

Pest Management in High Tunnels in Arkansas

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Acknowledgements

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High Tunnel Project

2012-2015 Extending the Market Season with High Tunnel Technology for Organic Fruit Production.

Acknowledge Funding: USDA-SARE

Co-PIs: Rom, Johnson, Popp, Garcia

Objectives:

- Test pest management strategies in HT for caneberries and blueberries (scouting and control tactics)

Pest Management Tactics

- Weed-free zone around plots and high tunnel
- Screen exclusion of mammals and insects
- Trapping for scouting & reduce pest numbers
- Release predatory mites against spider mites
- OMRI organic sprays (*soft, reduced risk*):
 - ✓ Aza-Direct against white flies, stink bugs, leafhoppers (LH), beetles
 - ✓ Ecotec, Saf-t-Side, JMS Stylet Oil against spider mites, whiteflies, aphids, LH
 - ✓ Bt (Deliver, Javelin) against caterpillars, raspberry crown borer
 - ✓ Surround kaolin clay repels Japanese beetles





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Management and Spray Guidelines

New - Insecticides For Spotted Wing Drosophila:

[Caneberries](#)

[Blueberry](#)

[Strawberry](#)

[IRAC Mode of Action](#) (Insecticide Resistance Action Committee)

[Fruit & Nut Pesticide Labels \(IRAC #\) and Use restrictions](#)

Arkansas

Prebloom Lorsban Advanced Spray - Grape scale/Cutworm ([pdf](#))

MP144 Insecticide Recommendation for Arkansas (2013) ([pdf](#))

MP467 2010 Arkansas Small Fruit Management (2013) ([pdf](#))

Registered Insecticides for Blackberry & Blueberry ([pdf](#))

Southeast

SE Blackberry / Raspberry Management Guide (2013) ([pdf](#))

SE Apple Orchard Management Guide (2013) ([pdf](#))

SE Peach/Nectarine/Plum Guide (2013) ([pdf](#))

[SE Peach Growers' Handbook](#)

Midwest

Midwest Small Fruit and Grape Guide (2013) ([pdf](#))

Midwest Tree Fruit Guide (2013) ([pdf](#))

Chemical Control

Save money, labor, and time:

- Spray only pest hot spots in early morning or late evening
- Conserve pollinators and natural enemies by keeping unsprayed, safe spots for natural enemy to "retreat"

Tactics for Mammals, Mites, Japanese Beetle



New Pest: Spotted Wing Drosophila



SWD fact sheet,
damaged fruit,
laminated sheet (how
to sample, sprays by
crop with preharvest
intervals - PHI)

New Pest Spotted Wing Drosophila (SWD)



Hearldandnews.com



Umn.edu

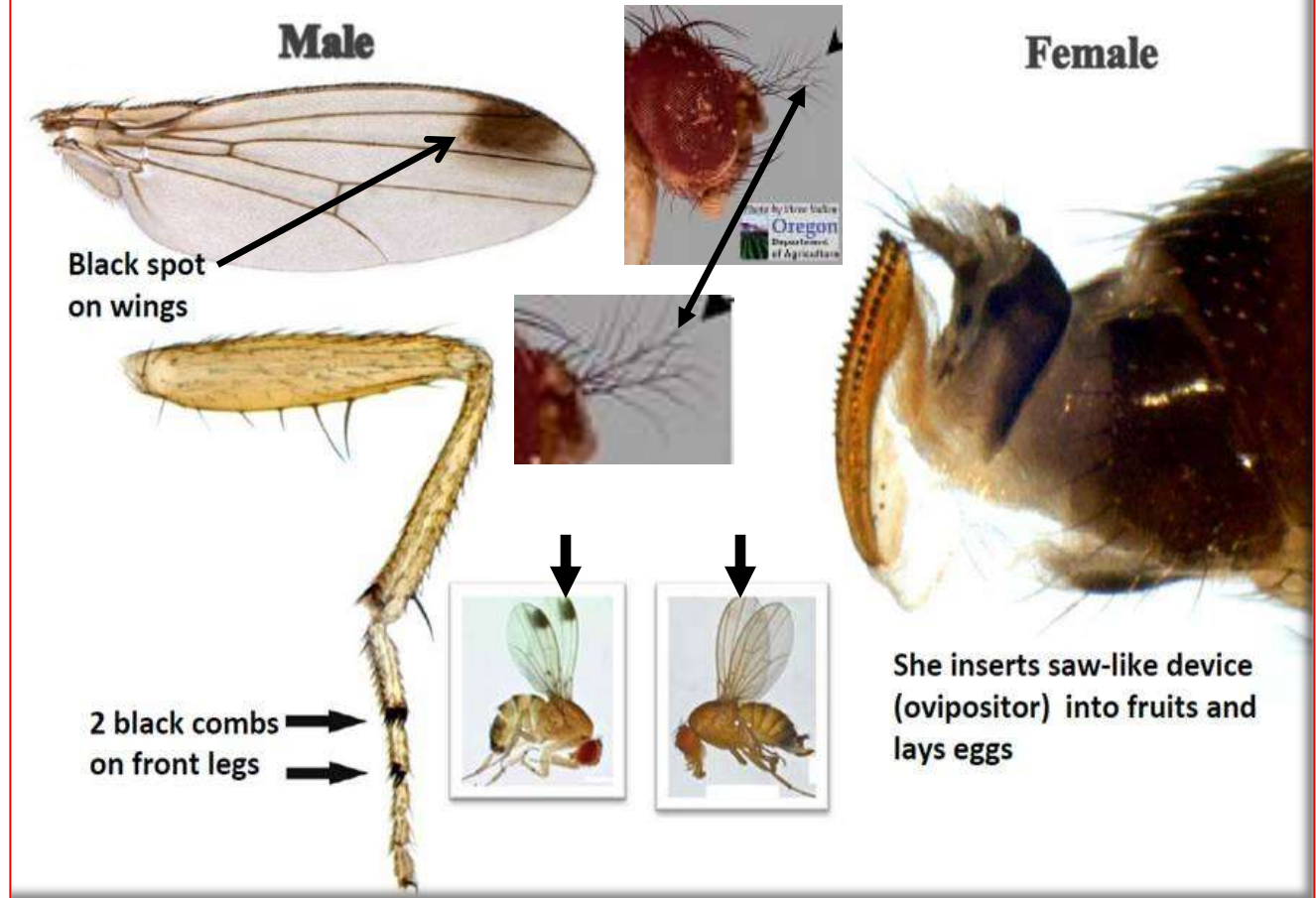


Entomophily.wordpress.com



Ucanr.edu

SWD Identification – key characters



Male:

- ✓ Black spot on the end of the first wing vein
- ✓ Two sets of combs on the front legs
- ✓ Antenna with many hairs (branched)
- ✓ Large red eyes

Female:

- ✓ No black spot on wing
- ✓ Sclerotized, double serrated ovipositor (>12 teeth per side)
- ✓ Antenna with many hairs (branched)
- ✓ Large red eyes

Active Ingredient	Trade name	IRAC #	Blueberry	Caneberry	Strawberry	Probable Efficacy
			PHI (days)	PHI (days)	PHI (days)	
Carbaryl	Sevin 80S	1A	7	7	7	Good
Diazinon	Diazinon	1B	7	7	5	Excellent
Malathion	Malathion 5EC	1B	1	1	3	Excellent
Methomyl	Lannate LV	1A	3	Not labeled	Not labeled	Excellent
Bifenthrin	Brigade WSB	3	1	3	0	Excellent
Esfenvalerate	Asana	3A	14	7	Not labeled	Excellent
Fenpropathrin	Danitol	3	3	3	2	Excellent
Pyrethrin	Pyganic*	3A	0	0	0	Good
Zeta-cypermethrin	Mustang Max	3	1	1	Not labeled	Excellent
Spinetoram	Delegate	5	3	1	Not labeled	Excellent
Spinetoram	Radiant	5	Not labeled	Not labeled	1	Excellent
Spinosad	Entrust*	5	3	1	1	Good/Exc



Trap design and field placement

- 3/16” diameter holes on side and lid or glue 1/4” mesh screen to lid and wire on plastic plate as rain cover
- 3 weeks before ripening, put at least 3 traps in planting at height of fruit
- Check weekly and replace bait weekly

Bait recipe

(Drill hole in lid of bait container to release CO₂ – or else it explodes)

- Mix together: 12 oz water, 4 Tbsp sugar, 1 Tbsp yeast, 2 Tbsp whole wheat flour, 1 Tbsp apple cider vinegar, 2 drops unscented dish soap.
- Weekly, strain out flies, add new bait to trap and **discard old liquid bait in garbage**.

For SWD fly confirmation, mail vial of flies to:

Ms. Barbara Lewis
AGRI 319 Department of Entomology
Univ. of Arkansas
Fayetteville, AR 72701

If SWD flies are in trap and fruit is ripening, spray weekly, but reapply after rain (rotate IRAC # to delay resistance to sprays)



Larvae sampling protocol

- Collect/bag 30 *ripening strawberries* or 70 *caneberries* you would eat
- Add 2-3 cups of sugar or salt water solution = 1 qt water + 1 cup sugar or 1 qt + 1/4 cup salt
- Look for larvae floating on top in 30 min. and record number of larvae/trap

Bramble Pests



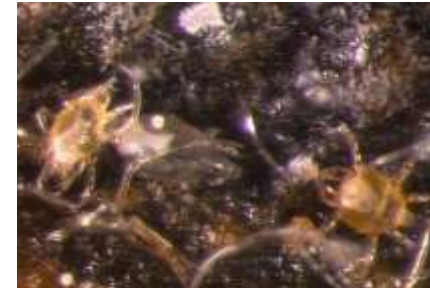
McDaniel mite



Twospotted spider mite



Red mite (?)



Broad mite

Raspberry crown
borer



Whitefly on card &
adult and nymph on leaf



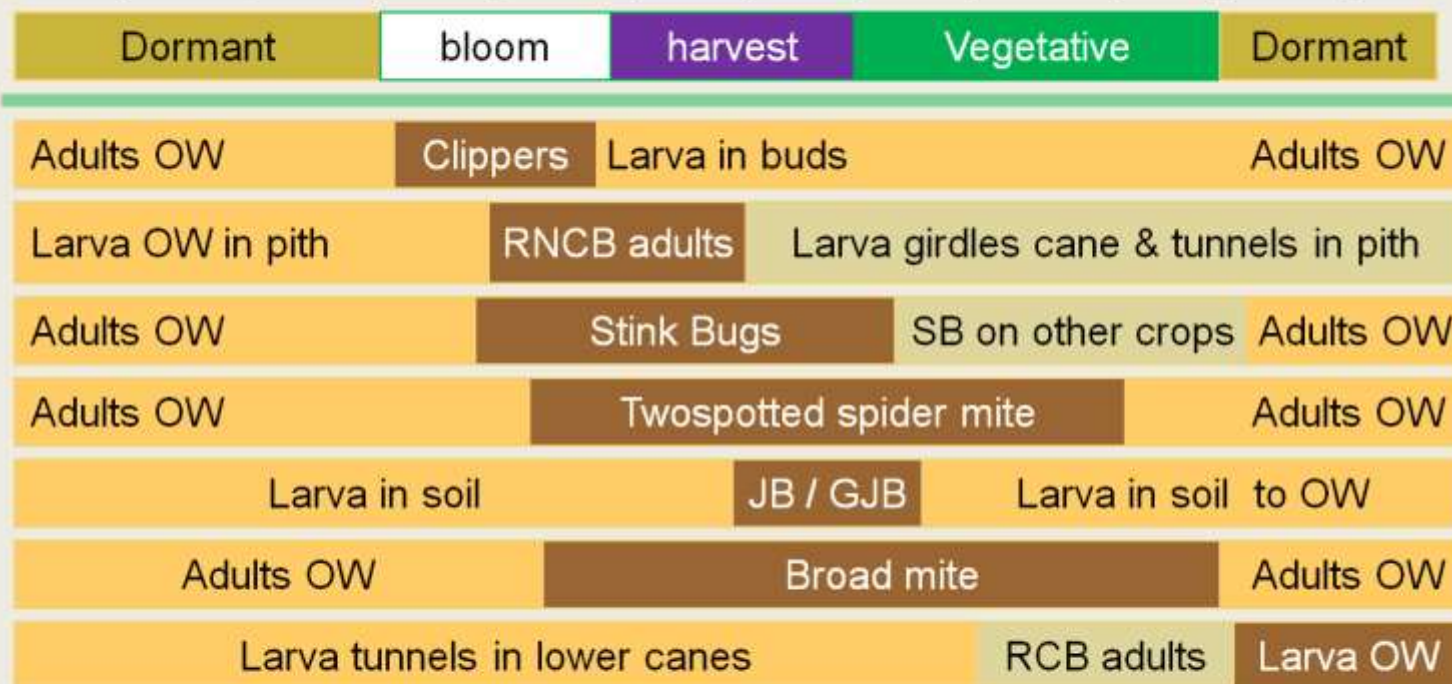
Rednecked
cane borer



Bramble Phenology

Blackberry Pests: brown boxes = stage to spray

Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec



Clippers = strawberry clipper; RNCB = rednecked cane borer;
 RCB = raspberry crown borer; JB = Japanese beetle; GJB = green June beetle
 OW = overwinter

Look for Whiteflies

Sticky traps - 3 traps per HT:

- 1 near the entrance
- 2 traps above canopy

Plant inspection weekly:

- Record number of adult whiteflies per trap
- Check leaves for immatures
- Threshold = 2 whiteflies/card/day
- Shop vac up adult whiteflies and spray Aza-Direct for immatures



Look for Spider Mites



- Keep HT weed free - spider mites develop from weeds or cover crops
- Check plants in hot spots and count number of spider mites & predators:
 - 5 **bramble** leaflets on 5 plants
 - 1 strawberry leaflet on each of 20 plants
- Threshold - keep counts below 10 mites per leaflet



Release Predatory Mites

- If spider mites are between 1 to 5 mites/leaflet without predators, introduce predator mites weekly for three weeks and monitor weekly to ensure control is achieved
- Use predator mites, *Neoseiulus californicus* or *N. fallacis*



Predator mite source:

Rincon-Vitova

<http://www.rinconvitova.com/>



Look for Raspberry Crown Borer



Nov. 1, soil drench with Brigade

Need to test Entrust & Bt compounds



Look for Rednecked Cane Borers



May-June: apply
Admire Pro once
or
Testing: Aza-Direct
or JMS Stylet Oil
as weekly sprays if
< 90° F

Strawberry

High Tunnel Project

2013 Determining Optimum Nitrogen Nutrition Management for Off-season High Tunnel Plasticulture Strawberry Production for Arkansas and the Southeast.

Acknowledge Funding: Southern Region Small Fruit consortium

Co-PIs: Garcia, Johnson, Kirkpatrick

Objectives:

- Evaluate efficacy of pest management practices
- Determine effects of nitrogen fertigation rates on yield, and aphid and spider mite densities
- Release predatory mites for spider mite control in winter

High Tunnel Strawberry Pests

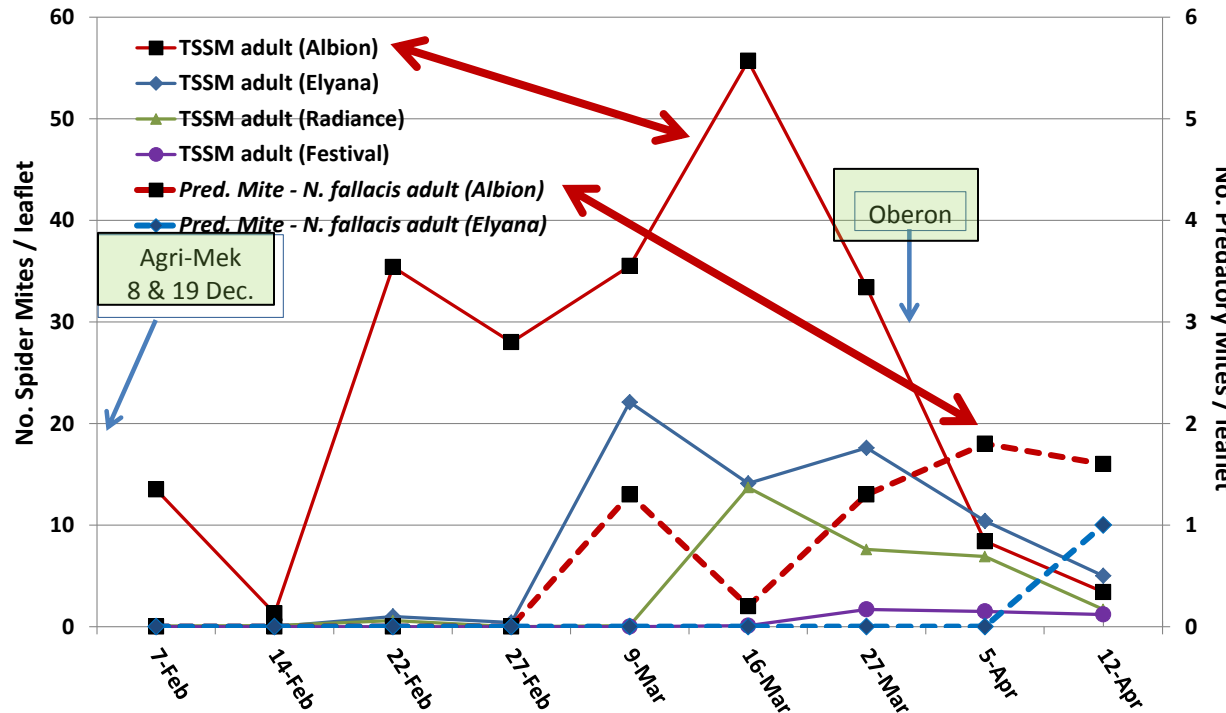
- Nov. 25, Dec. 2, 2011 – cutworms were damaging strawberry foliage and chewing small holes in green and ripe berries
 - Control: applied Deliver TM (11A; *Bt*) insecticide
- Jan. 27, 2012 – overwintering cutworms and crickets causing damage
 - Control: applied Deliver & Malathion



Strawberry Cultivar Susceptibility to Spider Mites (2011-12)

- Albion is most susceptible to spider mites
- Agri-Mek & Oberon reduced spider mites
- Oberon did not kill predatory mites

UA Farm - Fayetteville Hoop House - Number of Twospotted Spider Mites and Predatory Mites on Leaves of 4 Strawberry Cultivars (2012)



UC Statewide IPM Project
© Regents, University of California

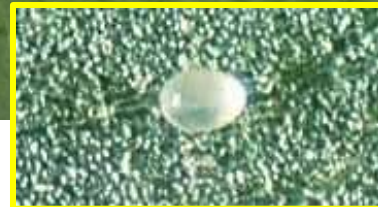
Methods: does N rate affect pest #s?

‘Festival’ strawberries planted in:

- 5 blocks in RCB design
- 20 plants per plot
- 4 Nitrogen fertigation rates:
 - 1= 0.0 kg N/Day/ha
 - 2= 0.25 kg N/Day/ha
 - 3= 0.50 kg N/Day/ha
 - 4= 0.75 kg N/Day/ha
- Biweekly, collected 1 leaflet/plant from 5 plants/plot
 - 1 lower (older) & 1 upper (newer) leaflet
 - Counted spider mites and predatory mites
 - Counted aphids and noted if parasitized

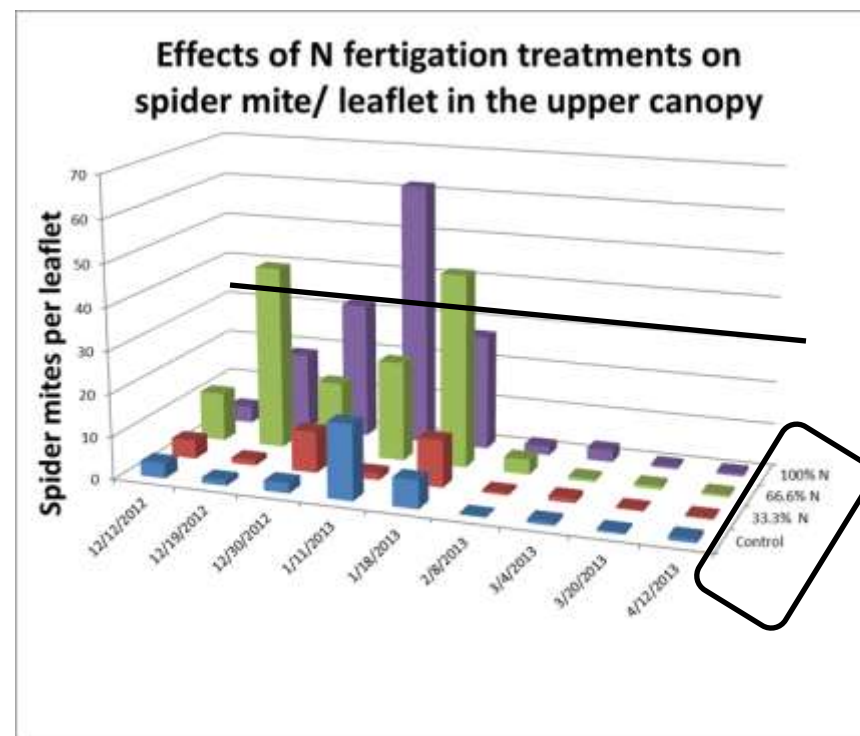
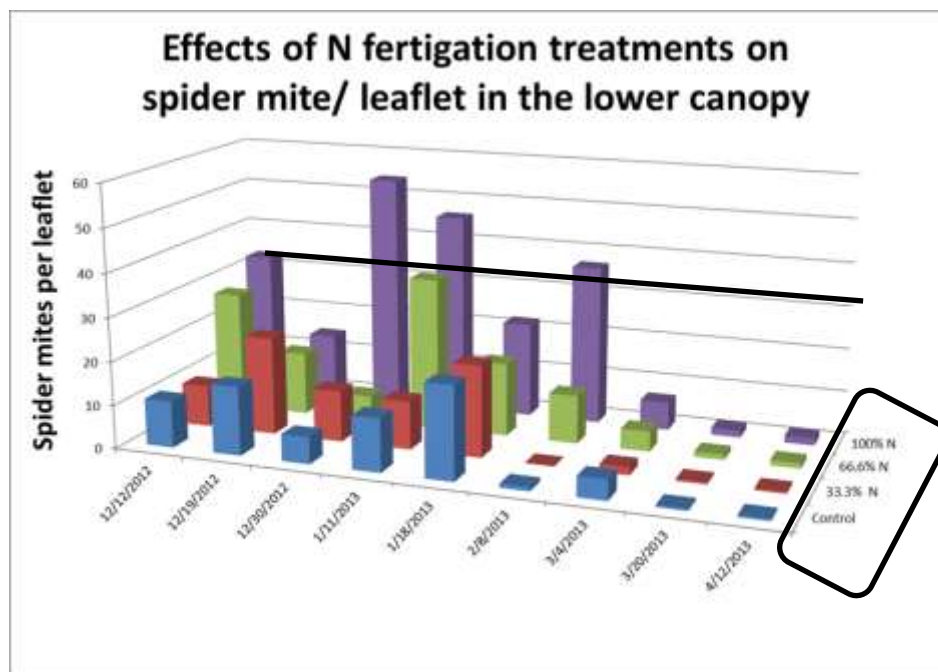


Spider Mites and Aphids



Numbers of Spider Mites/Leaflet

- Greater on Low (old) than Hi (new) Leaves
- Increased with N Rates from 1 to 4
- > 30 mites/leaflet can be damaging

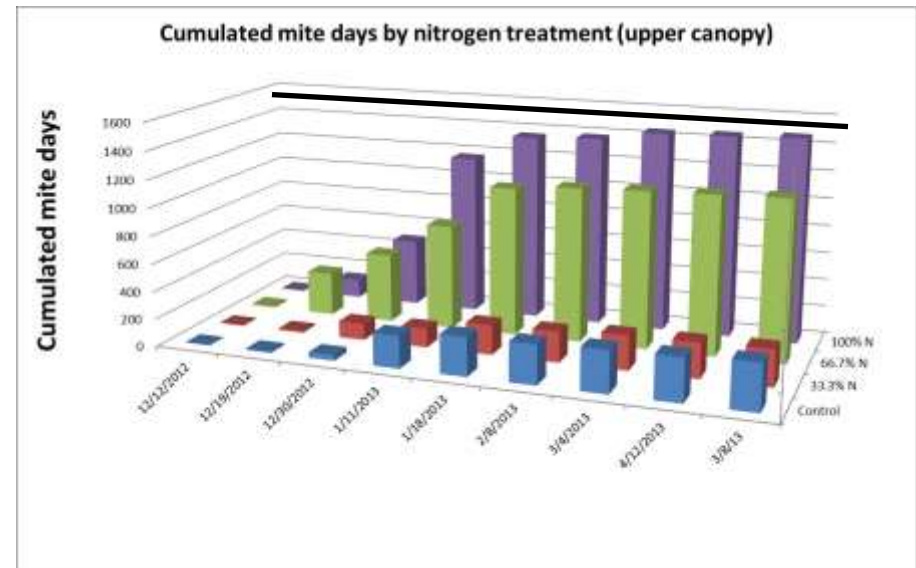
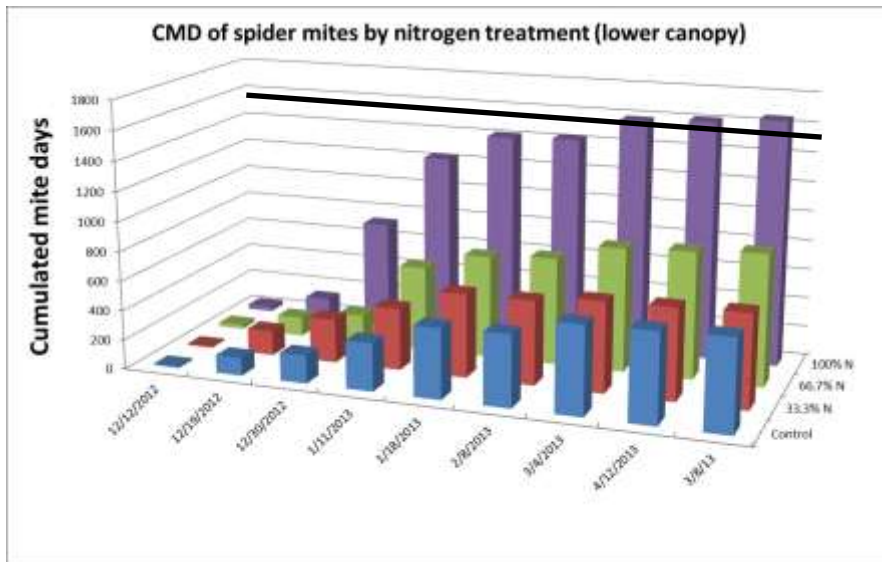


Agri-Mek spray on Jan.18 killed most of mites

Cumulative # Mite Days/Leaflet = feeding damage

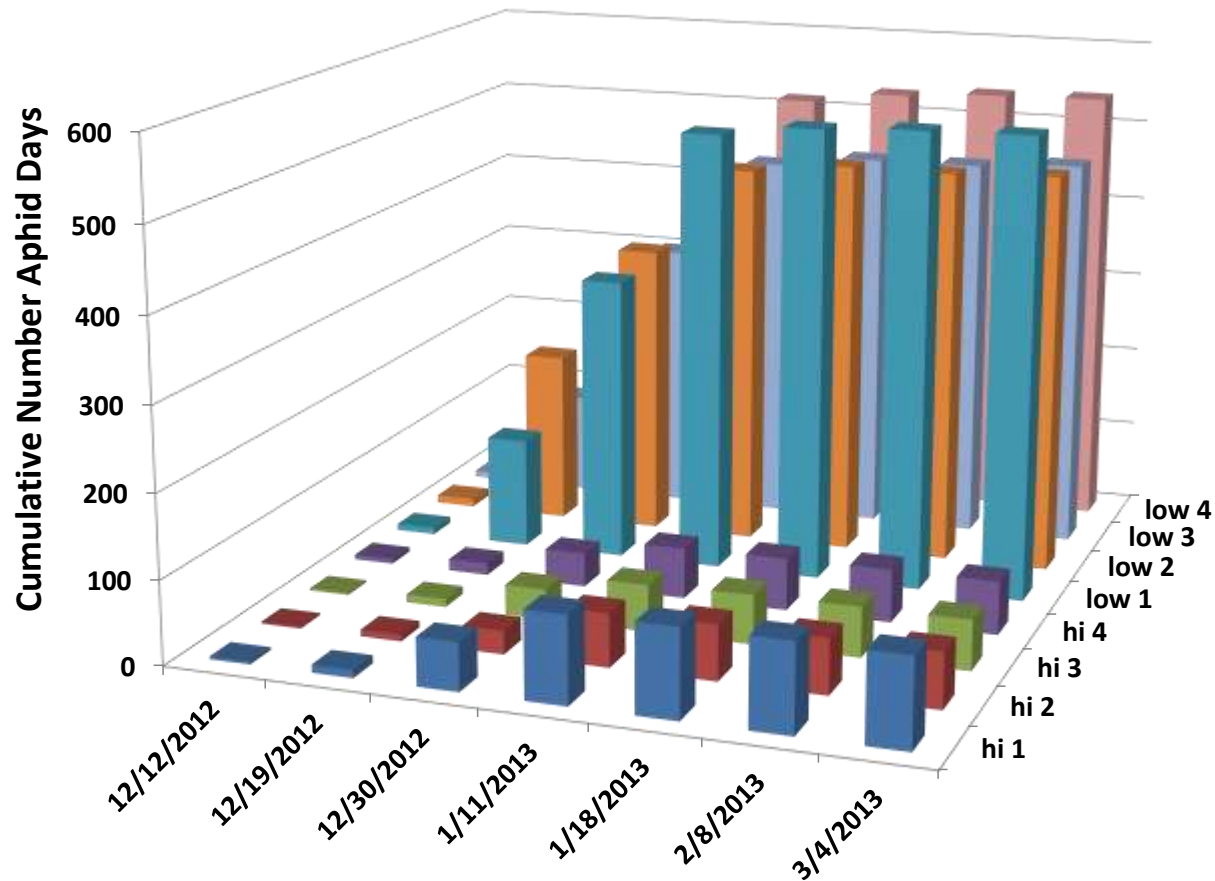
- Damage Threshold is above 1500 CMD
- CMD greater on low (old) than upper (new) leaves
- CMD increased for N rates 3 and 4 on upper leaves

Agri-Mek spray on Jan.18 killed most of mites and flattened out # CMD

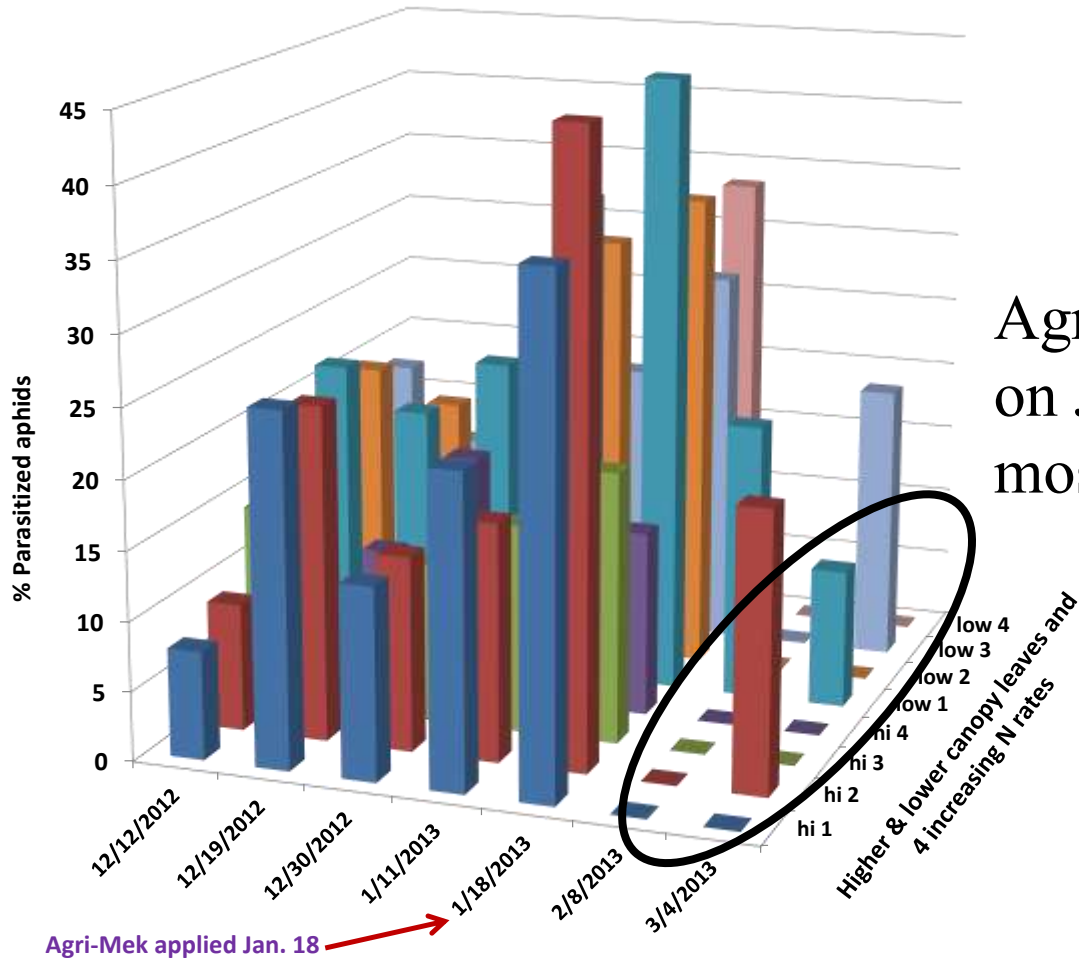


Cumulative Numbers of Aphids/Leaflet

- Greater on low (old) than hi (new) leaves
- No effect of N rates on # aphids/leaflet



- % parasitized aphids same on low as hi leaves
- Agri-Mek miticides killed aphids



Agri-Mek spray on Jan.18 killed most of aphids

Strawberry Miticides / Mite Stages Affected

Miticide	REI (hrs)	PHI (days)	Stages controlled	Residual activity (days)	IRAC #
Savey	12	28	ovicide/larvicide	60	10A
Agri-Mek	12	21	motile stages	28	6
Apollo (<i>Do not use after Green tip</i>) (not for strawberry)	12	21	ovicide	long	10A
Vendex	48	14	mobile stages	30	12B
Zeal	12	7	All stages	long	10B
Envidor (not for strawberry)	12	7	all stages	40	23
Nexter (formerly Pyramite) (not for strawberry)	12	7	Immatures	< 28	21A
Acramite	12	3	motile stages	28	UN
Oberon (translaminar)	12	3	Eggs & nymphs	14-21	23
Brigade (foliar/systemic)	12	0	?		3
Kanemite (acequinocyl)	12	1	Knockdown/residual Harmless to predator mites	21 d between trts	20
Malathion	12	3	suppressant	Short/contact	1B
Insecticidal soap	0	0	Marginally effective	Short/contact	suffocant

- Assembled to note miticides that control certain mite stages, PHI, residual and if registered on strawberry
- **Note:** Burrack (NCSU) found Agri-Mek, Acramite, Oberon and Zeal miticides all reduced numbers of motile spider mites and eggs for up to 3 weeks
- JMS Stylet Oil reduced motile spider mites with sprays applied at 3 week interval

Grapes

Scouting Grapes

- Grape berry moth larva enters berries > pea size
 - ✓ > 2% clusters with 1 or more new GBM damaged berries
 - ✓ Spray Bt
- Grape leafhopper – look for white leaf stippling & nymphs
 - ✓ > 5 nymphs
 - ✓ Spray Aza-Direct



Lessons from High Tunnel Projects

- **Exclusion:**
 - Chicken wire on tunnels prevent mammals eating plants or fruit
- **Brambles:**
 - Spider mites and whiteflies most damaging in June/July
 - Raspberry crown borers damage crown and kill canes
- **Strawberries:**
 - Cutworms, crickets and spider mites cause damage in winter
 - ‘Albion’ strawberry and ‘Nantahala’ raspberries get damaging mite levels
 - Increasing N fertigation rate causes slightly more spider mites
- **Grapes:**
 - Grape berry moth larvae cause berry damage and grape leafhoppers cause leaf stippling – both reduce yields

Future High Tunnel Project

2013 Optimizing nitrogen fertilization and spider mite management of extended season strawberry production under high tunnels.

Acknowledge Funding: North American Strawberry Growers Association

Co-PIs: Garcia and Johnson

Objectives:

- Develop economic threshold based for spider mite
- Determine the best adapted predatory mite species for management of spider mites on strawberry during winter and spring high tunnel production in Arkansas

Future High Tunnel Project

2013 Revitalizing Strawberry Production in Arkansas and the Surrounding Region via Extended Season Production Systems.

Acknowledge Funding: University of Arkansas CARS Strawberry Sustainability Program (Walmart Foundation)

Co-PIs: Garcia, Johnson, Rodriguez, Evans, Gibson

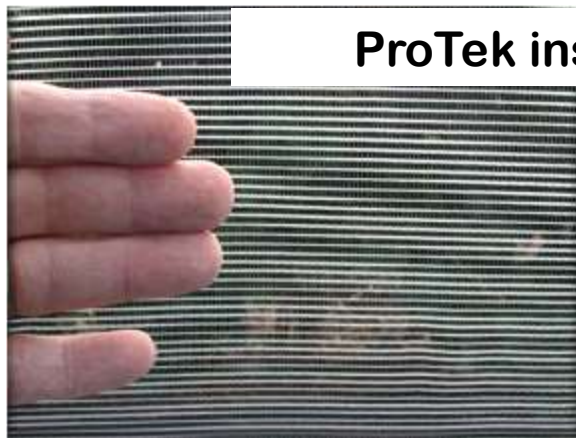
Objectives:

- Demonstrate integration of pest management by utilizing predatory species, exclusion netting, and other best management practices

Evaluating Screen Exclusion of Insects



Compare to open field berries



ProTek insect screen





Questions?

