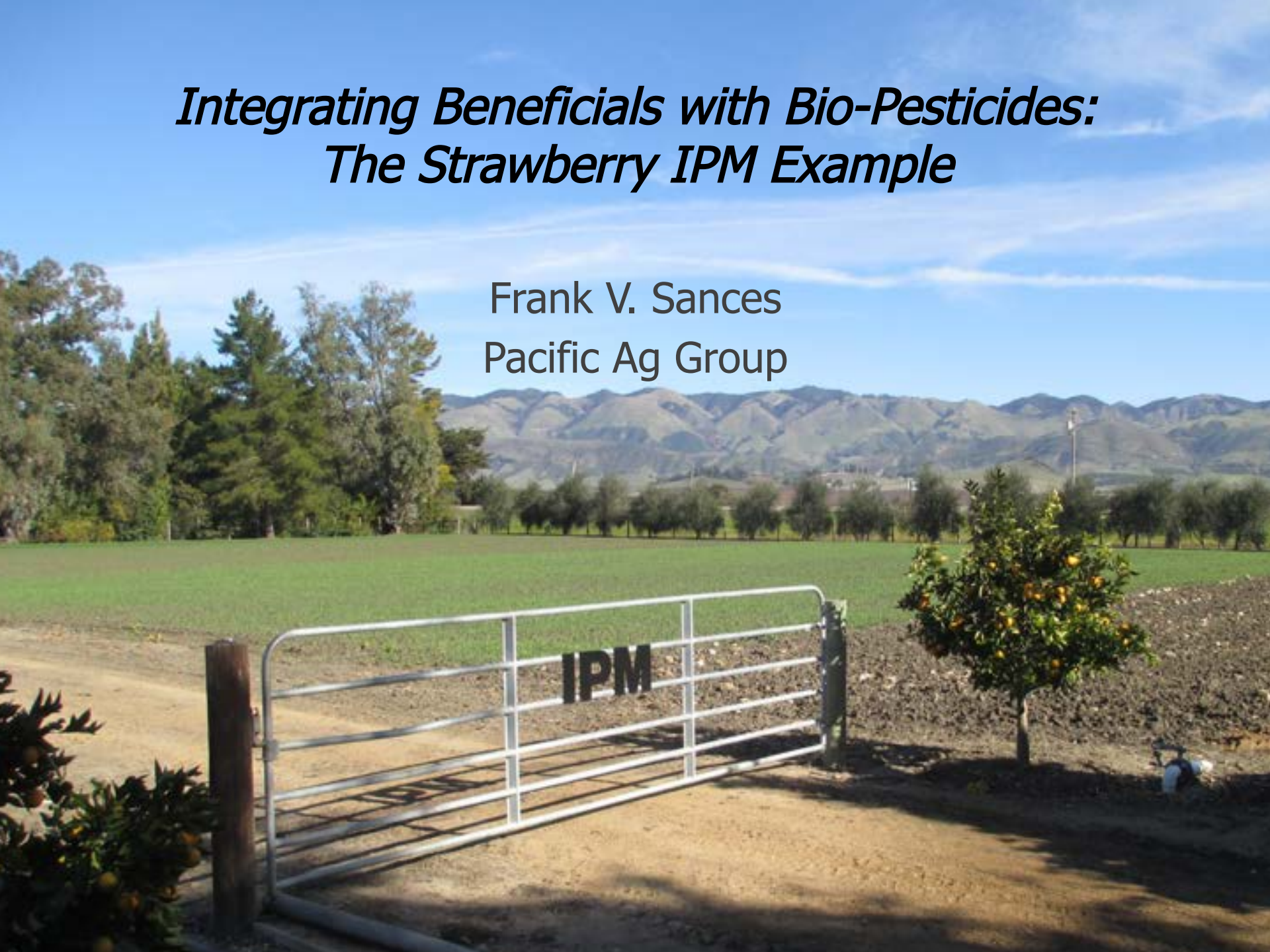
Integrating Beneficials with Bio-Pesticides: The Strawberry IPM Example

Frank V. Sances
Pacific Ag Group



Pacific Ag Group Research Facilities by Region

Pacific Ag Research:

Central Coast:
- San Luis Obispo
- Arroyo Grande (2)
- Huasna
- Guadalupe

Salinas Valley:
- Spreckels
- Chualar

San Joaquin Valley:
- Five Points
- Avenal

Michigan Ag Research:

Albion

Florida Ag Research:

Thonotosassa

Dover

Pacific Ag Laboratories

Hydroponic Greenhouses

Entomology

Plant Pathology

Winery

Nematology

Overview

I. Concepts, History, and Challenges of Strawberry Pest Management

II. Strawberry IPM Systems – California, Florida, and Spain

   i. Arthropods – Spider Mites, *Lygus hesperus*, Lepidopterans, Thrips

   ii. Plant Pathogens – Foliar and Soil Borne

   iii. Biological Tools – Conservation of Natural Enemies & Inundative Releases of Beneficials

III. Conclusions and Testimonials

   i. Trends and Opportunities

   ii. Grower Interviews

Strawberry Production Regions

California

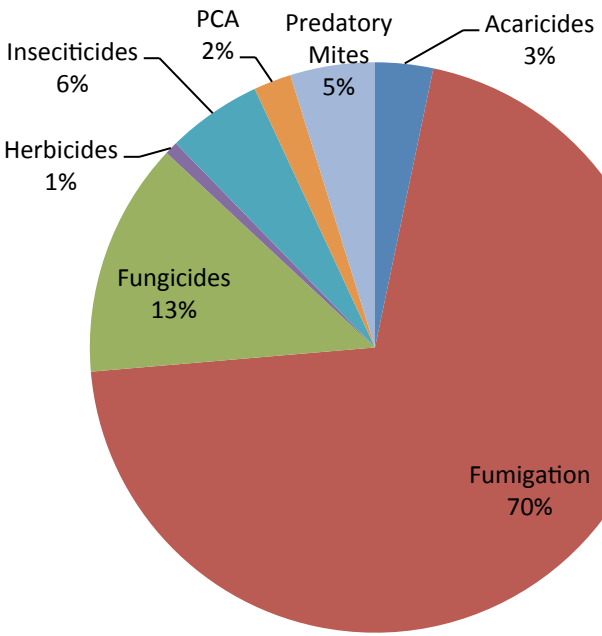
Florida

Spain (EU)

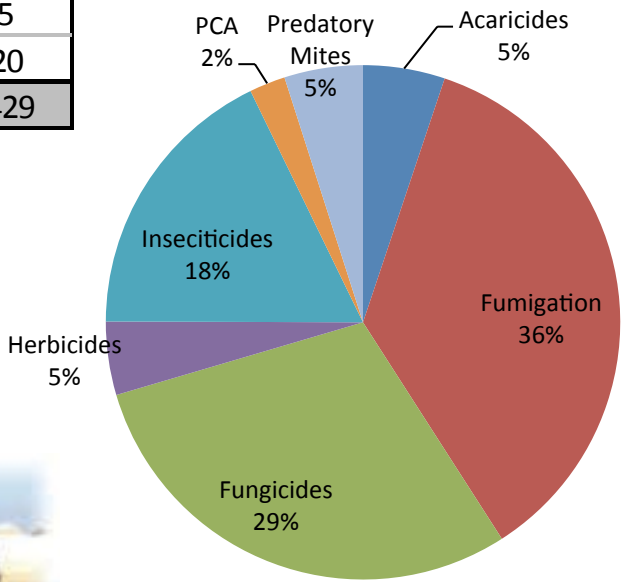
Strawberry IPM Costs by Region

Pest Management Costs Per Acre		
	California	Florida
Acaricides	$154	$125
Fumigation	$3,300	$869
Fungicides	$624	$717
Herbicides	$35	$112
Inseciticides	$252	$431
PCA	$100	$55
Predatory Mites (2x)	$225	$120
Total	$4,690	$2,429

California



Florida



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Arthropod Pests on Strawberries

Mite Damage in the Field

Foliar and Fruit Diseases

Sphaerotheca macularis
(Powdery Mildew)

Xanthomonas fragariae
(Angular Leaf Spot)

Colletotrichum acutatum
(Anthracnose)

Botrytis cinerea
(Botrytis Fruit Rot)

Soil Borne Pests

Belonolaimus longicaudatus
(Sting Nematode)

Macrophomina phaseolina
(Charcoal Rot)

Verticillium dahliae
(Verticillium Wilt)

Phytophthora cactorum
(Phytophthora Crown Rot)

Economic Thresholds

Direct Injury

Lygus Damage (Cat-facing)

Corn Earworm Feeding on Fruit

Foliar Damage from Moth Larva

Bronzing Caused by Thrips

Indirect Injury

Undamaged (left) and Mite-Damaged (right)

Spider Mite

Sting Nematode

Beneficials

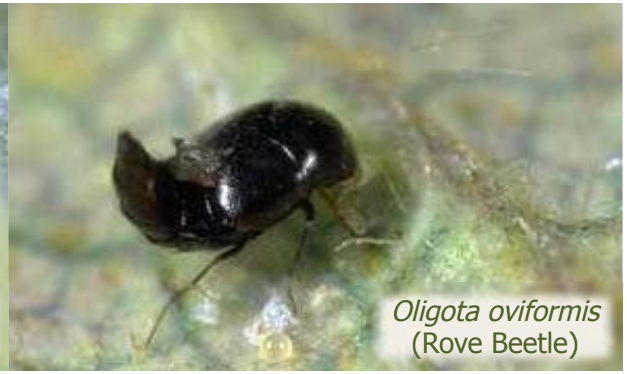
Orius tristicolor
(Minute Pirate Bug)

Scolothrips sexmaculatus
(Six-Spotted Thrips)

Feltiella acarisuga
(Predaceous Midge Larva)

Nabis spp.
(Damsel Bug)

Stethorus picipes
(Spider Mite Destroyer)


Oligota oviformis
(Rove Beetle)

Hemerobius pacificus
(Brown Lacewing)

Chrysoperla carnea
(Green Lacewing)

Geocoris spp.
(Predaceous Bit-Eyed Bug)

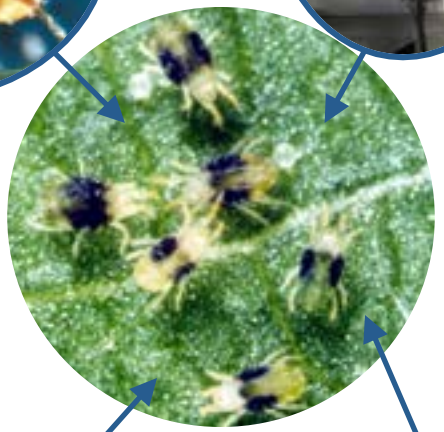
Predatory Mites Used in Strawberry IPM Systems

Phytosiulus persimilis Attacking a Two Spotted Spider Mite

Concepts of IPM

Biotic

I. Biocontrols
- Micro
- Macro



II. Host Plant
- Age
- Condition
- Variety
- Senescence

Abiotic

I. Weather
- Rainfall
- Temperature

II. Cultural Practices
- Irrigation
- Mulch Color

Conservation - Habitat

Dust Control

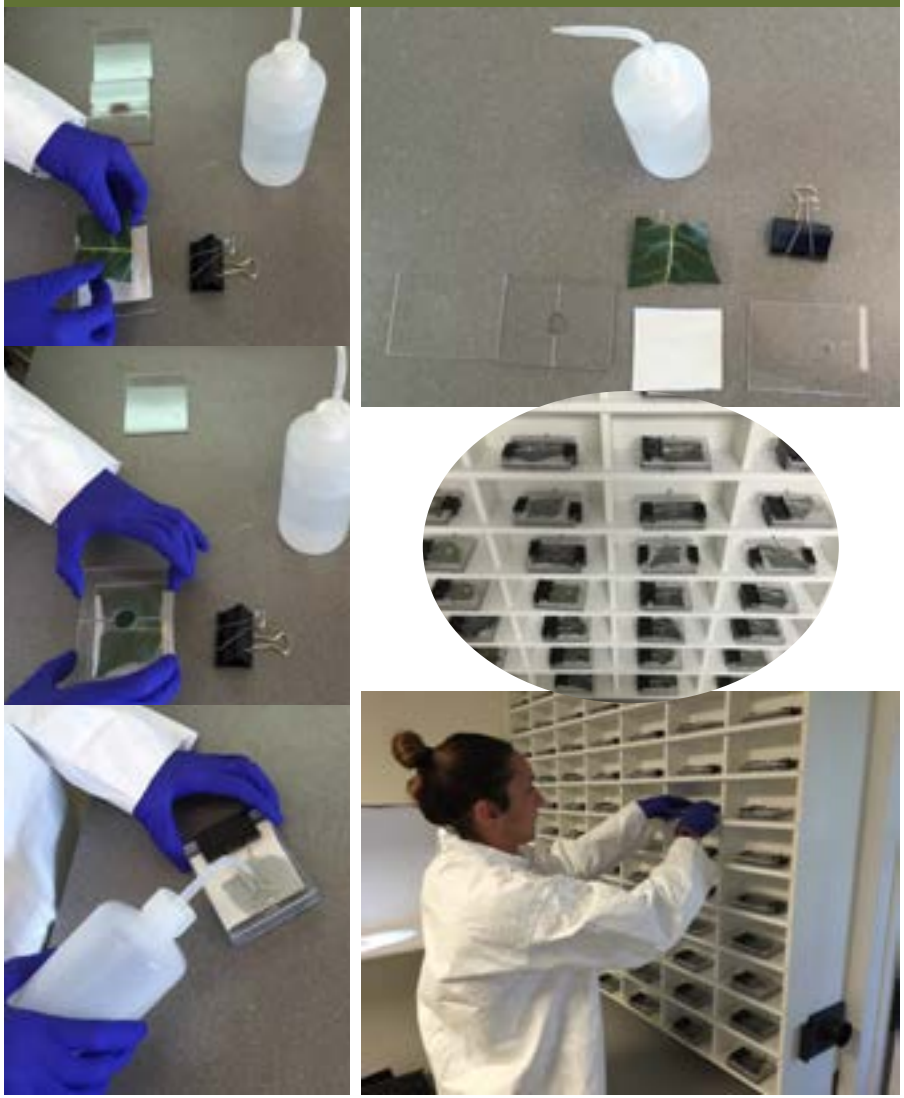
Soil Amendment Incorporation

In-Field Insectaries

Plastic Mulch Color

Evaluating the Impact of Pesticides on Beneficials

Laboratory Assessment – Munger Cells



In-Field Assessment

Timing and Distribution of Predator Mites

	California		Florida
	Southern	Central	
Schedule:	Dec: 20K Jan: 20K+	Jan: 20K Feb: 20K	Nov: 20K Dec: 20K
Prey to Predator Ratios:	Dec: 5 to 1 Jan: 10 to 1	Jan: 5 to 1 Feb: 10 to 1	Nov - March: 10 to 1
Threshold:	Nov - Jan: 5/Leaf Feb: 10/Leaf	Jan: 5/Leaf March: 10/Leaf	Entire Season: 1-5/Leaf

Mechanical Distribution

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Soil Borne Disease Management

I. Anaerobic Soil Disinfection (ASD)

Rosskopf/USDA-ARS

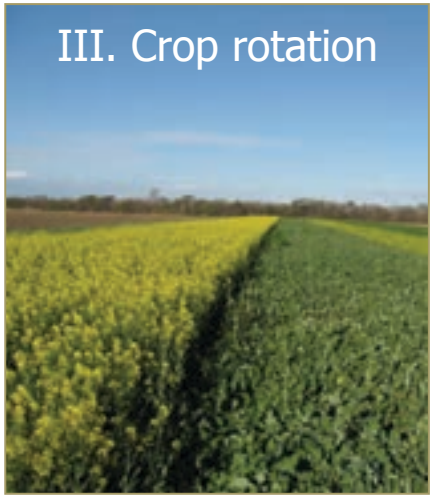
- Comparable yields to MeBr standard
- High level of weed control
- Easily adaptable to organic and conventional systems
- Easily scaled up or down from home garden-sized to farm-scale

Rosskopf, E. USDA-ARS. 2012.

Rosskopf, E. USDA-ARS. 2012.

II. Applications

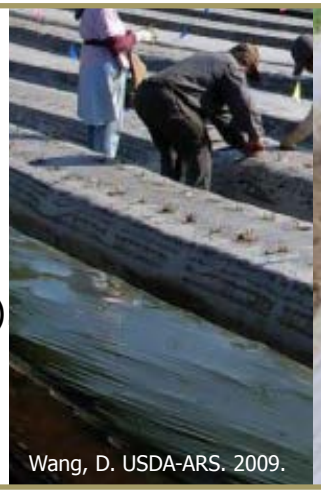
III. Crop rotation



IV. Soilless Substrate Troughs

Wang/USDA-ARS

- Hemispherical mulch-lined trough
- Filled with substrate (i.e. coir, perlite, peat, rice hulls)
- Plugs planted through mulch overlay


Wang, D. USDA-ARS. 2009.

Wang, D. USDA-ARS. 2009.

Role of Plant Health

Strawberry Grower Interviews

Carl Grooms – Fancy Farms (FL)

David Peck – Manzanita Farms (CA)

THANK YOU

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