



Great Lakes Fruit, Vegetable & Farm Market EXPO Michigan Greenhouse Growers EXPO

December 5-7, 2017

DeVos Place Convention Center, Grand Rapids, MI



Vine Crops

Where: Grand Gallery (main level) Room E & F

MI Recertification credits: 2 (1B, COMM CORE, PRIV CORE)

OH Recertification credits: 1 (presentations as marked)

CCA Credits: PM(1.0) CM(1.0)

Moderator: Ben Phillips, Vegetable Extension Educator, MSU Extension, Saginaw, MI

- | | |
|----------|---|
| 9:00 am | Integrated Management of Powdery Mildew and Gummy Stem Blight on Cucurbits: A Florida Perspective (OH: 2B, 0.5 hr) <ul style="list-style-type: none">• Gary Vallad, Plant Pathology Dept., Univ. of Florida |
| 9:30 am | Perspectives and Opportunities for Growing Orange Flesh and Specialty Melons <ul style="list-style-type: none">• Jonathan Schultheis, Dept. Horticultural Science, North Carolina State University |
| 10:00 am | Best Management Practices: Controlling Insects While Protecting Pollinators (OH: CORE, 0.5 hr) <ul style="list-style-type: none">• Rick Foster, Entomology Dept., Purdue Univ. |
| 10:30 am | Cover Cropping in Melons for Reduced Washing After Harvest <ul style="list-style-type: none">• Chris Gunter, Horticultural Science Dept., North Carolina State Univ. |
| 11:00 am | Session Ends |

Perspectives and Opportunities for Growing Orange Flesh and Specialty Melons

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Orange Flesh Melon Types: The landscape of orange flesh muskmelons (cantaloupes) has changed dramatically over the past five to ten years. Traditionally, there were two primary orange flesh melon types grown and sold; western types, which are fruits that range in size from about 3 to 5 pounds which are heavily netted and not sutured, and eastern types which have some netting, have a shorter shelf life but have a larger fruit size than a western melon, and tend to have a softer flesh with apparent more flavor than a western melon. The primary eastern melon cultivar grown and sold in the eastern United States, especially the southeastern United States, is Athena (originating from Syngenta). Athena has been the dominant cultivar grown since the 1990s and fruits average between 4 to 7 pounds. Another cultivar grown fairly extensively is Aphrodite. This is preferred in some regions of the eastern United States' markets because larger fruits than Athena are preferred.

The types of orange flesh muskmelons that are now available has changed over the past 10 years. The types are long shelf life (LSL, often referred to as Harper melon), Extended shelf life (ESL), and Tuscan or Italian. These melon types can be characterized as follows.

Long Shelf Life (LSL): Very firm flesh; excellent shipping type; High brix, up to 15.

This melon type will slip if left on the vine for an extended period of time; however, the fruit for these types should be harvested before the fruit slips, otherwise the flesh is likely to break down at or soon after harvest. Harvest cues include a subtle color change from green on rind to some lime/yellow color on many LSL cultivars. Some cultivars do not have this visual rind color cue causing more difficulty in when to harvest these melons. Another important visual cue is the netting which will migrate its way up the peduncle or stem of the fruit when ready for harvest. The fruit should be harvested by cutting the stem, otherwise the stem scar may plug into the flesh rendering the fruit unmarketable.

Note: A fairly new LSL melon has recently been developed that as it ripens goes from a green rind fruit to a golden yellow. This visual cue is much easier to detect than when small areas of the rind turns to a lime green/yellow.

Extended Shelf Life (ESL): Firmer flesh than the Athena melon, good shipping type, Brix generally from 11-13.

When harvested commercially, this fruit is harvested at the slip stage. The rind of the melon will turn a straw/tan color when ripe. These are a relatively new entry in the market place. Examples of these melons include Astound and Accolade which gained market share on Athena in 2016. Several seed companies are breeding these melon types.

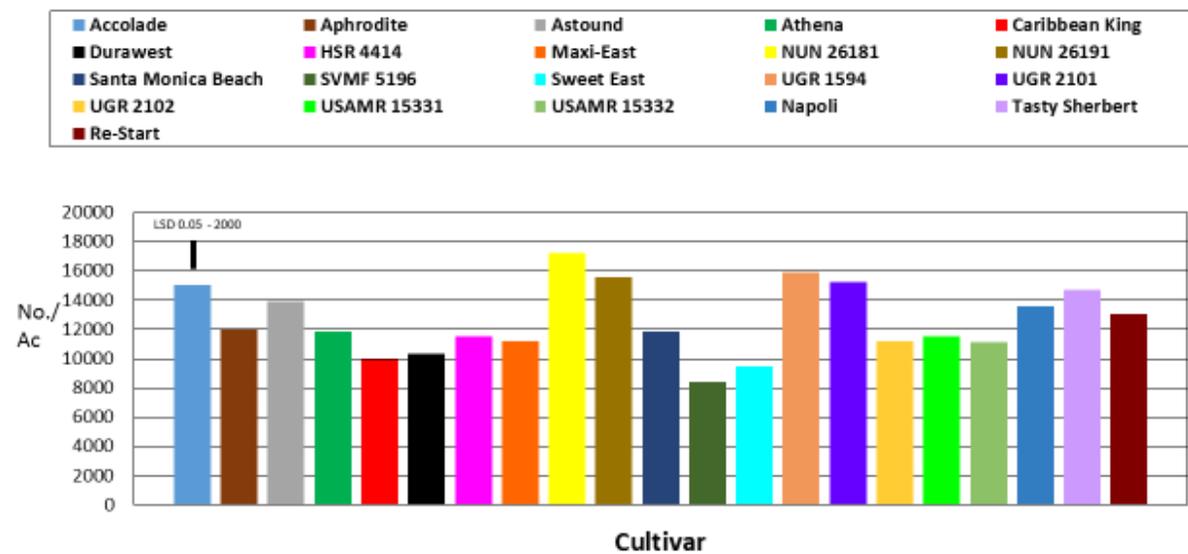
Tuscan or Italian: These are generally firm flesh melons. Melon usually have a stronger melon flavor than other orange flesh types. Brix is generally 12 to 15.

Tuscan melons are more prone to splitting near peak ripeness. Because of this, these melons may need to be harvested two times a day, especially when high temperatures are encountered. Fluctuations in moisture can also increase propensity to split. These melons are sutured.

Results:

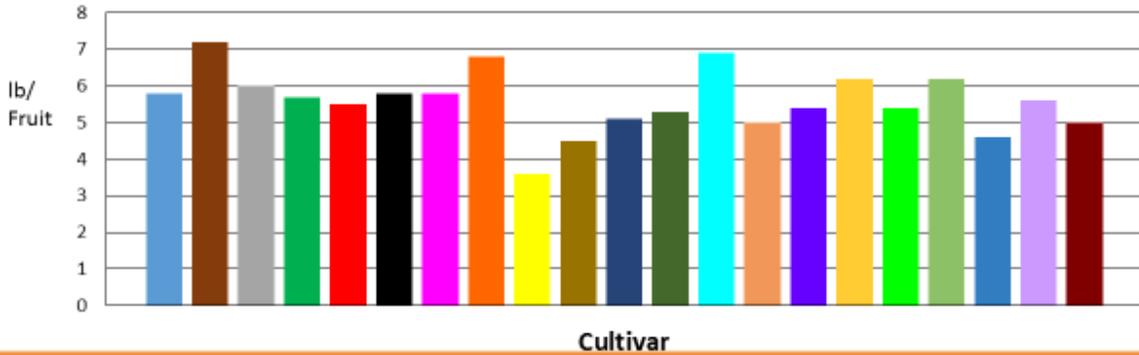
21 Melon entries were harvested 16 times in a study conducted in 2016. Yield ranged from 8,000 to 17,000 fruit per acre (see graph below). The highest yielding entries (above 14,000 fruits per acre) were NUN26181 (LSL), UGR 1594 (LSL), NUN 26191 (LSL), UGR 2101 (LSL), Accolade (ESL), and Tasty Sherbert (Tuscan). Athena yielded 11,870 fruit per acre, while average yields across all entries was 12,606 melons per acre.

Melon entry yield response, Cumulative total number fruit (Harvests 1-16), Kinston, NC, 2016



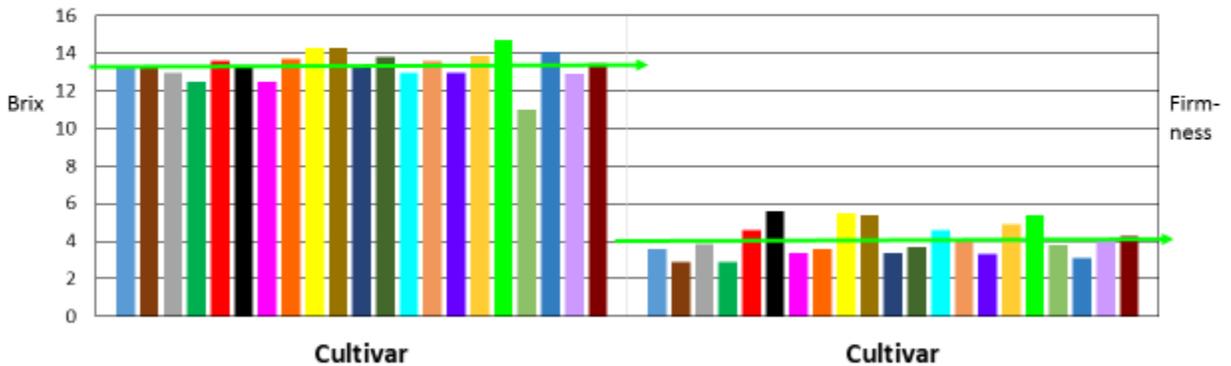
Average fruit weight ranged from 3.7 to 7.1 lb per fruit with the average fruit weight across all entries being 5.7 lb (see next graph). The cultivars with the heaviest fruits (greater than 6.5 lb) were Aphrodite, Maxi East and Sweet East, while cultivars with the lightest fruit (less than 5 lb) were NUN 26181, NUN 26191, and Napoli.

Average fruit weight per melon entry (lb), harvests 1-16, Kinston, NC, 2016



Soluble solids or brix was very high in all melon entries evaluated and ranged from 11 to 14.7 (see graph below). Firmness varied by orange flesh melon type. Some of firmest flesh melons were Durawest, NUN 26181, NUN 26191, UGR 2102 and USAMR 15332; all LSL types. Melon entries with the softest flesh were Aphrodite, Athena, and Napoli.

Brix and flesh firmness for each melon entry, Kinston, NC, 2016



Specialty Melon Types:

Beyond the traditional orange flesh melon types, there are several specialty melon types that may offer additional marketing opportunities. Some of these melon types are canary, galia, honeydew, Asian crisp flesh, hami, and piel de sapo (frog-skin). Many of these types, the exception being honeydew, the average consumer has not sampled. Some marketing will likely need to accompany these melon types to achieve success.

Due to limited time, the focus will be on the galia and canary melon types with some comments regarding honeydew and Asian crisp flesh types.

Galia Melons:

These melons are mainly grown in the Middle East and Spain. They are consumed in these countries and also shipped to Europe. A galia melon is highly aromatic, has a green flesh with rich melon flavor. A challenge with galia melons is its relatively soft flesh and short shelf life. However, more recently, an ethylene inhibitor gene has been incorporated into some new lines and cultivars which results in firmer flesh and long shelf life (LSL). Galia melons which do not contain the LSL gene typically produce dark green rind fruit on the vine. These rinds become netted and eventually turn yellow to golden yellow when ripe. Galia melons which contain the LSL gene generally produce rinds that are lime rather than dark green in color that when ripe will turn a golden yellow.

Six galia entries were evaluated in 2017; Courier (Hollar Seed Co.), Jucar and Tenorio (Rijk Zwaan), USAMR 14346 and USAMR 14350 (Volo Agri), and SFR 3203 (United Genetics). Courier and Jucar do not contain the ethylene inhibitor gene and generally had softer flesh melons than other four galia entries. Galia melons generally have a smaller fruit size than most other melon types. In our study average fruit size ranged from 2.9 to 5.1 lb. The cultivars with the largest fruits were Courier (4.4 lb) and Jucar (5.1 lb) and the entry with the smallest fruits was SFR 3203 (2.9 lb). Yields were comparable for all cultivars, the exceptions were Courier as yields were lower than the other entries and USAMR 14346 where yields were higher. USAMR 14346, USAMR 14350, and Tenorio all were exceptional Galia melons that have improved flesh firmness and shelf life than traditional galia melon cultivars.

Canary Melons:

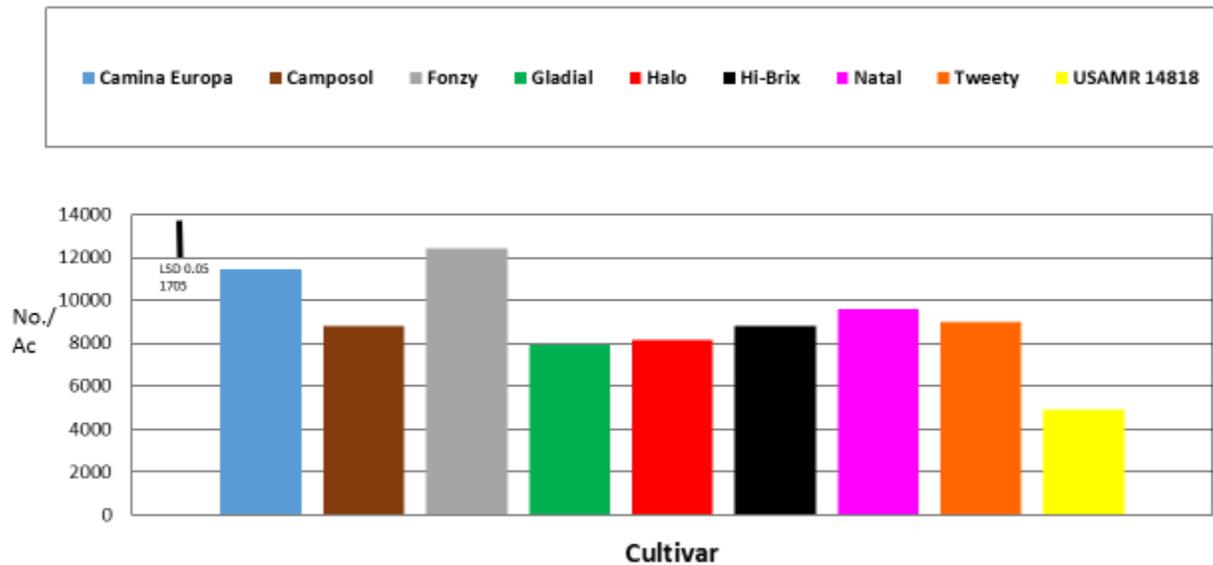
Canary melons have that given name based on their bright yellow rind and are commonly grown in Spain, Middle East, Central America and South America. Preference in Spain and the Middle East is for a wrinkled rind type of canary while in Central and South America, preference is for a smooth rind type. Canary melons have a pale green to white flesh. They can vary in shape from round to oval to football shape. One visual cue that usually indicates when canary melons are ripe is when the rind turns from a light yellow to golden yellow. In addition, some melons will produce netting on the fruit when ripe which is sometimes referred to as “sugar cracks”.

Nine canary entries were evaluated in 2017.

<u>Entry</u>	<u>Seed Company</u>	<u>Entry</u>	<u>Seed Company</u>
1. Camina Europa	Seedway	6. Hibrix	Bayer Crop Science
2. Camposol	Seedway	7. Natal	Rijk Zwaan
3. Fonzy	Seminis	8. Tweety	DP Seeds
4. Gladial	Rijk Zwaan	9. USAMR 14818	Volo Agri
5. Halo	Hollar		

The earliest producing cultivars were Fonzy and Gladial, which produced 41 and 51% of their fruit number in the first three of twelve harvests, while the lowest yielding early harvest entry was USAMR 14818 which produced less than 10% of their fruit number during the initial three harvests. By keeping the vines healthy, a second set of fruit occurred and resulted in high numbers of fruit yield during harvests ten through twelve, especially with Fonzy which produced 47% of its fruit during that harvest period. The highest yielding cultivar over all twelve harvests with respect to fruit number were Camino Europa and Fonzy, while the lowest yielding was USAMR 14818 (see graph below).

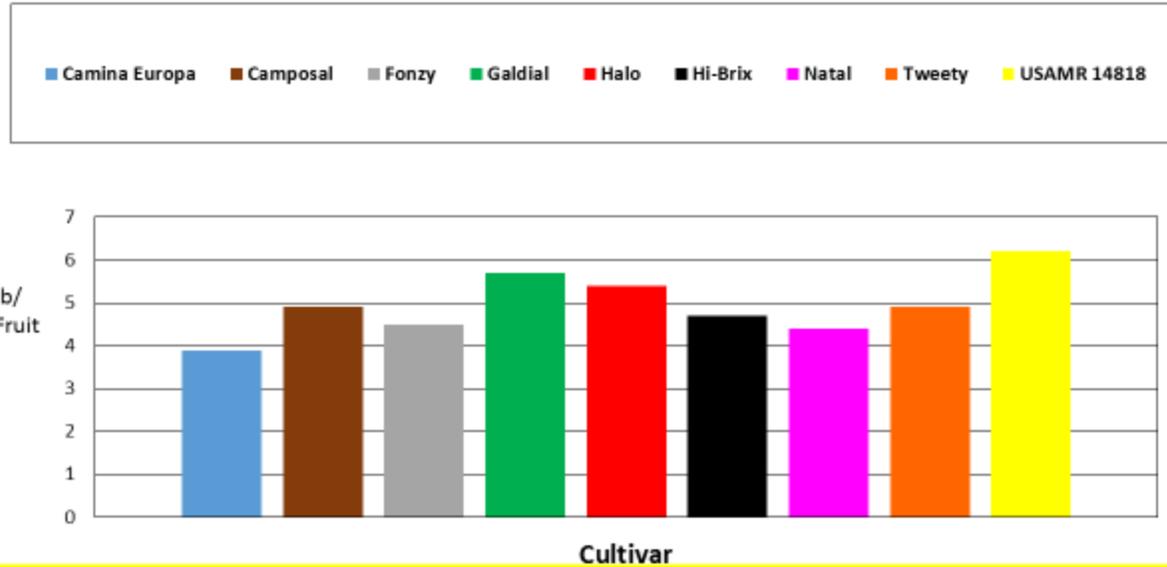
Canary entry yield response, Cumulative total number fruit (Harvests 1-12), Clayton, NC, 2017



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USAMR 14818 produced that largest average fruit size of 6.2 lb, while some of smallest average fruit sizes were produced by Camino Europa (3.9 lb) and Fonzy (4.5 lb). Average fruit size across all cultivars and all harvests was 5.0 lb (see graph on next page).

Average fruit weight per melon entry (lb), harvests 1-16, Kinston, NC, 2016



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With respect to yield when considering fruit weight, most cultivars had comparable yields. The only entry with lower fruit weight was USAMR 14818.

Other specialty melons may offer marketing opportunities. These include golden honeydew and Asian crisp flesh melons. A very attractive golden honeydew was SFR 3083 while a successful Asian crisp flesh melon that was marketed was Sprite melon. Sprite melon seed is no longer available; however, some seed companies are have active programs that are breeding the melon type.

Summary:

With consumer interest in new products, there are opportunities to grow and market specialty melons like canary, galia, golden honeydew and Asian crisp flesh types. Additionally, there are variations in traditional orange flesh melon, typically referred to as cantaloupes. In addition to eastern melons traditionally being grown like Athena and Aphrodite, there are long shelf life, extended shelf life and Tuscan melon orange flesh types.

Best Management Practices: Controlling Insects While Protecting Pollinators

Rick Foster
Department of Entomology
Purdue University



Pollinators and Fruits and Vegetables

- Pollinators are important for the production of many fruit and vegetable crops
- Practices in fruit and vegetable fields have the potential to impact pollinator populations



Vegetable Crops That Require Pollinators

- Cantaloupe
- Cucumber
- Pumpkin
- Squash
- Watermelon



Threats to Honey Bees and Other Pollinators

- Parasites: Varroa mites, tracheal mites, small hive beetles
- Diseases
- Loss of habitat
- Stress from long range transport
- Pesticides



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Insecticides kill insects, including bees! Who would have guessed?

- Of the vegetable insecticides
57/75 (76%) have pollinator precautions on the label
- 26 insecticide modes of action (IRAC)



Courtesy Ric Bessin, U. Kentucky

Striped Cucumber Beetles

- Feed on leaves, stems, flowers, and fruit
- Transmit bacterium that causes bacterial wilt of cucurbits to muskmelons and cucumbers
- Can be devastating if not controlled



Economic Thresholds

- Muskmelons and cucumbers – 1 beetle/plant
- Watermelons – 5 beetles/plant



Neonicotinoids on Cucurbits

- Control of striped cucumber beetle, aphids, leafhoppers etc.
- Imidacloprid – Admire Pro
- Thiamethoxam – FarMore, Platinum, Actara
- Acetamiprid - Assail



Untreated Plants



Problem

- Most neonicotinoids highly toxic honey bees
 - Lethal effects
 - Sublethal effects
 - Altered behavior, decreased learning ability and memory, lack of coordination, inability to return home
- Systemic



Field Design

Treatment	Chemical	Trade Name	Application Method
1	Control		
2	Imidacloprid	Admire Pro	Soil - bedding tray, transplanting
3	Thiamethoxam	Platinum	Soil - transplanting
4	Imidacloprid	Admire Pro	Soil - transplanting
5	Thiamethoxam	Actara	Foliar Spray – June 24
6	Acetamiprid	Assail	Foliar Spray – June 24
7	Thiamethoxam	FarMore	Seed treatment



Conclusions

- Foliar sprays of Assail should have no negative impacts on honey bees
- FarMore seed treatments may or may not have negative impacts on honey bees
- The use of Platinum or Admire Pro at planting may have adverse effects on honey bees
- The use of Actara as a foliar spray will likely have adverse effects on honey bees



BEST MANAGEMENT PRACTICES FOR STRIPED CUCUMBER BEETLES ON MUSKMELONS

Questions of Interest

- Do FarMore treated seeds provide protection from beetle feeding?
- Do soil applications of Platinum at planting provide protection from beetle feeding?
- Does the high rate of Platinum provide greater protection from beetle feeding than the low rate?
- Do foliar sprays of Warrior provide protection from beetle feeding?

Conclusions

- Use of FarMore treated seeds does not reduce cucumber beetle numbers and may cause harm to pollinators, but may also increase yield – more about this later

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Conclusions

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- Use of soil drenches of Platinum (and most likely Admire Pro) will result in residues that are potentially harmful to pollinators but do provide improved control of SCB
- **The low rate of Platinum results in reduced residues in pollen and provides control equivalent to the high rate**

Conclusions

- Use of FarMore treated seeds does not reduce cucumber beetle numbers and may cause harm to pollinators, but may also increase yield – more about this later
- Use of soil drenches of Platinum (and most likely Admire Pro) will result in residues that are potentially harmful to pollinators but do provide improved control of SCB
- The low rate of Platinum results in reduced residues in pollen and provides control equivalent to the high rate
- **Foliar sprays of Warrior (and other pyrethroids) when the threshold of 1 beetle/plant is exceeded will result in some direct mortality to pollinators and will provide excellent control of SCB and higher yields**

Best Management Recommendations Muskmelons

- Use of FarMore treated seeds is probably not worth the cost – further research needed
- Use of planting time applications of Platinum or Admire Pro are worthwhile for SCB control but use the low rate
- Scout weekly and treat for SCB with a pyrethroid insecticide only if > 1 beetle/plant
- If aphids become a problem, treat with Assail
- Make any foliar insecticide applications in late afternoon, evening, or at night

Why did FarMore treated seeds sometimes result in higher yields even though insect numbers were not reduced?

- FarMore400 contains the insecticide thiamethoxam and the fungicides mefenoxam, fludioxonil, and azoxystrobin
- FarMore300 only contains the fungicides mefenoxam, fludioxonil, and azoxystrobin

FarMore Study - Vincennes

Seeds	SCB/plant	% Wilt	No. Fruit	Fruit Weight	Weight/ Melon
Untreated	2.75	26.6	29.1	221	7.68
FarMore 300	4.10	26.6	27.0	201	7.48
FarMore 400	2.70	29.7	28.0	194	6.97
P>F	0.17	0.80	0.85	0.44	0.23

FarMore Study - Lafayette

Seeds	SCB/plant	% Wilt	No. Fruit	Fruit Weight	Weight/ Melon
Untreated	2.10	7.5	15.4 b	37.3 b	2.53
FarMore 300	2.25	7.5	23.9 a	64.0 a	2.67
FarMore 400	1.50	8.1	20.1 ab	48.9 b	2.72
P>F	0.47	0.99	0.01	0.0002	0.86

Conclusions

- FarMore300 may increase yields due to the fungicides present
- The insecticide in FarMore400 does not improve SCB control and may harm pollinators

Watermelons

- Not susceptible to bacterial wilt
- Economic threshold for striped cucumber beetles is 5 beetles/plant

Best Management Practices Treatments

- Untreated control
- Low rate of Platinum at planting
- High rate of Platinum at planting
- Warrior as needed for SCB
- Low rate of Platinum; Warrior as needed

SCB Populations - Vincennes

Treatment	June 2	June 9	June 14	June 21	June 29	July 7
Untreated	0.34	0.88	5.59	1.22	0.19	0.28
Low Platinum	0.06	1.78	4.81	1.25	0.25	0.25
High Platinum	0.12	1.00	4.63	0.84	0.16	0.22
Warrior	0.06	1.00	5.87	0.72	0.09	0.06
Low Platinum; Warrior	0.16	1.50	5.06	0.47	0.13	0.09
P>F	0.61	0.06	0.47	0.51	0.68	0.40

Planted May 18

SCB Populations - Lafayette

Treatment	June 6	June 12	June 15	June 20	June 22	June 27	July 3	July 6
Untreated	0.50	1.88	3.41	2.25	0.07 b	1.09	0.97 b	0.31
Low Platinum	0.00	0.22	2.19	3.53	0.35 a	1.38	1.56 ab	0.38
High Platinum	0.00	0.72	1.38	2.72	0.36 a	2.25	1.69 ab	0.88
Warrior	0.16	1.38	1.88	2.13	0.14 b	0.81	0.97 b	0.56
Low Platinum; Warrior	0.00	0.25	1.53	2.97	0.22 ab	1.97	1.75 a	0.66
P>F	0.44	0.11	0.12	0.59	0.003	0.06	0.009	0.17

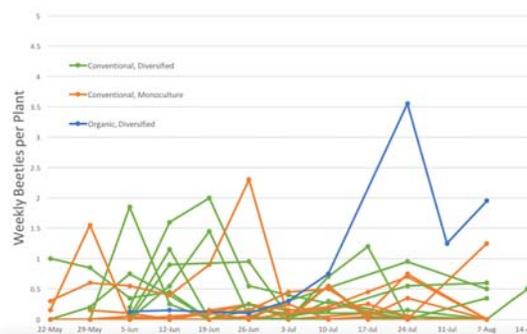
Planted May 26

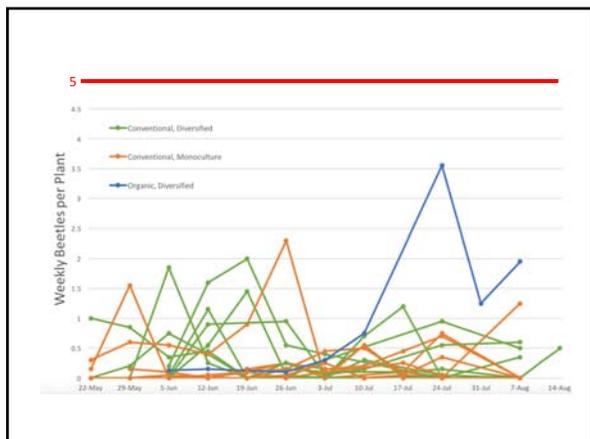
Watermelon Threshold = 5 beetles/plant

- In small plot studies, we reached the threshold once in Vincennes and never in Lafayette
- What about commercial farms?

Watermelon Fields

Farm	Field Size (acres)	Description of Operation
1	1.78 ac	Conventional, Diversified
2	3.29 ac	Conventional, Diversified
3	2.00 ac	Conventional, Diversified
4	0.686 ac	Organic, Diversified
5	0.578 ac	Conventional, Diversified
6	20.5 ac	Conventional, Diversified
7	100.0 ac	Conventional, Monoculture
8	22.4 ac	Conventional, Diversified
9	43.0 ac	Conventional, Monoculture
10	31.7 ac	Conventional, Monoculture
11	2.50 ac	Conventional, Diversified
12	15.7 ac	Conventional, Monoculture
13	28.0 ac	Conventional, Monoculture
14	13.7 ac	Conventional, Diversified
15	29.5 ac	Conventional, Monoculture





Pest Sampling Data

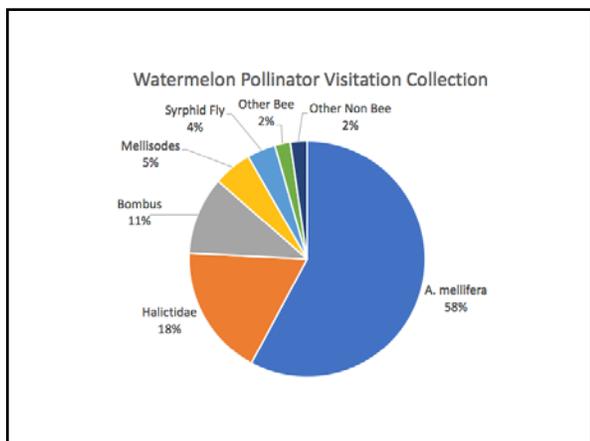
- No field observed to have reached threshold for a sampling date (142 total sampling dates)
- 29 out of 2828 total plants sampled had five or more striped cucumber beetles
- 7 out of 15 fields never had a single plant with five or more striped cucumber beetles
- Fields had varying levels of management

SCB Populations in Commercial Fields

- None ever reached threshold, but most growers were using insecticides
- Even organic grower, who sprayed nothing, never reached the threshold
- Implication is that many growers are treating too much
- Overtreating for SCB may increase probability of aphid or mite outbreaks
- Overtreating for SCB increases chances of negatively impacting pollinators

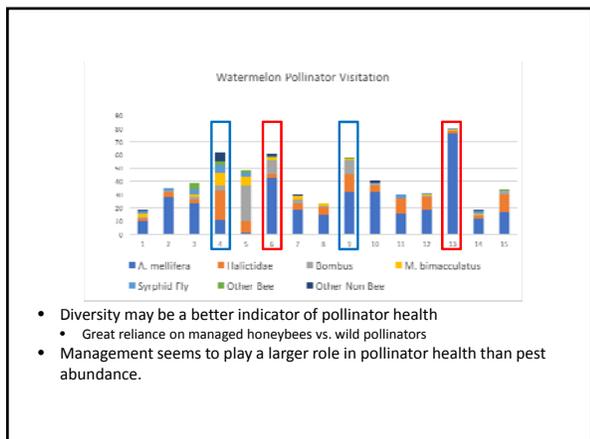
Pollinator Sampling

- Pollinator Collection
 - All non-pest insects observed on flowers were collected
 - Two sampling dates during flowering
 - 30 minutes of collection per sampling date



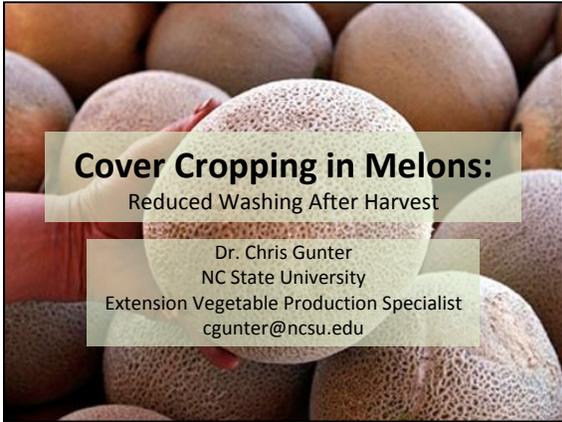
Watermelon Pollinator Visitation

- Field abundance ranges from 19-80 collected pollinators
- Average abundance 40.8



- ### Preliminary Best Management Practices for Watermelons
- Don't use FarMore400 treated seed (not readily available)
 - Use the low rate of a planting time application of Admire Pro or Platinum, mainly for aphid control
 - This application is optional
 - Scout weekly and treat for SCB with a pyrethroid insecticide only if > 5 beetles/plant
 - If aphids become a problem, treat with Assail
 - Make any foliar insecticide applications in late afternoon, evening, or at night
 - Most Indiana growers already doing this





Cover Cropping in Melons:
Reduced Washing After Harvest

Dr. Chris Gunter
NC State University
Extension Vegetable Production Specialist
cgunter@ncsu.edu

Outbreak of Listeria in Cantaloupe
Problem: Improper wash water maintenance
Solution: Eliminate washing!



CNN Health

Is cantaloupe safe to eat?
By the CNN Wire Staff
updated 10:25 AM EST, Thu September 25, 2011

Melon Cover Cropping: Retailer Acceptance and Microbial Quality of Non-Washed Fruit
Federal State Marketing Improvement Program



USDA U.S. DEPARTMENT OF AGRICULTURE
AMS AGRICULTURAL MARKETING SERVICE

NC STATE UNIVERSITY

Project Team



Horticultural Science
Chris Gunter
Penny Perkins-Veazie

Family and Consumer Science
Ben Chapman

Resource Economics
Jonathan Baros

Food Science
Eduardo Gutierrez
Sophia Kathariou

Objectives

Pre-Harvest Field Practices
Athena Cantaloupe Production
Cover Crop Systems

Post Harvest
Microbiome
Fruit Quality

Retail Acceptance
Risk Perception
Acceptability



Objectives – Pre-Harvest

Methods in Brief
Netted Melon – Athena
Commercial Management (Pest and Fertility)
3 Locations
Cover Crops
Mustard
Buckwheat
Sunhemp



Eliminating Cantaloupe Washing Cover crops and Post harvest quality

Grown on research station and farm

3 Cover crops
Physical barrier between soil

Presence of generic *E. coli*, *coliforms*, *STEC*, *Listeria monocytogenes*, *Enterococci*, *Salmonella*
In soil and on fruit



Mustard



Buckwheat



Sunhemp

Farm 1



Farm 2



Initial Findings

- Overall Microbial Populations Varied By Location
- Cover Crop Effect Varied by Location
- Melon Quality During Storage Not Negatively Impacted by Cover Crop Use

Objectives – Retail Acceptance

Methods in Brief

Question: Under What Conditions will Retailers Accept U Cantaloupe?

Conduct two-part interviews with 40 retail sector members

- Step 1: Evaluate baseline risk knowledge and self report behavior of buyers and food safety/QA individuals
- Step 2: Provide project results in visuals and text of field unwashed cantaloupe with a focus on risk tradeoffs

Quantitative (ranking/scale) and qualitative (open-ended) d



If you are a retailer and are interested in participating in the project please contact

Ben Chapman (benjamin_chapman@ncsu.edu)

Allied Studies



*FS Risk at the Produce-Animal Interface:
Identifying pathogen sources and movement on
diversified farms* (Center for Produce Safety)

Sid Thakur – NCSU College of Vet. Medicine

Gunter, Gutierrez, Chapman, Hanning (UTK)



Diversified Farming Systems



Next Steps?

Alternative solutions!
Field studies...

Cover crops



Mustard greens
Glucosinolates



Buckwheat
Phenolic
Compounds



Sunn Hemp
Pyrrolizidine
Alkaloids

Solarization



Top 5 cm can reach up to
55°C in moist soils (Cohen and
Rubin, 2007)

Thank you for your attention!



Happy to take any questions?
cgunter@ncsu.edu