Tomato IPM in the U.S.

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Two major tomato production areas in the U.S.

Florida - fresh market

and

California - processing/fresh market

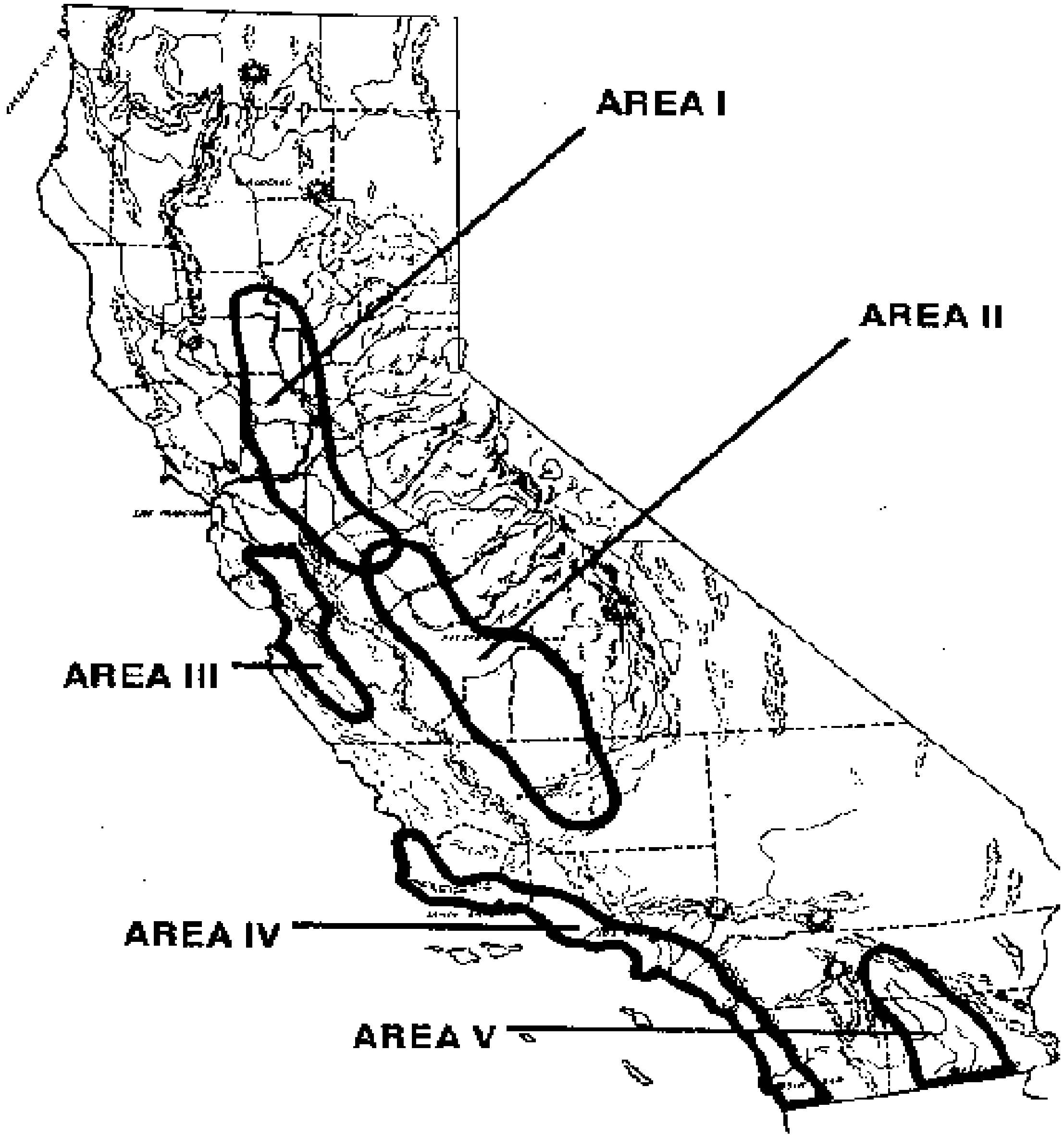
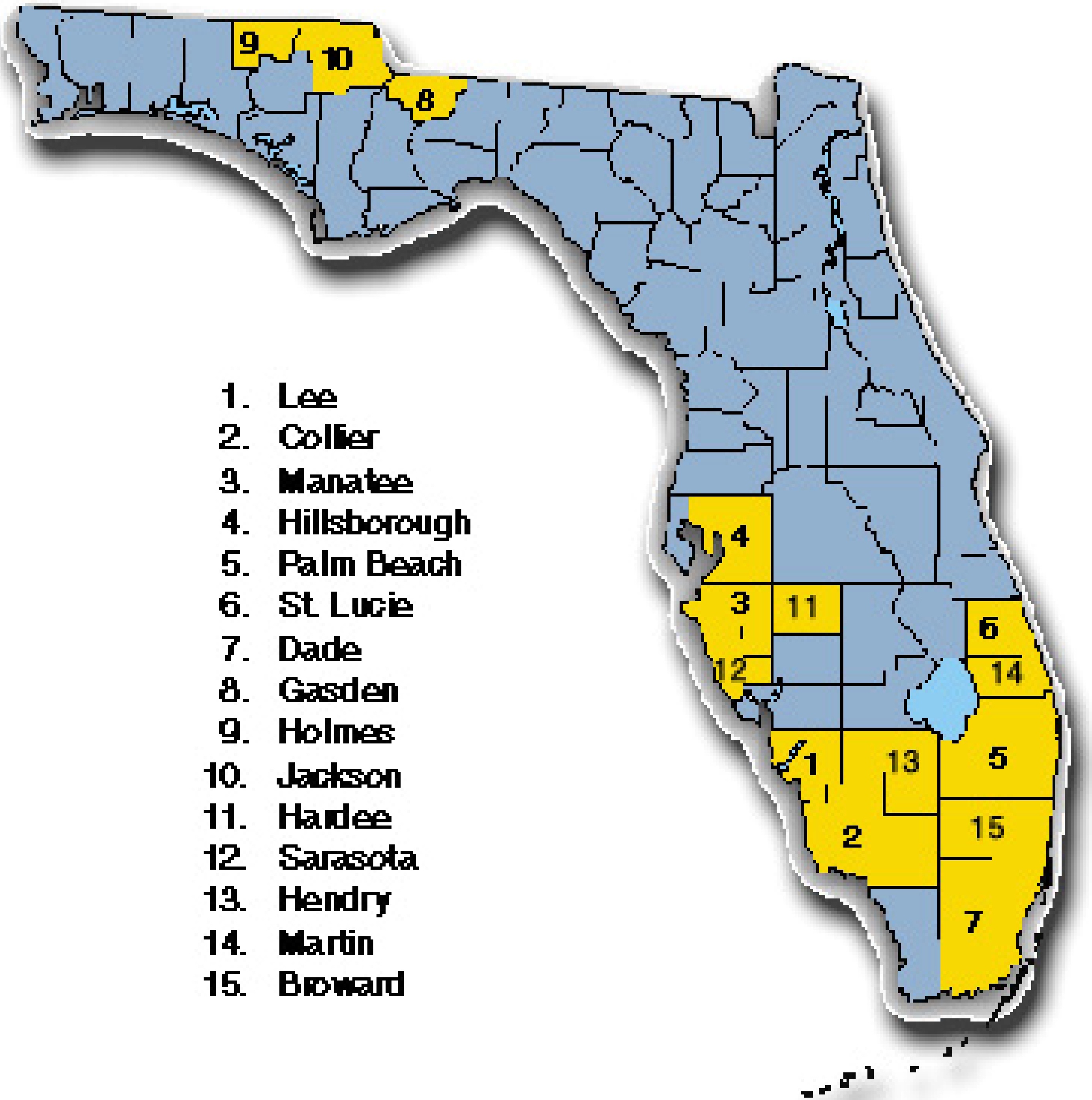


Figure 1. Major tomato producing areas in California.

92% of processing
and
35% of fresh market

1999 Crop Profile for Tomatoes
(Processing) in California



95% of fresh market between Oct – June

Florida Crop/Pest Management Profiles: Tomatoes
Michael J. Aerts
Norman Nesheim

Tomato Insect Pests

90%-CA, 100%-FL, 75%-other areas

- Whiteflies
- Stinkbugs
- Thrips
- Lepidoptera - many species
- Leafminers
- Pinworms
- Aphids
- Flea beetles
- Colorado potato beetle
- Tomato psyllid
- Mites
- Leafhopppers
- Wireworms
- Mole crickets

Tomato Diseases

60%-CA, 100%-FL, 60%-Other areas

Bacterial Spot
Target Spot
Early Blight
Late Blight
Fusarium Wilt
Verticillium Wilt
Fusarium Crown Rot
Bacterial Wilt
White Mold
Southern Blight
Powdery Mildew
Viruses

Tomato Weeds

99%-CA, 100%-FL, 85%-other areas

Nightshades
Nutsedges
Dodder
Field bindweed
Grasses

Tomato Nematodes

75%-CA, 98%-FL, 65%-Other areas

root-knot nematode-several species

sting nematode

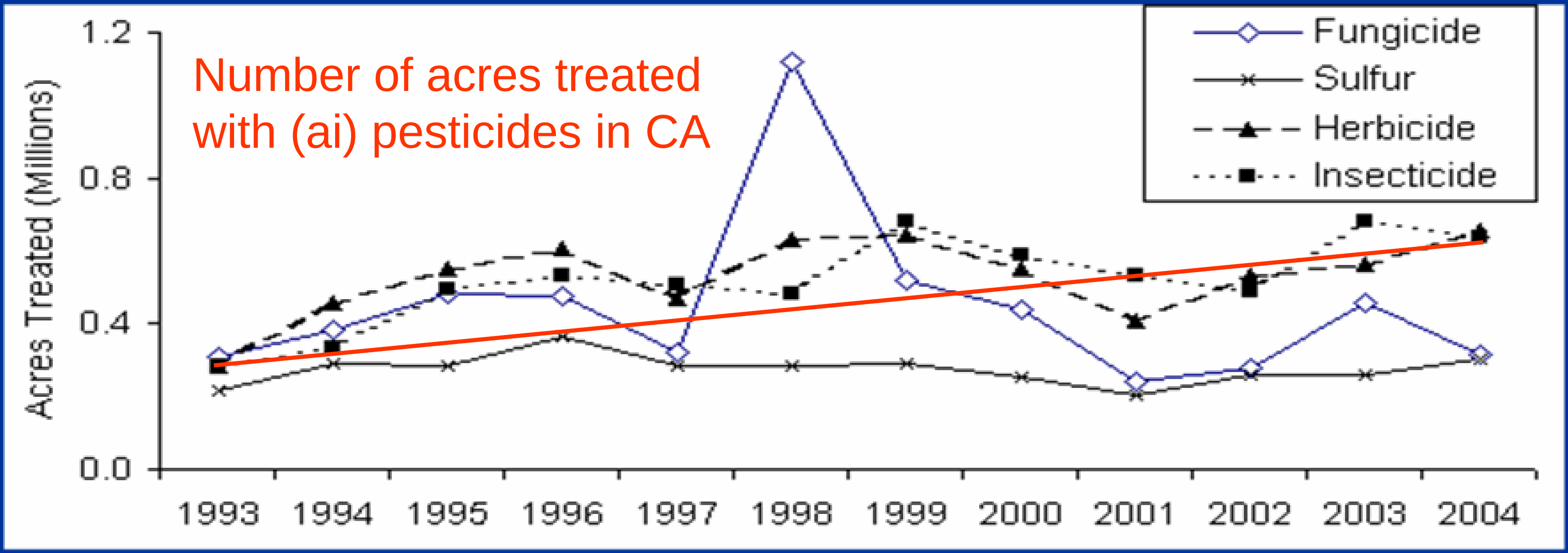
Integrated Pest Management

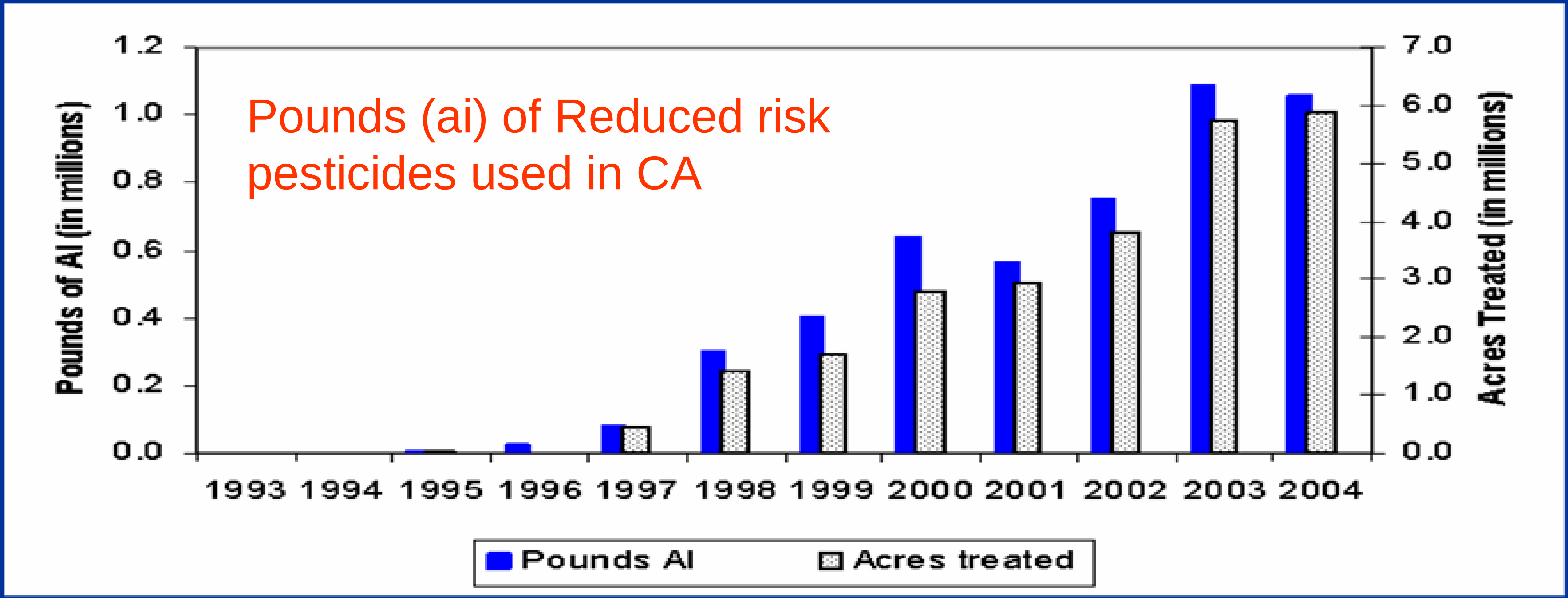
- Use of multiple control tactics (chemical, cultural, biological) integrated into a single pest control strategy (usually one pest).
- Management of the complex of pests that attack a crop.
- Interactions among pests, the crop and the environment within the context of a social, political and economic matrix.

Pesticide use values for 2004 compared to peak usage data for the period 1992 through 2004 demonstrate a 75% reduction in the application of restricted or "Danger"-labeled insecticides in fresh market tomato.

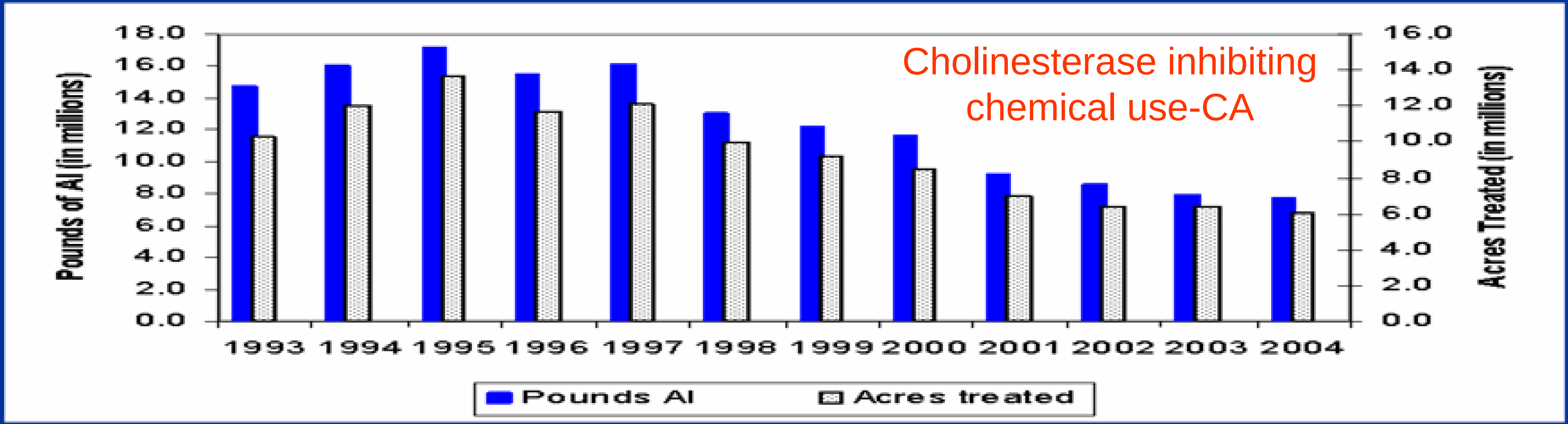
The reduction in use of the restricted use and "Danger"-labeled pesticides is believed to be due to strong adoption of integrated pest management (IPM) principles by Florida tomato growers, working in conjunction with Extension agents and professionals.

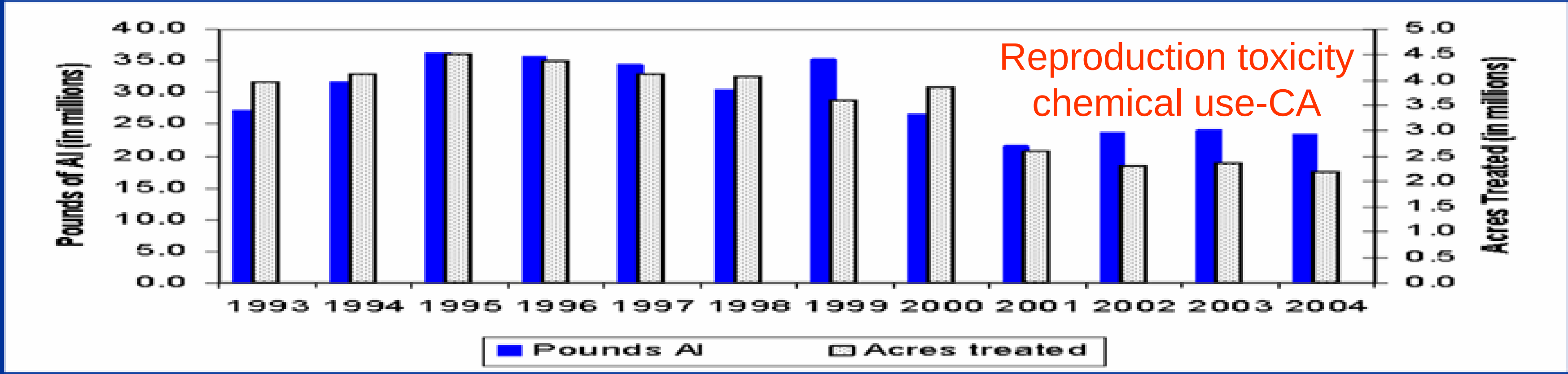
Mossler, M. A. Document PI-87, 2005. Information Office, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

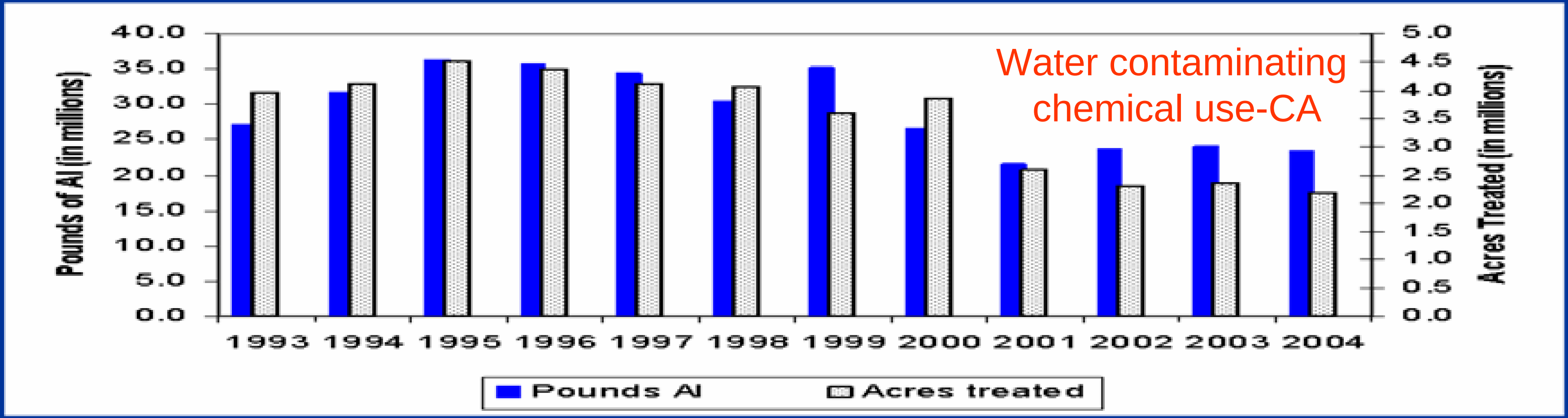




CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION, California Environmental Protection Agency
http://www.cdpr.ca.gov/docs/pur/pur04rep/04chem.htlm







CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION, California Environmental Protection Agency http://www.cdpr.ca.gov/docs/pur/pur04rep/04chem.htm

IPM Continuum:

Biointensive

Insects
Diseases
Weeds
Nematodes

biologically-based controls

prevention

reduced risk pesticides

thresholds

scouting

Chemically intensive

Scouting

- 90% of all growers in CA and FL 'scout' their field in some way—bug counters and consultants

- Vegetables in US:
  60% for insect pests
  55% for plant diseases
  40% for weeds

- Biologically intensive IPM approaches on only 8% of crop acreage

IPM Continuum:

Biointensive

Insects - thresholds
Diseases - models
Weeds – precision ag
Nematodes - ?

biologically-
based controls

prevention

reduced risk pesticides

thresholds

scouting

Chemically intensive

Risk assessment models
TOMCAST

- Early Blight
- Blackmold
- Powdery Mildew
- Late Blight

Alternaria alternata

Phytophthora infestans


Leveillula taurica

California PestCast

Black mold

Late blight

Powdery mildew

Disease Model Database

This database is a clearinghouse of information about models developed for economically important crop and turf diseases in California. A model is included in the database if it uses weather, host, and/or pathogen data to predict risk of disease outbreak. This database is a part of a project called "PestCast," a regional weather network to support the development, validation and implementation of crop disease models.

A plant disease model is a mathematical description of the interaction between environmental, host and pathogen variables that can result in disease. A model can be presented as a simple rule, an equation, a graph or a table. The output of a model can be a numerical index of disease risk, predicted disease incidence or severity, and/or predicted inoculum development.

- Description of the database contents
- What are plant disease model development, validation, and implementation?
- Fungicides and disease forecasting

Select a Crop Disease

This symbol indicates work conducted in California.

Almond
Shothole
Scab

Apple
Fireblight
Scab

Carrot
Alternaria leaf blight

Celery
Septoria late blight

Grapes
Botrytis bunch rot
Powdery mildew
Downy mildew

Lettuce
Downy mildew
Sclerotinia drop

Pear
Fireblight
Scab

Pistachio
Alternaria late blight

Potato
Late blight

Stone Fruit
Brown rot

Strawberry
Botrytis
Powdery mildew

Tomato
Powdery mildew

Tomato, processing
Blackmold
Late blight

Turf
Rhizoctonia blight (Brown patch)

Walnut
Walnut blight

UC IPM HOME | HELP DESK | PESTCAST

California PestCast

UC IPM

Frank Zalom, UC Davis

Thresholds

- Growers use some kind of threshold most of the time
  - each grower has a set comfort level
- Some thresholds not realistic commercially
  - following the “best” science does not always mean the best commercial success
  - there is an art to pest management

IPM Continuum:

Biointensive

Neonicontinoids
Microbial byproducts
Inorganics minerals
IGRs

biologically-
based controls

prevention

reduced risk pesticides

thresholds

scouting

Chemically intensive

Reduced risk pesticides

The FQPA expedited EPA’s review and registration decision-making process for pesticides that are classified as less risky to human health and the environment than existing conventional products.

Advantages of reduced-risk pesticides include:

- low impact on human health
- low toxicity to natural enemies
- low toxicity to non-target organisms (birds, fish, etc)
- low potential for groundwater contamination
- lower use rates
- compatibility with Integrated Pest Management
- low pest resistance potential

Trade Name	Chemical Name	How it works	What it controls
Confirm, Intrepid	tebufenozide, methoxyfenozide	IGR – ecdysone agonist causes a premature lethal molt. Mostly through ingestion, some contact, feeding ceases in 24 hrs, death in 2-3 days	Small Lepidoptera larvae (worms or caterpillars) such as armyworms, beet AW, tomato fruit worm, loopers, hornworm, yellow striped AW.
Spintor	Spinosad	Microbial metabolite-- fermentation product (interferes with nicotine-like receptors in nerve endings) of soil bacteria-Actinomycetes	Lepidoptera larvae, leaf miners, certain thrips species, Colorado potato beetle
Proclaim	Avermectins-emamectin benzoate	Microbial metabolite, Mostly through ingestion. Disruption of nerve impulses causes paralysis in hours, death in days	Lepidoptera larvae
Avaunt	Indoxacarb	Inhibits Na^{+} entry into nerve cells, paralysis and death 6-48 hours. Contact and ingestion	Lepidoptera larvae, beet AW, diamond back moth, fruit worms
Courier, Applaud	Buprofezin	IGR – Chitin synthesis inhibitor, contact and ingestion	White flies, leaf hoppers
Agri-Mek	Avermectins	Fermentation product of soil bacterium *Steptomyces avermitilis*, via ingestion. Inhibits signal transmission at neuromuscular	Colorado potato beetle, mites, thrips, some Lepidoptera larvae
Knack	Pyriproxyfen	IGR- Jh mimic sterilizes whitefly adults and eggs	Lepidoptera larvae, good on large beet armyworms
Rimon	Novaluron	IGR – chitin inhibitor, enters via ingestion	Immature: Whitefly, thrips, some Lepidoptera larvae
Oberon	Spiromesifen	Tetronic acid derivatives interfere with lipid biosynthesis	Mites, whiteflies
Admire, Provado Actara,Platinum,	Imidacloprid Thiamethoxam-neonicotinoids	Interfere with nerve endings, keeps nerve receptor channels open	Sucking insects, Colorado potato beetle, other beetles
Agree, Cutlass, DiPel, XenTari	*Bacillus thuringiensis*	Protein toxin attaches to gut of insect causing rupture and death in 24-48 hours	Many Lepidopteran larvae such as hornworm, cabbage looper, fruitworm,

Fungicides

Common Name	**Trade Name**
Cyprodinil	Vangard
Fenhexamid	Elevate
Fludioxonil	Scholar
Streptomyces lydicus	Actinovate
Pyrimethanil	Scala
Fenamidone	Reason
Boscalid	Endura
Azoxystrobin	Quadris
Pyraclostrobin	Cabrio
Bacteriophage	AgriPhage
Famoxadone	Tanos
Tolyfluanid	Previcur
Iprovalicarb	Melody
Cyazofamid	Ranman
Neem	Trilogy
Dimethomorph	Acrobat

Neonicotinoids have revolutionized the growing of crops in several areas of the country:

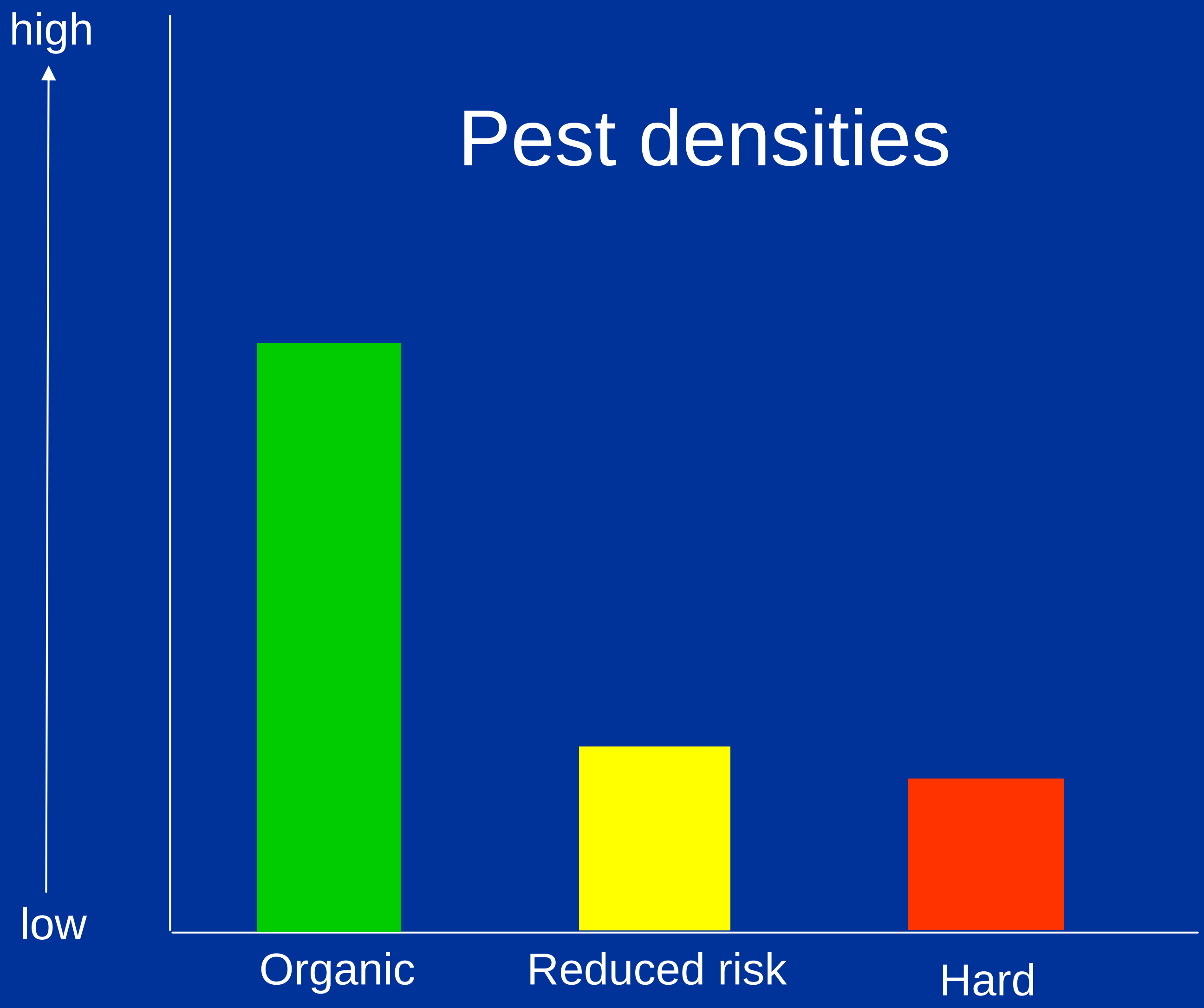
Tomato in FL -- TYLCV + SLW control

Cucurbits and other crops in Arizona-- the SLW

Potatoes in the northern US--CPB

SARs, Systemic Acquired Resistance chemicals are especially important for control of bacterial spot and speck as in some areas the bacteria have become tolerant of copper fungicides

Reduced risk chemical study[1]



[1] Koss, A.M., A.S. Jensen, A. Schreiber, K.S. Pike, and W. E. Snyder. 2005. Environ. Entomol. 34:87-95

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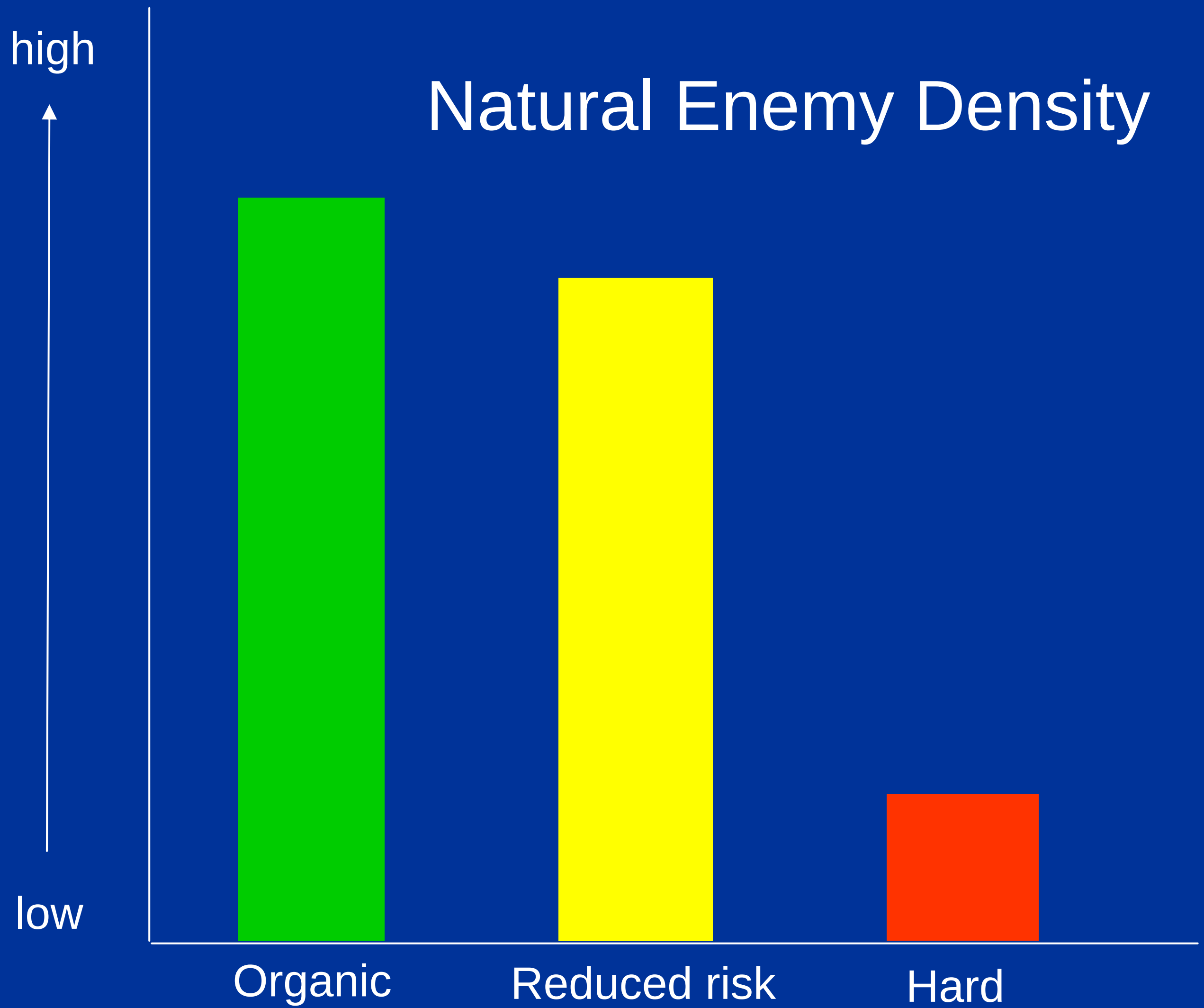


[1] Koss, A.M., A.S. Jensen, A. Schreiber, K.S. Pike, and W. E. Snyder. 2005. Environ. Entomol. 34:87-95

Too much dependence on reduced risk chemicals as everyone becomes too comfortable with using these safe, effective products

Q BIOTYPE WHITEFLY: Has developed resistance to many of the insecticides we currently rely on for control.

- High levels of resistance or tolerance to many reduced risk pesticides.

- Some data suggests tolerance to pyrethroid and organophosphate combinations.

- If this pest was to become widespread in vegetable production areas, control options would be greatly limited.

IPM Continuum:

Crop rotation
Clean seeds/Transplants
Irrigation Management
Sanitation
Cultivation

Biointensive

biologically-
based controls

prevention

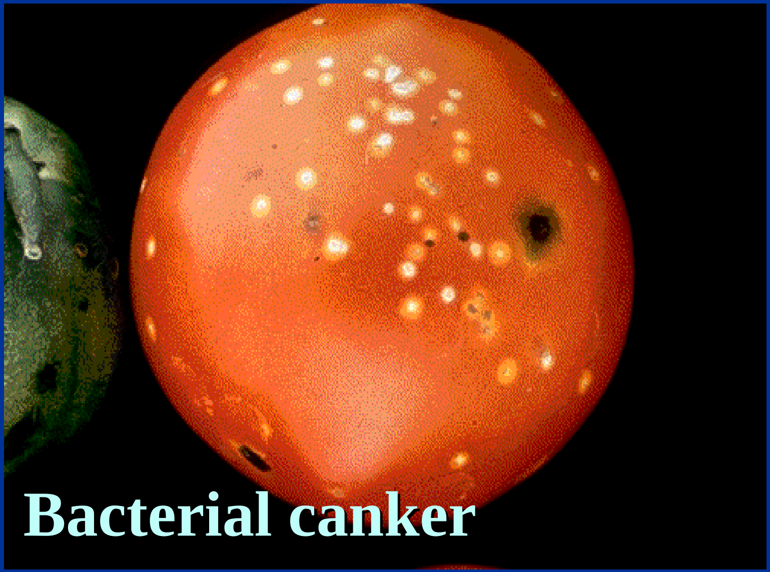
reduced risk pesticides

thresholds

scouting

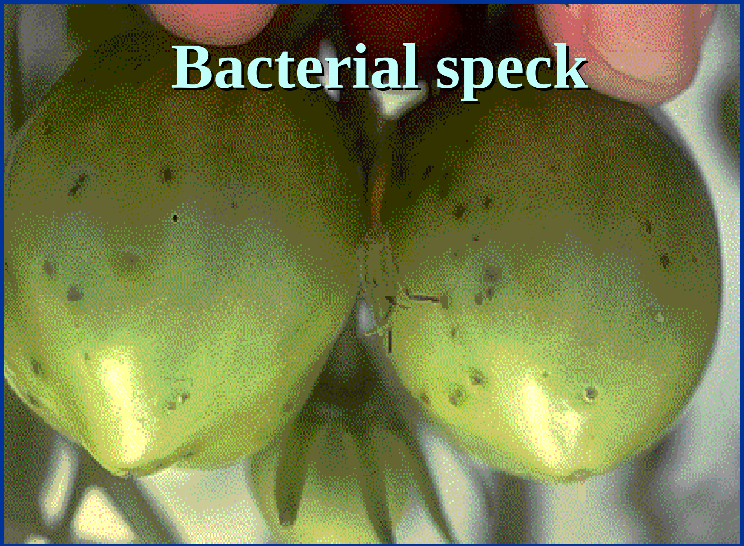
Chemically intensive

Bacterial canker
Bacterial speck
Bacterial spot



Clean seeds/transplants

Plant resistance (to one race of bacterial speck only)



Frank Zalom, UC Davis

	Farm B	Farm A
Preventive practice cost in transplant production	$3.04	$0.86
Preventive practice cost in production field	$150.25	$67.00
Packout (25 lb boxes)	2400	2040
Value per package	$35.00	$35.00
Value per acre	$84,000.00	$71,400.00
Minus cost of preventive practices	$83,846.71	$71,332.14
Real cost of NOT performing preventive practices		($12,514.57)

	Farm B	Farm A
Preventive practice cost in transplant production	$3.04	$0.86
Preventive practice cost in production field	$150.25	$67.00
Packout (25 lb boxes)	2400	2040
Value per package	$5.00	$5.00
Value per acre	$12,000.00	$10,200.00
Minus cost of preventive practices	$11,846.71	$10,132.14
Real cost of NOT performing preventive practices		($1,714.57)

Frantz, G. 1992. Glades Crop Care, Inc

IPM Continuum:

Biointensive

Natural enemy preservation
Parasite releases
Microbial pesticides
Plant Resistance
Pheromones

biologically-based controls

prevention

reduced risk pesticides

thresholds

scouting

Chemically intensive

Microbial pesticides are formulated microorganisms or their by-products. They tend to have advantages over botanicals in that they are generally more selective, so specific pests may be controlled with little or no effect on non-target organisms.

- Microbial insecticides include bacteria *(Bacillus thuringiensis-strains, B. subtilis* and *Saccharopolyspora spinosa* – spinosad – SpinTor, Entrust) and fungi *(Beauvaria bassiana)* and various species of the bacteria *Pseudomonas*, *Bacillus*, and *Streptomyces*.

- Other microbial products include beneficial fungi and bacteria *(Streptomyces, Gliocladium, Trichoderma harizanum) Metarhizium sp Paecilomyces fumosoroseus* control of whiteflies *Beauveria bassiana* for greenhouse and field use that attack or compete with plant pathogenic fungi.

- Harpins are produced by bacteria and other microbes. Pathogenic bacteria need harpins to infect their host plants. When applied to plants, synthetic harpins stimulate the plant's defense systems.

Integrated Pepper Weevil Management in Florida

- Cultural control: The key to success is judicious management of the nightshade by weeding chemically, mechanically or both

- Parasitoid releases: When nightshade vegetation was not amenable to eradication, it became a candidate for the *C. hunteri* release program. 1000 to 2000 wasps/A were released on a bi-weekly basis into nightshade

- Pheromone monitoring of PEW: Indicated where weevil were moving and when the would move into field. Used GPS/GIS to track movement

- Reduced Risk pesticides: With the reduced population size of PEW available to migrate into the pepper fields, the reduced risk chemicals satisfactorily controlled the in-field infestations

- Scouting: Scouting is necessary during the season and fallow for the crop and the nightshade vegetation to anticipate, detect and evaluate infestations for best decision-making. Reduced risk pesticides used for other pests.

- Third year results: PEW populations and pepper fruit infestations were reduced by an average of 82% on the 3 farms.


1.Scouting
2.Thresholds/Forecasting
3.Reduced risk pesticides
4.Prevention
5.BioIPM Systems