2019 Research Studies on Sunburn and Insect Pest Exclusion Systems in Tree Fruit

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THE JENTSCH LAB

INSECT BIOLOGY, ECOLOGY, AND MANAGEMENT IN HUDSON VALLEY AGRICULTURAL COMMODITIES

Plant Protection Presentations

Fruit Production IPM Presentations:

2019

2019 Research Studies on Sunburn and Insect Pest Exclusion Systems in Tree Fruit. 2020 39th Annual Long Island Ag Forum, Suffolk County Community College, Riverhead, NY Jan. 8th

Developing Cultural Strategies To Manage Spotted Wing Drosophila In Blueberry Production Systems. 2019 NEVFC December 12th, DoubleTree Hotel – Manchester, NH

Search

2017 BLOG PAGES

- Mixed Review of Cosmic Crisp. Times Herald Record, Jan. 6th, 2010 January 6, 2020
- HVRL Hazelnuts: Filbert Blight Resistant Hazelnut for a Sustainable, Agricultural Future? December 17,

Tree Fruit Management Employing Exclusion Netting

Exp 1: Sunburn Management on 'Honeycrisp' on Nic 29

Exp 2: Insect Pest Management on RPI Apple Strains on G.11

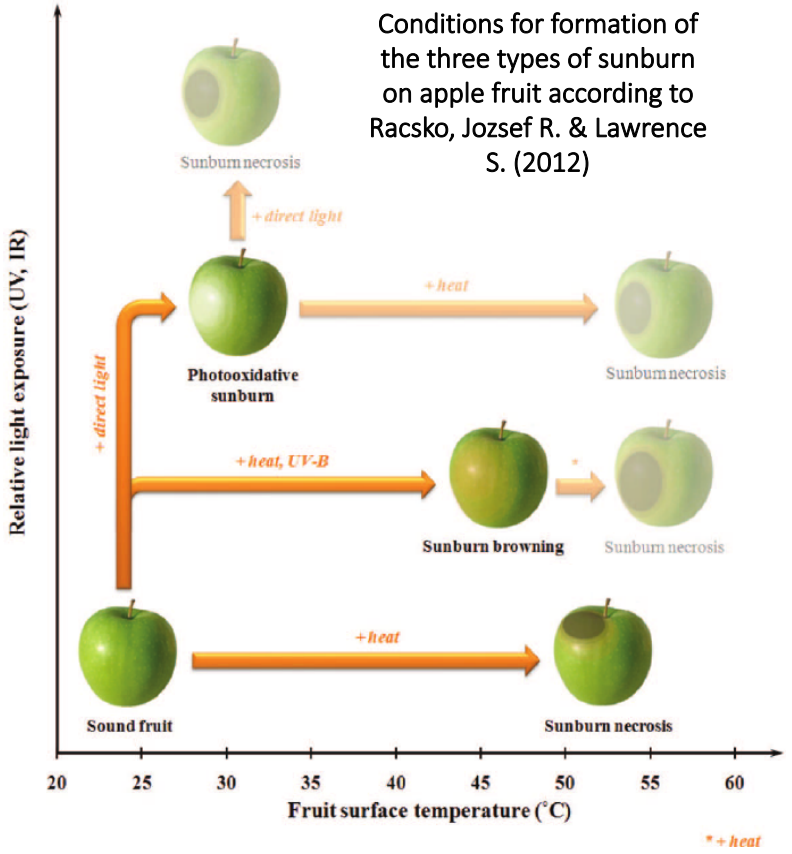
Sunburn Management on 'Honeycrisp'

Sunburn browning SB-1 (A) and SB-2 (B)

Sunburn necrosis

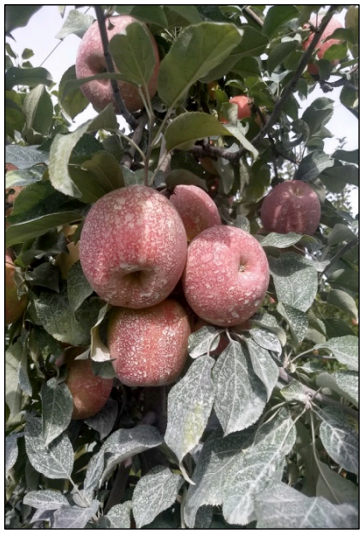
Photooxidative sunburn

Conditions for formation of the three types of sunburn on apple fruit according to Racsko, Jozsef R. & Lawrence S. (2012)



- RCBD using 4 replicates, two varieties (Cameo & Honey Crisp)
- Trees on Nic 29, 4’ x 11’ spacing
- Three tree panel, center tree used for data collection
- 3 sprayed and two netted treatments with UTC
- Tower sprayer for disease & insect mgt; Trmts using upright boom @100 GPA @ 2.1 mph

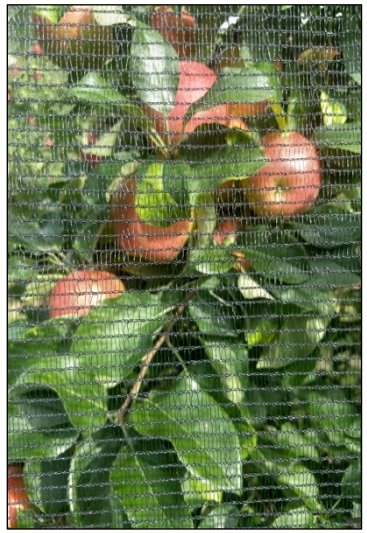
Purshade
(calcium carbonite)



ScreenDuo
(Kaolin)

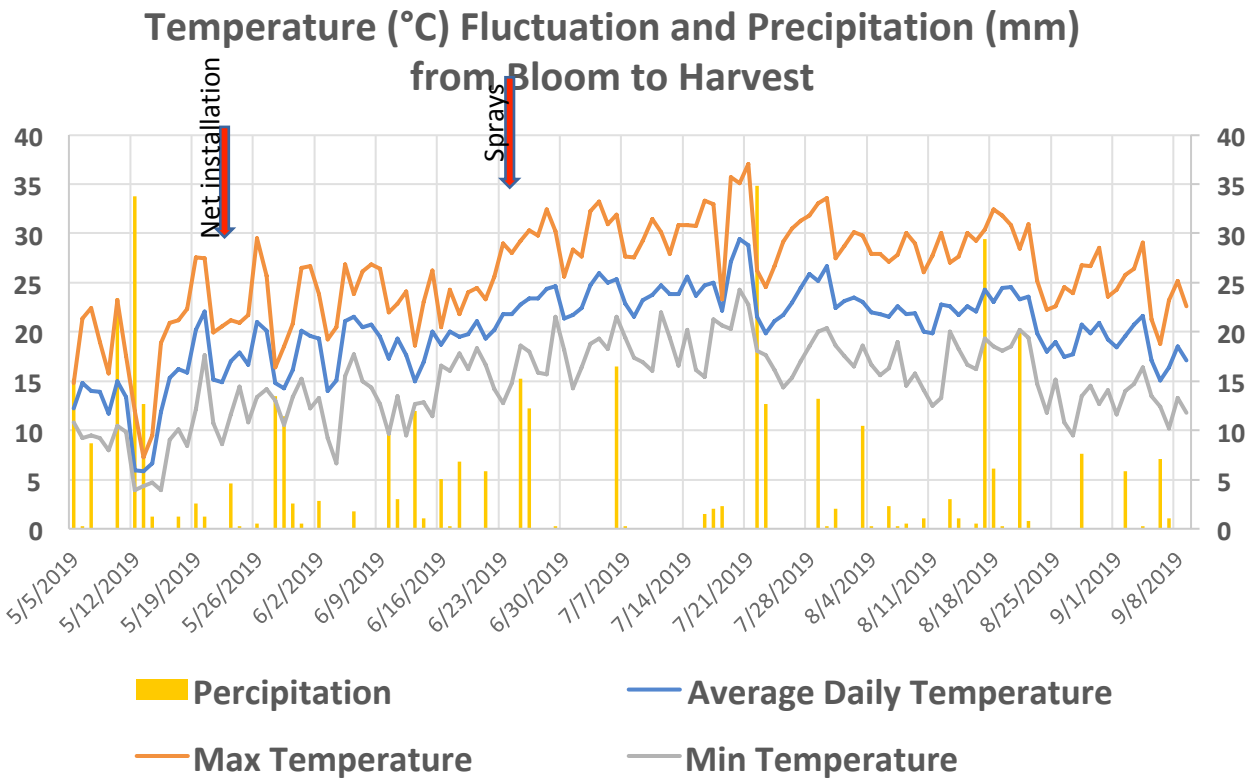
Surround
(Kaolin)

Drape Net – White

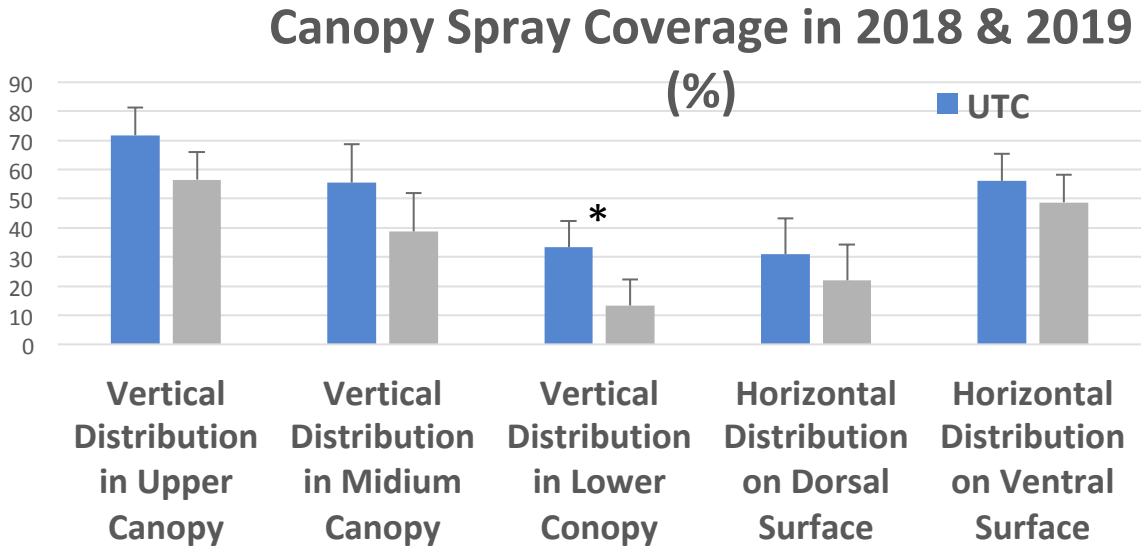


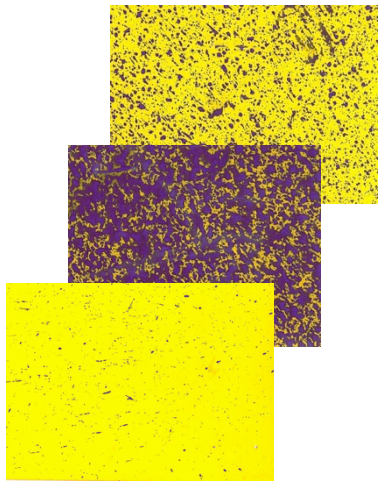
Drape Net – Black

Sunburn Management
Summary of results to date



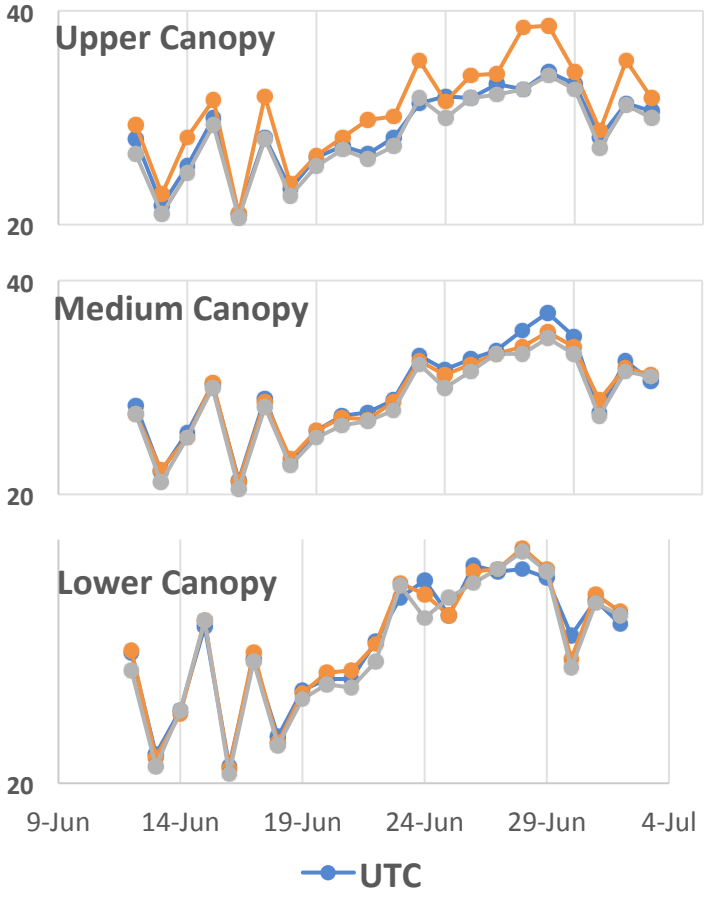
Sunburn Management
Summary of results to date





Significant difference between treatments detected with Wilcox on test is marked with asterisk (*) at α=0.05.

Sunburn Management
Summary of results to date



Vertical Distribution of the Average MDT within the Tall Spindle Canopy Recorded from June 12th to July 2nd

Treatments	Temperature (°C) Lower Canopy	Medium Canopy	Upper Canopy	F-Value
UTC	28.0 aC	29.4 aA	28.8 bB	<.0001
Drape Net White	28.1 aC	29.1 bB	30.8 aA	<.0001
Drape Net Black	27.7 bC	28.5 cA	28.2 cB	<.0001
F-Value	0.0223	<.0001	<.0001	

Means followed by the same low case letter within the column and upper-case letter within a row are not significantly different at P≤0.05 according to Student's t-test.

Sunburn Management
Summary of results to date

Vertical Distribution of the Photosynthetic Active Radiation Within the Tall Spindle Canopy Recorded on August 2nd

Treatments	Share of PAR intercepted by the whole canopy (%)	Share of PAR intercepted by different level of canopy (%)			
		Lower Canopy	Medium Canopy	Upper Canopy	F-Value
UTC	36.4 a	26.3 aA	37.0 aA	45.9 aA	0.2676
Drape Net White	23.8 b	16.6 aB	15.2 bB	39.8 aA	0.0361
Drape Net Black	21.8 b	15.3 aA	20.6 bA	29.7 aA	0.2132
F-Value	0.0478	0.4949	0.0176	0.5469	

Means followed by the same low case letter within the column and upper-case letter within a row are not significantly different at P≤0.05 according to Student's t-test.

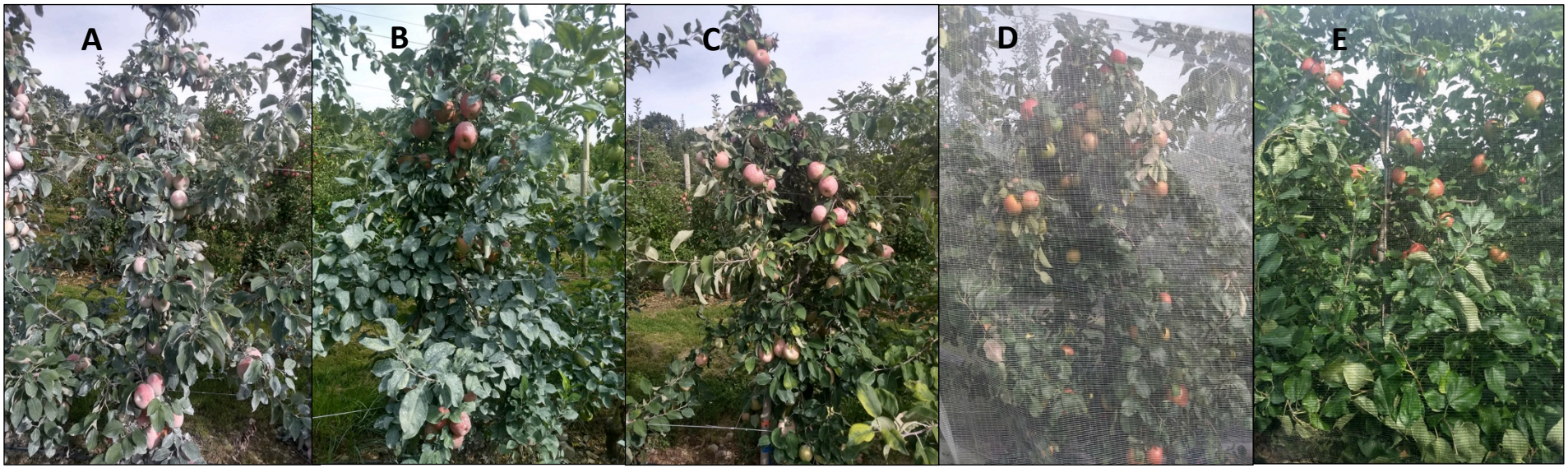
Sunburn Management
Summary of results to date

Fruit Temperature Recorded in East and West side of the Canopy under Full Sunlight Exposed Apples During Heat Events on July 20th (MDT: 35°C) and 30th (MDT: 33.5°C) between 12pm to 3pm.

Treatments	Fruit Temperature (°C)	
	West Side of the Canopy	East Side of the Canopy
UTC	38.4 a	36.0 a
ScreenDuo	35.4 cd	35.3 a
Surround	35.7 bcd	34.5 a
PurShade	37.5 ab	35.7 a
Drape Net White	36.5 abc	35.2 a
Drape Net Black	34.9 d	35.2 a
ChiSq-Value	0.0011	0.4723

Means followed by the same letter are not significantly different at P≤0.05 according Wilxocon Method.

Sunburn Management
Summary of results to date



(A) ScreenDuo ***(B) Surround*** ***(C) Purshade*** ***(D) Drape Net White & Black*** ***(E) UTC***

Sunburn Management
Summary of results to date

(A) ScreenDuo,
(B) Surround,
(C) Purshade,
(D) Drape Net White &
(E) Drape Net Black.

Treatment effect on yield, dropped fruits, fruit weight means/tree (Sep. 9, 2019).

Treatments	Number of Fruits	Yield per Tree (kg)	Dropped Fruits	Average Fruit Weight (g)
UTC	102.7 a	20.8 a	5.7 bc	216.7 d
ScreenDuo	78.5 abc	16.2 ab	4.0 c	227.8 bcd
Surround	98.8 ab	21.4 a	11.9 ab	219.2 cd
Purshade	68.7 bc	16.4 ab	7.2 ab	247.4 abc
Drape Net White	84.0 abc	19.6 a	15.0 a	248.5 ab
Drape Net Black	52.2 c	14.0 b	12.7 ab	273.4 a
F-Value	0.0141	0.041	0.0038	0.0015

Means followed by the same letter are not significantly different at P≤0.05 according to Student's t-test.

Sunburn Management
Summary of results to date

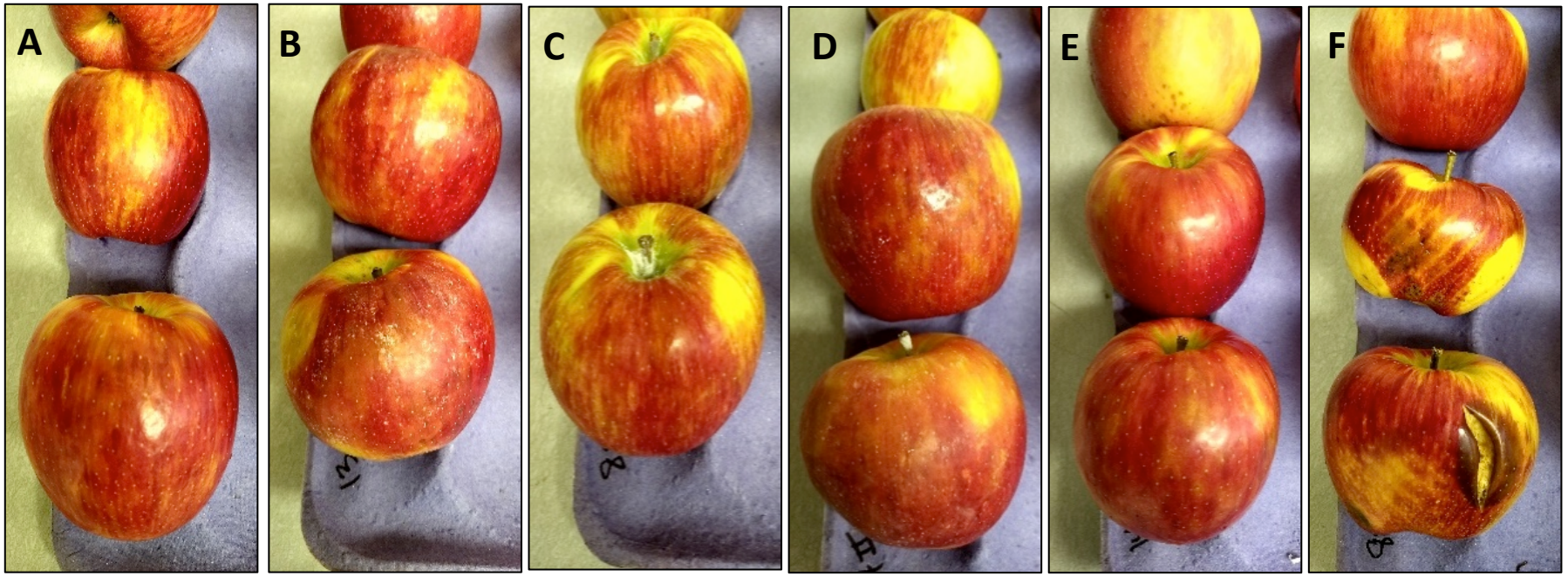
The treatments effect on Honeycrisp fruit chemistry, flesh firmness and bitter pit incidence in 2019.

	SSC (%)		TA (g/100mL as malic acid)		FF (kg)		
Treatments	B	NB	B	NB	B	NB	***Bitter pit incidence (%)**
UTC	13.3 a	11.5 ab	0.46	0.41 ab	9.1	9.0	9.2
ScreenDuo	13.5 a	12.0 a	0.49	0.45 a	9.3	8.8	26.7
Surround	12.4 bc	11.5 ab	0.41	0.40 ab	9.1	8.7	9.2
Purshade	13.2 ab	12.0 a	0.45	0.44 a	9.3	9.0	15.0
Drape Net White	12.8 abc	11.2 b	0.40	0.37 b	9.0	8.6	25.8
Drape Net Black	12.3 c	11.1 b	0.49	0.46 a	8.9	8.3	40.0
F-Value	0.0448	0.0223	0.0907	0.0409	0.3854	0.5092	0.0577

Means followed by the same letter are not significantly different at P≤0.05 according to Student's t-test.
*Bitter pit evaluated at harvest and 60 days after

For best post-storage eating quality, fruit should be harvested with a minimum firmness of 6 kg and at least 13% soluble solids.

Sunburn Management
Summary of results to date



Sunburn affected apples:

(A) UTC, (B)ScreenDuo, (C) Surround, (D) Purshade, (E) Drape Net White & (F) Drape Net Black.

Sunburn Management
Summary of results to date

Treatments effect on sunburn necrosis (SN), sunburn browning (SB), photooxidative sunburn (PS) and color 2019.

Treatment	SN (%)	SB (%)	PS (%)	Total Sunburn (%)	Blush (%)	a*/b*		Hue	
						B	NB	B	NB
UTC	0.0	11.7 c	0.0	11.7	51.4	1.75	0.15	-53.81	-31.84 ab
ScreenDuo	0.8	10.0 bc	0.0	10.8	58.5	1.90	0.22	-52.47	-30.48 bc
Surround	0.8	1.7a	1.7	2.5	57.5	1.64	0.18	-52.57	-32.9 a
Purshade	0.0	7.5 bc	0.0	7.5	63.4	2.04	0.24	-55.23	-32.17 ab
Drape Net White	0.0	4.2 ab	0.0	5.8	55.5	1.98	0.19	-55.76	-30.33 bc
Drape Net Black	1.7	6.7 bc	0.0	8.3	53.5	1.75	0.09	-53.45	-28.62 c
ChiSq[§] or F-Value	0.8496[§]	0.0295[§]	0.2532[§]	0.1375[§]	0.1719	0.0865	0.5485	0.1418	0.0104

Means followed by the same letter are not significantly different at P≤0.05 according Wilcoxon Method[§] or according to Student's t-test.
a* is the red/green coordinate; b* is the yellow/blue coordinate

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Sunburn Management
Conclusions

- The largest temperature difference DNW (~ 2°C, top to bottom).
- Upper canopy: DNW (+2°) vs. UTC & DNB.
- ScreenDuo, Surround & DNB reduced fruit surface temperature.
- DNW & DNB received 12.6 and 14.6% less light than UTC.

- 2018: SB Necrosis reduced by Purshade & DNB. Total SB% reduced by DNB
- 2019: DNW & Surround controlled SB Browning

- Impact on color development: blush and a/b reduced in DNB (2018)
- Brighter color in all trts vs. UTC (2018), only DNB on NB-side (2019).

- All trts (2018) & Surround & DNB (2019) lowered SSC on B-side
- TA lowest in DNW (only 2019)

- No sign diff in BP incidence, but it was 40% in DNB (2019)

- No impact on yield 2018, but huge reduction in 2019 seen in DNB (yield & fruit#) & Purshade (yield).
- Average fruit weight increased in DNW, DNB & Purshade.

Drape Net Insect Exclusion Study

Support from

The New York State Apple Research and Development Program

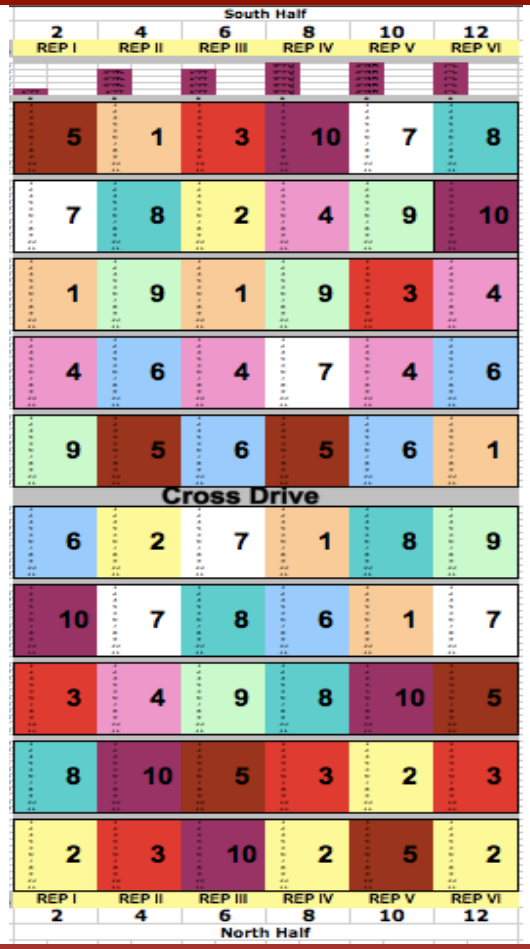
DrapeNet®
cost effective crop protection

Insect Pest Management Study of the Drape Net Insect Exclusion System

Cornell University

Hudson Valley Research Laboratory

Insect Pest Management Study Using Drape Net Insect Exclusion System



Varieties

- Winecrisp
- Pixie Crunch
- Topaz
- Nova Easygro
- Crimson Crisp
- Liberty
- Scarlet O'Hara
- Florina Querina
- Enterprise
- Goldrush

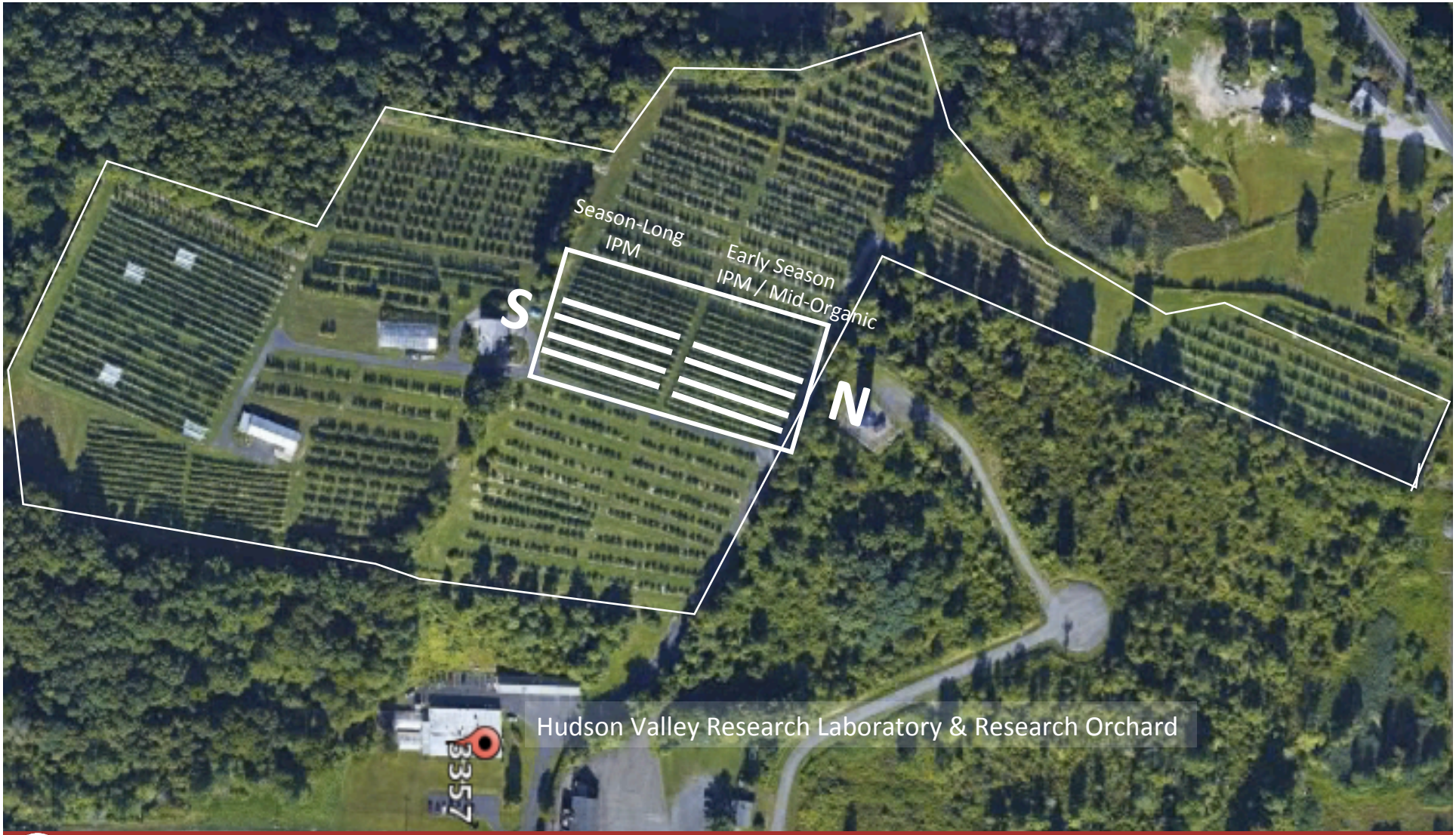
Orchard Layout

- Scab Resistant PRI Selections (Purdue, Rutgers & Illinois - PRI)
- 10 Varieties on G.11
- 4' x 11' spacing @ 10'H (990 T/A)

Established Organic Transitional Block

- Original design for insect & disease efficacy screening studies
- Woodchip weed management
- Composted chicken manure


Season-Long IPM
Early Season IPM
S
N
Hudson Valley Research Laboratory & Research Orchard
33S7


Season-Long
IPM
Early Season
IPM / Mid-Organic
S
N
Hudson Valley Research Laboratory & Research Orchard
33537

2018 Drape Net

- ‘Net Wiz’ cost $15,700
  - Spool of netting
- Netting cost $3,500/A
- Application rate of 2.0 – 3.0 mph approx. 2-4 A / hr.
- 3 persons for application
- Additional labor for
  *Complete exclusion ties at tree base
  *Cut ends secured to posts
  *Sew new spool to net in row

2018 Drape Net

- ‘Hangs’ on top trellis wire
- Forces apical shoots to grow horizontally
- Attached to posts and gathered at trunks using 6“ zip ties or garment / tag gun
- Homeowner applications to single free standing trees


5

Drape Net Insect Exclusion Study
Stink Bug

Drape Net Insect Exclusion Study
Pest management Program

Treatment/Formulation	RateTiming	Application Dates
Early Season IPM		
Actara	5.5 oz/A	18th May
Avaunt	6.0 oz/A	25th May
Entrust SC	10.0 fl oz/A	8th June
Venerate	2.0 gal/A	21st June
Season Long IPM		
Actara	5.5 oz./A	18th May
Avaunt	6.0 oz./A	25th May
Imidan 70W	4.9 lbs/A	7th June
Esteem 35WP	5.0 oz/A	21st June
Assail 30SG	4.0 oz/A	21st June
Altacor	4.5 oz/A	21st June
Assail 30SG	4.0 oz/A	10th July
Exirel	20.5 oz/A	24st July
Exirel	20.5 oz/A	31st July
Exirel	20.5 oz/A	6th Aug.
Bifenture 10DF	32.0 oz/A	6th Aug.

Pre-Net

Post-Net Application

Pre-Net

Post-Net Application

Drape Net Insect Exclusion Study
Insect Pest Management Efficacy

Results of 2018 Insecticide and Acaricide Studies in Eastern New York. Jentsch et. al.

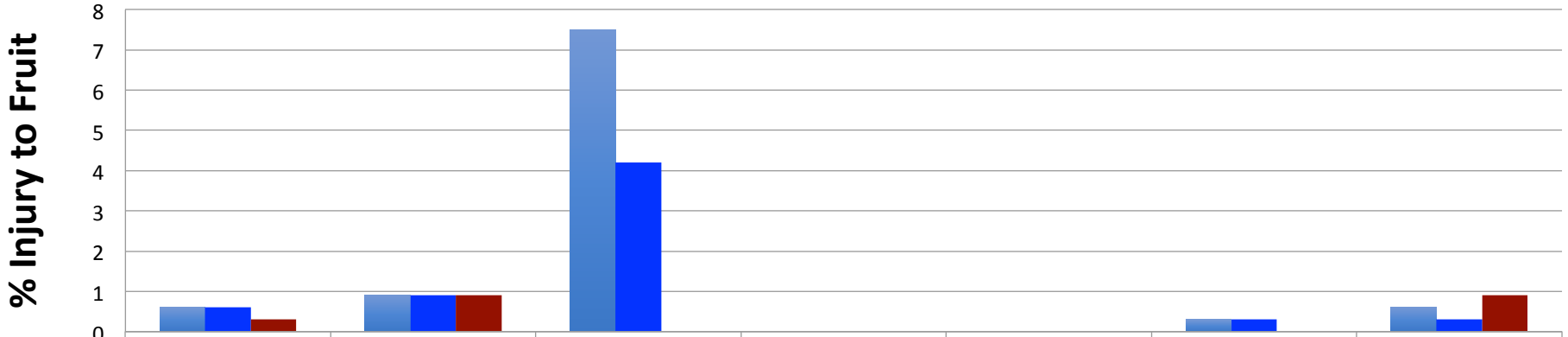
Table 1 **Management of the Apple Insect Complex Using 'Drape Net' IPM / Organic Split and Season Long IPM Management . Hudson Valley Research Laboratory, Highland, NY - 2018**

Net Type / Treatment / Rate	Incidence (%) of insect damaged cluster fruit											
	PC	EAS	TPB	Lf.Rlr	Int. Lep	Ext.Lep	CM	AM.P	AM.T	SJS	SB	Clean
1. Black Drape Early Season IPM	3.0 a	0.6 a	4.4 a	10.9 bc	2.2 b	18.8 b	11.3b	0.6 b	0.6 b	96.3 a	0.3 b	1.3 c
2. White Drape Early Season IPM	4.7 a	0.0 a	4.4 a	11.9 b	3.1 b	20.3 b	12.5 b	0.9 b	0.9 b	95.6 a	0.9 b	0.6 c
3. No Drape Early Season IPM	**10.8 a**	**0.8 a**	**4.6 a**	**22.9 a**	**6.7 a**	**37.1 a**	**23.8 a**	**7.5 a**	**4.2a**	**83.8 b**	**3.8 a**	**1.3 c**
4. Black Drape Season Long IPM	5.6 a	1.3 a	7.8 a	0.3 d	0.0 c	1.6 c	0.3 c	0.0 bc	0.0 b	6.6 d	0.0 b	82.5 a
5. White Drape Season Long IPM	7.8 a	0.9 a	7.8 a	0.3 d	0.0 c	0.6 c	0.0 c	0.3 b c	0.3 b	20.0 c	0.0 b	65.9 b
6. No Drape Season Long IPM	**5.6 a**	**0.9 a**	**5.0 a**	**0.6 cd**	**0.3 c**	**1.3 c**	**0.0 c**	**0.6 b c**	**0.3 b**	**6.3 d**	**0.9 b**	**81.3 a**
P value	0.2062	0.6565	0.5998	0.0001	0.0001	0.0001	0.0001	0.0001	0.0135	0.0001	0.0154	0.0001

[a] Evaluation made on 'Crimson Crisp, Honey Crisp & Gold Rush cultivars harvested on 29 September. Data were transformed using arcsine(sqrt(x)) prior to ANOVA (P ≤0.05). Means separation by Fisher Protected (P ≤0.05); treatment means followed by the same letter are not significantly different. Arithmetic means reported.

Drape Net Insect Exclusion Study

IPM / Organic Split and Season Long IPM in Apple Management Programs Using 'Drape Net' .



	Black Drape Early Season IPM	White Drape Early Season IPM	No Drape Early Season IPM		Black Drape Season Long IPM	White Drape Season Long IPM	No Drape Season Long IPM
AM.P	0.6	0.9	7.5		0	0.3	0.6
AM.T	0.6	0.9	4.2		0	0.3	0.3
SB	0.3	0.9	0		0	0	0.9

Conclusion – 2019

- Use of **exclusion netting** will likely aid in reducing hail, bird, and migratory insect damage and sunburn injury of sensitive varieties, decreasing the need for late season pesticide use, reducing the insecticide resistance potential and residue.

- I**ncreased temperatures** may accelerate fruit maturity, especiality in tree tops, causing increased drop if first pick is delayed. Fruit touching net is vulnerable to sunburn and insect feeding.

- Applications of fungicides and insecticides for disease and endemic insects is essential while augmentation of predatory and parasitic insects into complete exclusion systems may be needed to manage WAA and SJS in yeasr 1 & 2.

Conclusion – 2019

- Application timing of **exclusion netting** may be used to reduce the need for crop load management.

- Further study to develop and optimize winter pruning strategies for enclosures, amendments to provide cost effective access for summer pruning and multiple harvest picks may improve efficiency and increase grower adoption of this innovative tree fruit management strategy.

Thanks to the staff at the HVRL for all their support:

Extension Associate / Horticulturalist	Dana Acimovic
Laboratory Technician	Lydia Brown
Research Assistant	Christopher Leffelman
Research Assistant	Lucas Canino
Farm Manager	Albert Woelfersheim
Administrative Assistant	Erica Kane
Administrative Assistant	Christine Kane
HRVL & NEWA Weather Data.....	Christopher Leffelman, Albert Woelfersheim

Special thanks to **Elijah Talamas** (Trissolcus spp. / parasitoid identification)

ARDP - NYS Ag. & Mkts, NY Farm Viability Institute, NYS SCRI, NYS Orchards & Farmers

National Institute of Food and Agriculture (NIFA), U.S. Department of Agriculture, Specialty Crop Research Initiative under award numbers 2016-51181-25409 and 2011-51181-30937.