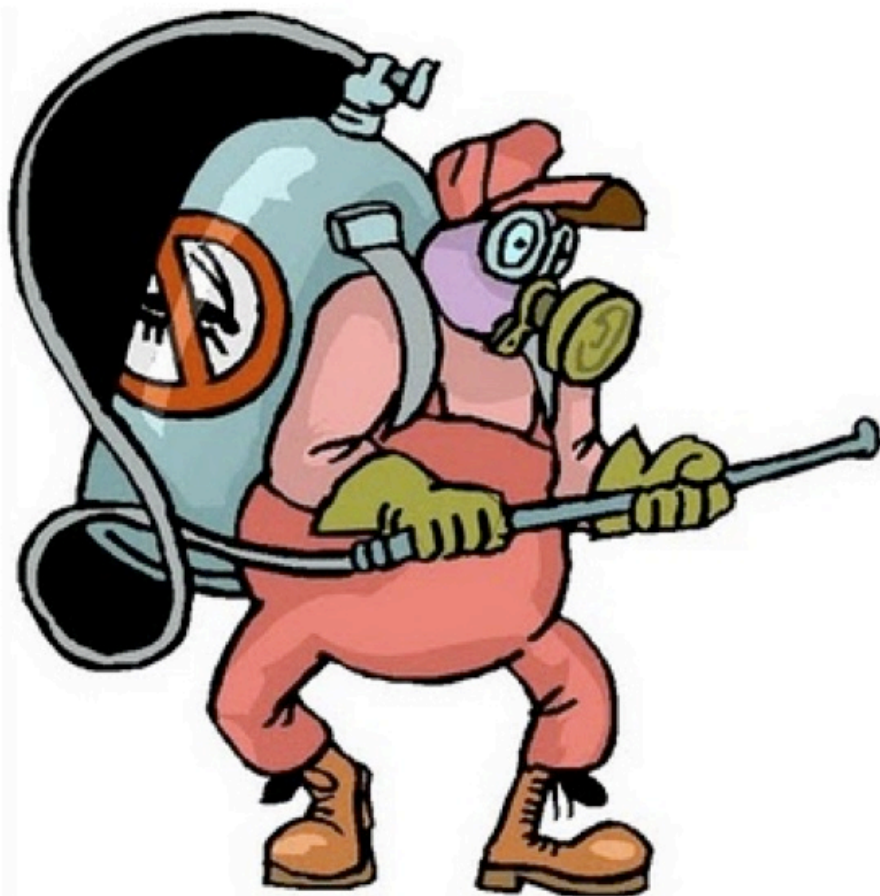
ENSURE STOCK PLANTS ARE PEST FREE







Spray Snails with Insecticide?



Oh Cool! A Shower!

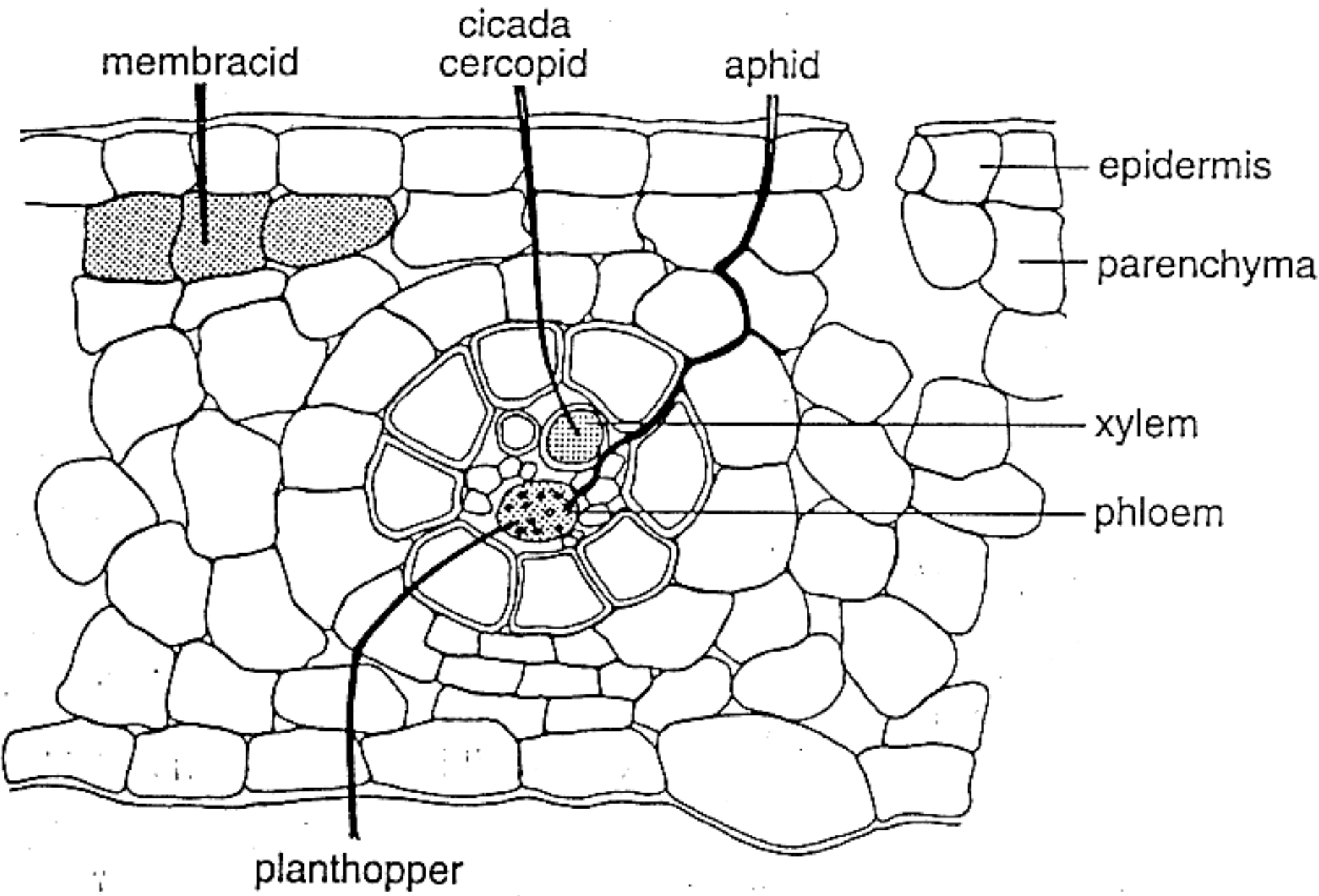


Selective Feeding Blockers

- **Aria (flonicamid) and Endeavor (pymetrozine) Group 9**
- Plant bugs, Leaf hoppers, Stink bugs

Neonicotinoids

- **Marathon, Safari, Flagship Group 4**
- True bugs, aphids, mealybugs, soft scale, whiteflies, adelgids, etc.



Whitefly Resistance in the Lab

Evaluation of Insecticide Rotations and Mixtures as Resistance Management Strategies for *Bemisia argentifolii* (Homoptera: Aleyrodidae)

PRABHAKER, NILIMA; TOSCANO, NICK C.; HENNEBERRY, THOMAS J. 1998

Source: [Journal of Economic Entomology](#), Volume 91:. 820-826(7)

- **Continuous applications of bifenthrin**

Resulting levels of resistance

BIFENTHRIN - early resistance development that steadily increased under continuous selection to 752-fold by generation F₂₇

Why Rotate Insecticides?

- **To preserve or sustain pesticide effectiveness**
- **The pesticide no longer kills a sufficient number of individuals to be considered effective**
- **Frequent applications of a given pesticide over multiple generations remove susceptible individuals, leaving resistant individuals to reproduce**

Managing Pesticide Resistance

Minimize pesticide use (monitoring)

Avoid tank mixes

Avoid persistent pesticides

Use long term rotations

Minimizing Selection Pressure

Select pesticides that attack different resistance mechanisms in the insect/mite

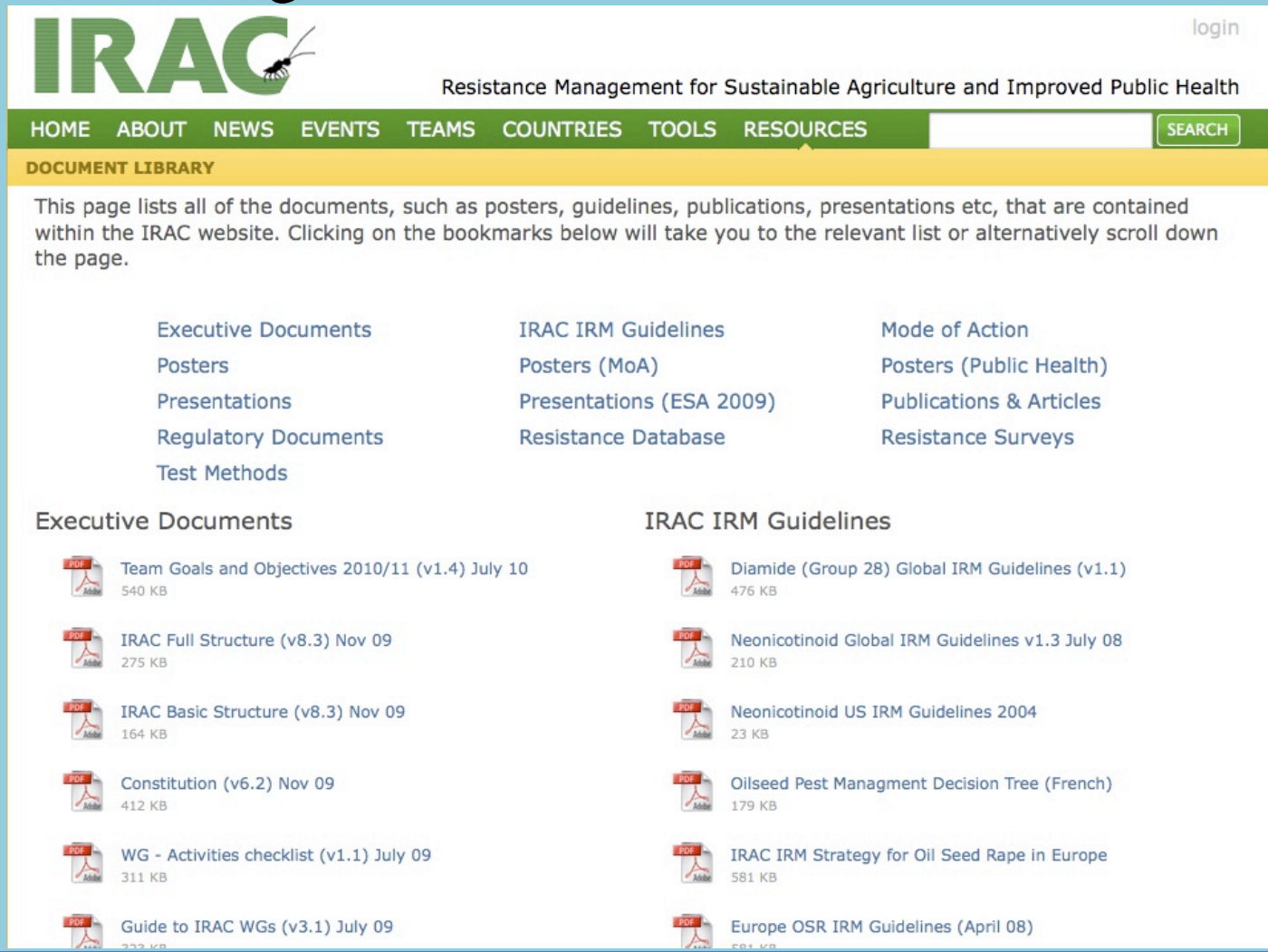
Susceptible individuals will produce more offspring - fitness costs for genes

Length of time or number of generations of a species between applications

Resources

IRAC - Insecticide Resistance Action Committee

IRAC-online.org



IRAC login













Resistance Management for Sustainable Agriculture and Improved Public Health

HOME ABOUT NEWS EVENTS TEAMS COUNTRIES TOOLS **RESOURCES**

DOCUMENT LIBRARY

This page lists all of the documents, such as posters, guidelines, publications, presentations etc, that are contained within the IRAC website. Clicking on the bookmarks below will take you to the relevant list or alternatively scroll down the page.

Executive Documents	IRAC IRM Guidelines	Mode of Action
Posters	Posters (MoA)	Posters (Public Health)
Presentations	Presentations (ESA 2009)	Publications & Articles
Regulatory Documents	Resistance Database	Resistance Surveys
Test Methods		

<h3>Executive Documents</h3> <ul style="list-style-type: none"> Team Goals and Objectives 2010/11 (v1.4) July 10 540 KB IRAC Full Structure (v8.3) Nov 09 275 KB IRAC Basic Structure (v8.3) Nov 09 164 KB Constitution (v6.2) Nov 09 412 KB WG - Activities checklist (v1.1) July 09 311 KB Guide to IRAC WGs (v3.1) July 09 223 KB	<h3>IRAC IRM Guidelines</h3> <ul style="list-style-type: none"> Diamide (Group 28) Global IRM Guidelines (v1.1) 476 KB Neonicotinoid Global IRM Guidelines v1.3 July 08 210 KB Neonicotinoid US IRM Guidelines 2004 23 KB Oilseed Pest Management Decision Tree (French) 179 KB IRAC IRM Strategy for Oil Seed Rape in Europe 581 KB Europe OSR IRM Guidelines (April 08) 581 KB
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DOC ID 524052

ACCEPTED
FOR REGISTRATION
SEPT 20, 2010

GROUP 3 INSECTICIDE

DECATHLON® 20 WP

Greenhouse and Nursery Insecticide in Water Soluble Packaging

New York State Department
of Environmental Conservation
Division of Solid & Hazardous Materials
Pesticide Product Registration

FOR COMMERCIAL USE ONLY. FOR BROAD-SPECTRUM CONTROL OF CRAWLING AND FLYING INSECT PESTS ON ORNAMENTALS AND NURSERY STOCK

ACTIVE INGREDIENT: Cyfluthrin, cyano(4-fluoro-3-phenoxyphenyl)methyl-3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylate	20%
OTHER INGREDIENTS:	80%
TOTAL:	100%

Keep water soluble packets in this container. Store in a cool, dry place but not below freezing (32°F). Sell in original packaging only.

EPA Reg. No. 432-1402-59807 EPA Est. indicated by second and third digits of the batch number on this package. (03)=3125-MO-1 (98)=33967-NJ-1

**STOP - READ THE LABEL BEFORE USE
KEEP OUT OF REACH OF CHILDREN
CAUTION**

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle. (If you do not understand the label, find someone to explain it to you in detail.)

See inside for First Aid, Precautionary Statements and complete Directions for Use.

981750

Net Contents: 300 grams or Six-50 gram packets

Produced for:
OHP, Inc.
PO Box 230
Mainland, PA 19451
(800) 356-4647



Consider the Risk

Save the most effective product(s) for the time of year or cropping cycle with the most risk

- When no. of pest are most prevalent**
- When the crop is the most susceptible**

Use rotations with softer products or chemicals that are suppressive during the least risk

Example - Whiteflies

The most effective products are *neonicotinoids, Avid, Distance*, so do not use these at any time during the year or cropping cycle when there is low risk

This ensures the products effectiveness as a cleanup product or preventive during high risk

Use soft products or suppressive products during the cooler times of the year when thrips are less likely to be present

Consider Other Pests

Whiteflies and mites then never use avid for whiteflies

**Low risk – Soap or Oil or
IGR>BotaniGard>pyrethroid>OP**

**High risk –
neonicotinoid>Judo>Avid>pyrethroid+OP**

**These rotations are appropriate as products with
different modes of action are being used every *two*
weeks.**

Fungus Gnats

Larvae/maggots are found in decaying organic matter.

Adults flutter on media surface.

When populations are large, larvae will feed on roots and on poinsettias, up in the hollow stem.



Fungus Gnat Control

Adults can be suppressed with aerosols or evening fogs.

Larvae can be controlled by the following pesticides that need to be rotated. Treating early in the crop will reduce populations during later plant development.

Distance

Gnaturol

Safari

Nemasys



**Unique modes of
action**

Crop Cycle

July August Sept October November December

Fungus Gnats

Safari IGRs Distance, Adept, Nematodes, Gnaturol

Whiteflies

Safari IGRs, Marathon, Soap, Pyrethroid Safari

European Pepper Moth

Bt, *Conserve*, Bifenthrin, Orthene

https://mrec.ifas.ufl.edu/Iso/BEMISIA/WhiteflyManagementProgram_2011.pdf

Table A. Cuttings are Not Anchored in Soil

Suggested Products	IRAC Class	B-Biotype	Q-Biotype
Foggers and aerosol generators	Many	Yes	Yes

Table B. Cuttings Able to Withstand Sprays

Suggested Products	IRAC Class	B-Biotype	Q-Biotype
Foggers	Many	Yes	Yes
Avid (abamectin) + pyrethroid or acephate	6 + 3 or 1	Yes	Yes
<i>Beauveria bassiana</i>	n/a	Yes	Yes
PFR-97	n/a	Yes	Yes

Table C. Root System is Not Well Developed

Suggested Products	IRAC Class	B-Biotype	Q-Biotype
Avid (abamectin)	6	Yes	Yes
Distance (pyriproxyfen)	7C	Yes	No
Endeavor (pymetrozine)	9B *	Yes	No
Enstar II (kinoprene)	7A	Yes	No
Sanmite (pyridaben)	21	Yes	Yes
Talus (buprofezin)	16	Yes	No
Tank Mixes:			
Avid + Talstar	6 + 3	Yes	Yes
Pyrethroids + acephate	3 + 1	Yes	No
Pyrethroids + azadirachtin	3 + 18	Yes	No

Table D. Plants are Actively Growing

Suggested Products for Foliar Applications on Actively Growing Plants	IRAC Class	B-Biotype	Q-Biotype
Avid + Pyrethroid	6 + 3	Yes	Yes
<i>Beauveria bassiana</i>	n/a	Yes	Yes
Distance (pyriproxyfen)	7C	Yes	No
Enstar II (kinoprene)	7A	Yes	No
Horticultural Oil	n/a	Yes	Yes
Insecticidal Soap	n/a	Yes	Yes
Judo (spiromesifen)	23	Yes	Yes
Kontos (spirotetramat)	23	Yes	Yes
M-Pede	n/a	Yes	Yes
Orthene + pyrethroid	1 + 3	Yes	No
PFR-97	n/a	Yes	Yes
Sanmite (pyridaben)	21	Yes	Yes
Talus (buprofezin)	16	Yes	No

Table E. Plants are Two Weeks from Shipment or First Cutting Harvest (table on next page)

Control of whiteflies is often challenging during this stage due to the difficulty of achieving adequate under leaf spray coverage, a lack of labeled products from multiple IRAC Classes, and concerns about phytotoxicity or residue on final product.

Apply a drench or foliar application 14 days prior to shipment of finished plants or the initial harvest of cuttings from stock plants. If adequate spray coverage cannot be achieved, plants should be drenched. To reduce resistance

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