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Past, Present and Future - a Road Map to Integrated, Area-wide, Systems, and Enterprise Risk Management Approaches to Pest Control

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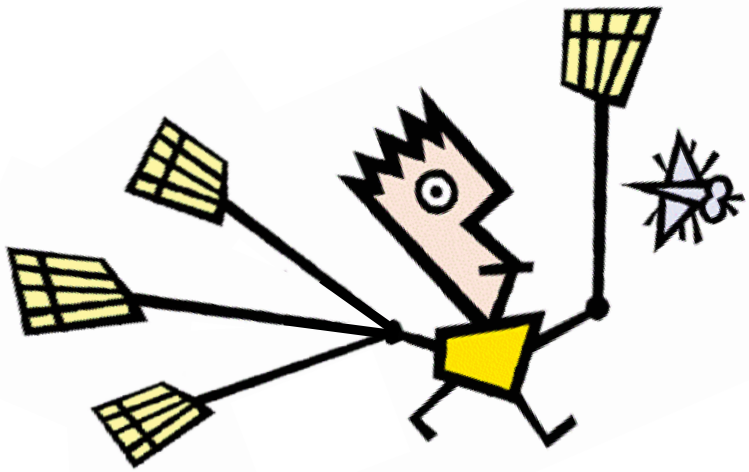


Change and Innovation in Pest Management

TAKE HOME MESSAGES

Know your enemy, think area-wide and work collectively!

- The first rule of war and pest management is '**know your enemy**'
- **Area-wide** Pest Management is as much a way of thinking as it is a type of program
- Pest Management programs are becoming increasingly complex, data and technology driven and as such require a more **collective approach**

Change and Innovation in Pest Management

DRIVING FORCES

- Realization that **status quo** isn't adequate to meet food needs of future generations
- **Economies of scale** … farms and operations are getting bigger
- Trading partners want **safe trade** … not shared pests
- **Resistance** to many control tactics have made 'silver bullets' a thing of the past
- Increasing concerns for the **environment and human health**
- Bilateral and multilateral agreements requiring **science-based decisions**


IPM: Each grower/manager applies their own best management practices

Integrated Pest Management

A DEFINITION - a (science) decision-based process involving coordinated use of multiple tactics to optimize pest control (insects, pathogens, weeds, vertebrates) in an ecologically and economically sound manner

Pioneers

- Chinese (300 BC-300 AD) - crop phenology in pest avoidance, natural enemies of pests, soap insecticidal properties
- A.D. Pickett (1948) - selection of pesticides to protect natural enemies
- Rachel Carson (1963) - Silent Spring
- Huffaker, van den Bosch, Prokopy (1970s)

Integrated Pest Management

Who drives IPM - Individual growers/organizations

IPM Tools/Tactics

- Monitoring - weather, pests & diseases, pesticides
- Action Thresholds
- Forecasting
- Cultural Methods - mowing, tilling, sanitation, soil preparation
- Host (Plant) Resistance
- Biological Controls - predators, parasites, diseases
- Mating Disruption
- Chemicals - reduced risk and bio-rational

Integrated Pest Management

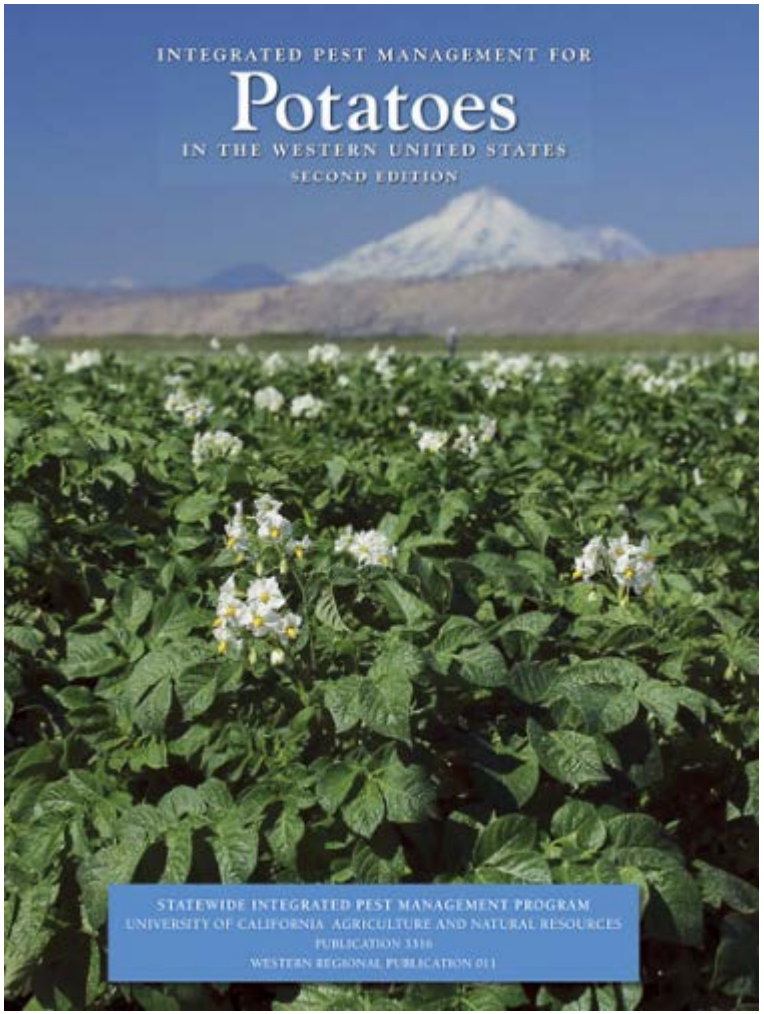
IPM can be applied to any pest management situation

Santa Clara County Integrated Pest Management Program

Putting IPM into Practice through Real World Examples

IPM

Pest and Termite




Area-wide: Growers + stakeholders work together to manage key pest that affects them all

Area-wide Pest Management

A DEFINITION - systematic pest control uniformly applied to the **total population** of a key pest in a clearly defined geographical area to predetermined levels using biologically based criteria

Pioneers

- cottony cushion scale (1888); gypsy moth, USA (1890s); cattle ticks, USA (1906); tsetse fly, Portugal (1911); Locusts, China (1929/51); malaria, global (1955); screwworm, NA (1957)
- E.F. Knipling & R.C. Bushland (1950s)
- Joint FAO/IAEA Division of Nuclear Techniques in Food & Agriculture (1964)
- USDA-ARS Area-wide Pest Management Program (1995)

Area-wide Pest Management

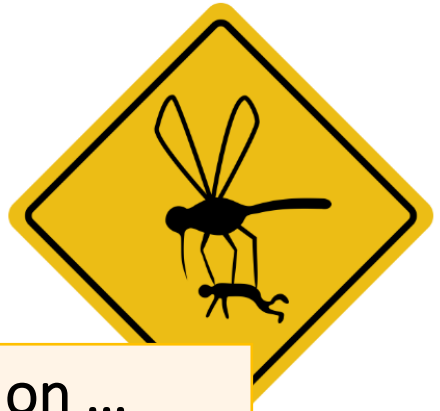
Key Characteristics:

- Key pest
- Total population
- Defined area
- Multiple stakeholders (growers, industry, public, gov't, scientists)
- Proactive
- Focus on re-infestation
- Focus on monitoring

» » AWPM is as much a <u>way of thinking</u>
as it is a type of program

Area-wide Pest Management

(tools & tactics)



In this Area-Wide Conference – presentations on …	
False codling moth / SIT	Locusts / forecasting
Rice pests / ecology	Codling moth / SIT
Fruit flies / SIT, Attract & Kill	Ticks / IPM
Mating disruption / MD	Mosquitoes / SIT, traps, genetics
Citrus greening – HLB / IPM	Tsetse flies / SIT, IPM
Spotted wing drosophila	Screwworm / SIT
Biocontrol of aphids / BC	Stable flies / traps, IPM
Pink bollworm / SIT	Gypsy moth / MD, Bt
Sugarcane borer / SIT, Bt	


Systems Approach: Growers wishing to export follow specified protocols

Systems Approach to Pest Management

A DEFINITION - a defined set of pest risk management measures, at least two of which act independently that cumulatively achieve the appropriate level of phytosanitary protection

⇨ expanded IPM programs designed to meet the phytosanitary requirements of trading partners

Who drives SA – Industry / Government

Pioneers:

- E.B. Jang / H.R. Moffitt / R. L. Mangan

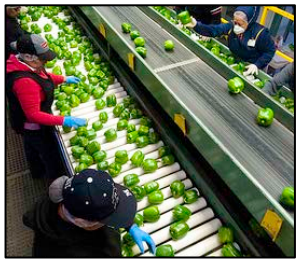
Systems Approach to Pest Management

Pre-harvest

- Treatment
- Cultivars
- Sanitation
- Certification
- Areas of Low pest prevalence
- Pest free areas
- Planting time

Harvest

- Treatment
- Culling
- Sanitation
- Ripeness
- Harvest timing
- Handling



Post-harvest

- Treatment
- Inspection
- Sanitation
- Certification

Shipping

- Treatment
- Inspection
- Sanitation
- Type of transport

Distribution

- Inspection
- Treatment
- Restrict end use
  - Timing
  - Location
  - Quantity
- Post-entry quarantine

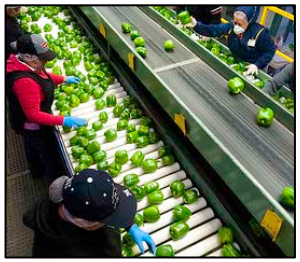
End use

Pre-Entry

Post-Entry

Systems Approach to Pest Management






Pre-harvest | Harvest | Post-harvest | Shipping | Distribution | End use

+++++ Level of risk ++ + --

Left to right: Tomato photo by Bob Nichols. Sweet potato harvest photo by Lance Cheung. Green pepper photo by Bob Nichols. Ship photo by USDA Foreign Agriculture Service. Inspection and schoolchildren photos by USDA. Flickr.com/photos/usdagov

Systems Approach for Papaya

Target: Medfly (*Ceratitis capitata*)

Area: Central America

Mitigations

- Poor host
- Low pest prevalence
- Specific cultivars
- Maturity stage
- Hot water dip

Enterprise Risk Management: Industry develops business plan that specifically considers and addresses risk options

Enterprise Risk Management - ERM

A DEFINITION - process of planning, organizing, leading, and controlling activities in an organization to meet its stated risk profile and maximize benefits to its stakeholders

Risk appetite - organizations stated risk tolerance
Risk tolerance(s) - day-to-day operations that tell you if you are within the stated risk appetite of our organization

Regulatory risk appetite statement …

- reduce pest establishment below current levels
- increase trade with other countries

Industry risk appetite statement …

- reduce consignment rejections to zero
- increase consignments by 30%


What road should I take?
Well where are you going?
I don't know.
Then it doesn't matter. If you don't know where you are going, then any road will get you there.

Enterprise Risk Management - ERM

Who Drives ERM – Industry (pioneers)

Examples

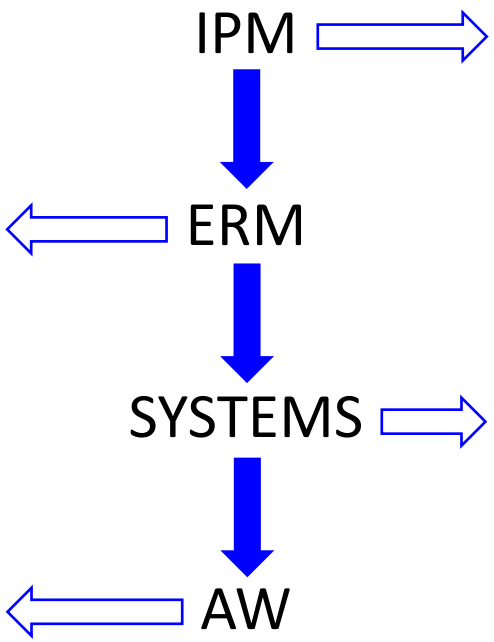
- Avocados exports from Mexico
- British Columbia apple growers and codling moth
- South African citrus growers and false codling moth
- U.S. National Clean Plan Network – plant viruses
- California nut tree growers and navel orange worm

Road Map -
Navel Orange Worm Management in California

CA Nut Tree Growers have been well organized since the 1970s

2015 All pistachio production in CA using atoxigenic strain of *Aspergillus flavus* (AF36) to reduce aflatoxin production

Concern about long term sustainability of FCM IPM - growers investing in AW approaches, including SIT, MD puffers



Best management practices
- water management
- sanitation
- monitoring
- mating disruption
- pesticides

No regulatory mandate for SA other than a <2 % damage threshold for NOW for premium nut prices

Future Directions

- **New surveillance technologies** - drones and remote sensing
- **Molecular/Genetic tools** such as CRISPR, RNAi, paratransgenesis
- Automation of pest management **data bases**
- **Automation of decision-making** based on digital monitoring data
- Refinement of **systems approaches**, including approaches for moving products out of quarantines established because of invasive pest outbreaks

Conclusion

Scientists from all disciplines need to improve communication and foster collaboration to meet the pest management challenges of the future while preserving our natural ecosystems

Know your pest,

think area-wide,

work collectively!

THANK YOU !