



# Cotton Insect Pest Management Update

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Virginia Beach, VA



VIRGINIA AGRICULTURAL  
EXPERIMENT STATION  
VIRGINIA TECH.

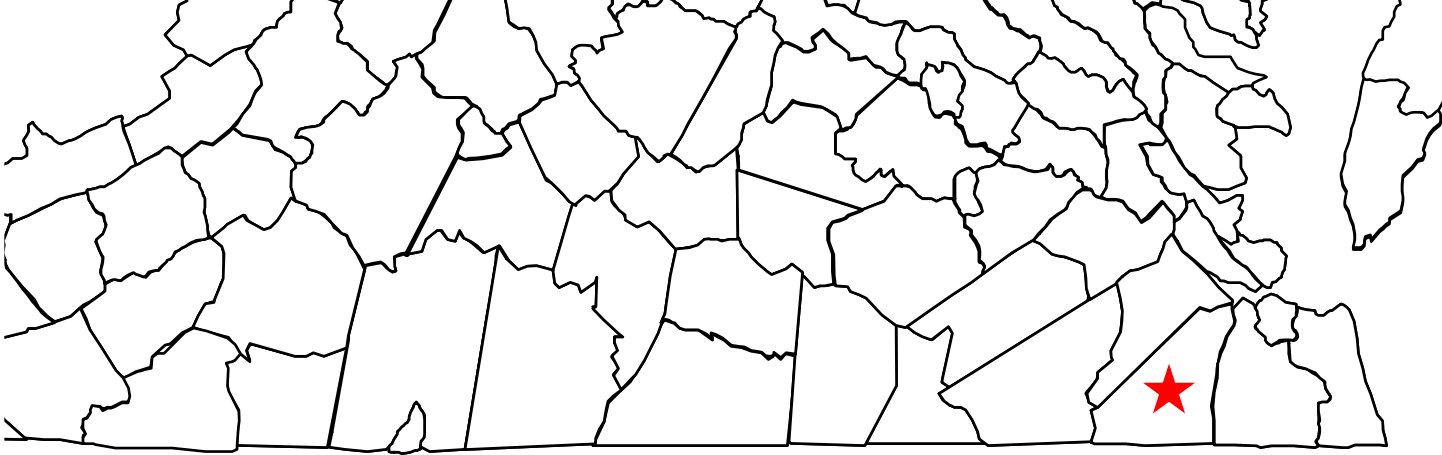
MS Entomology – Dr. Sally Taylor



BS Environmental Horticulture



PhD Entomology – Dr. Francis Reay-Jones



# TIDEWATER AGRICULTURAL RESEARCH AND EXTENSION CENTER





\$21/acre

\$6/acre

\$30/acre

\$73.80/acre

**Total cost of losses & managing insect pests of cotton in Virginia**

**\$ 9 million**

**1. Thrips, plant bugs, and Thryvon technology**

**2. Bt resistance update**

## Field Crop Entomology Needs Assessment

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# Thrips

- Consistent early season pest in VA



# Seedling injury rating scale (J. Greene, Clemson)



**0**



**1**



**2**



**3**



**4**



**5**

**Thrips injury scale: 0-5 where 0 = no injury and 5 = dead plants  
2-3 is foliar treatment threshold**

# Adult thrips species composition in cotton—2024

Tidewater AREC Field 67  
n = 462 (across all trts)  
Sampled June 4 & 11

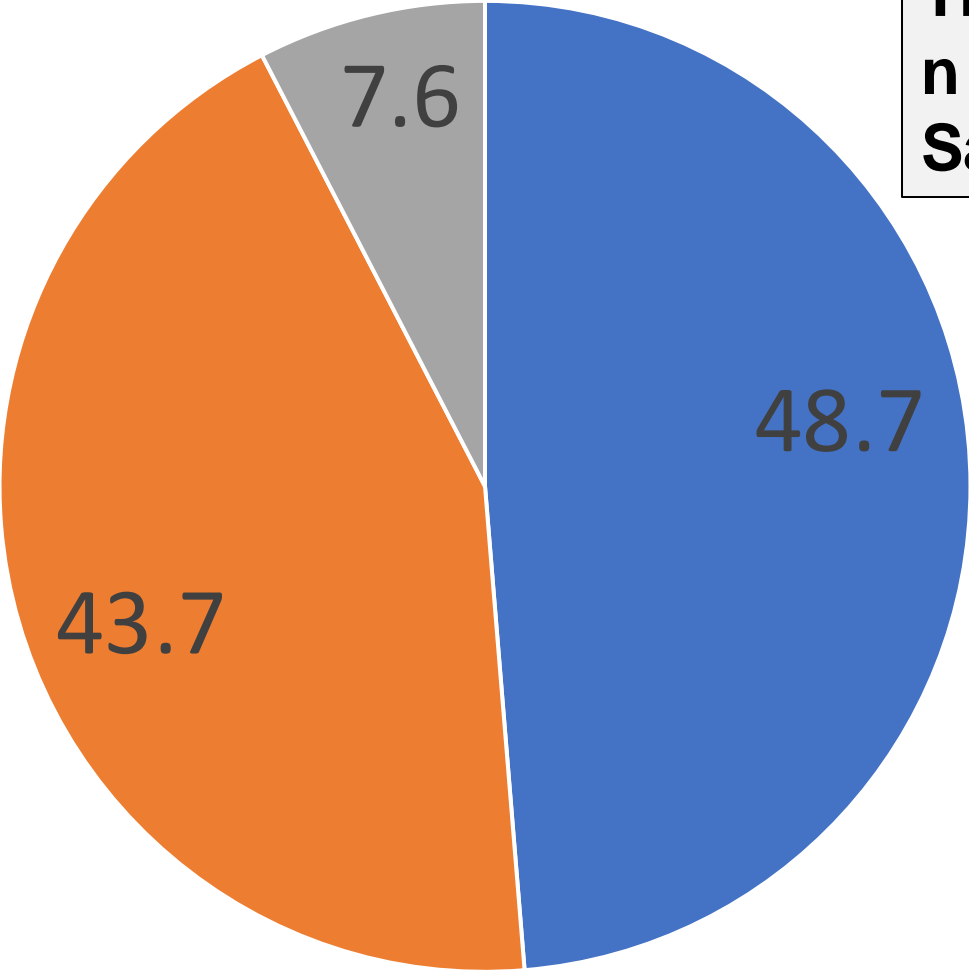


Image by David Cappaert, Bugwood.org



Image by Sophia Conzemius, Clemson University

■ Tobacco ■ Western ■ Other



# Thrips Management

## At-plant options

### In-furrow;

Acephate (Orthene 97)

Aldicarb (AgLogic)

Phorate (Thimet)

Imidicloprid (Admire Pro)

### Seed Treatments;

Imidacloprid (Gaucho, Grande, Aeris)

Thiamethoxam (Cruiser, Avicta)

## Foliar options

Acephate (Orthene 97)

Spinetoram (Radiant SC)

Plinazolin, intrepid edge, others?

\*29% survival in imidacloprid assay in 2023 (12% or higher is considered resistant) – Assay conducted by Dr. Anders Huseeth at NCSU

## Orthene Resistance Confirmed for Thrips in Cotton: A Suggested Plan Forward

– Written By [Dominic Reisig](#)

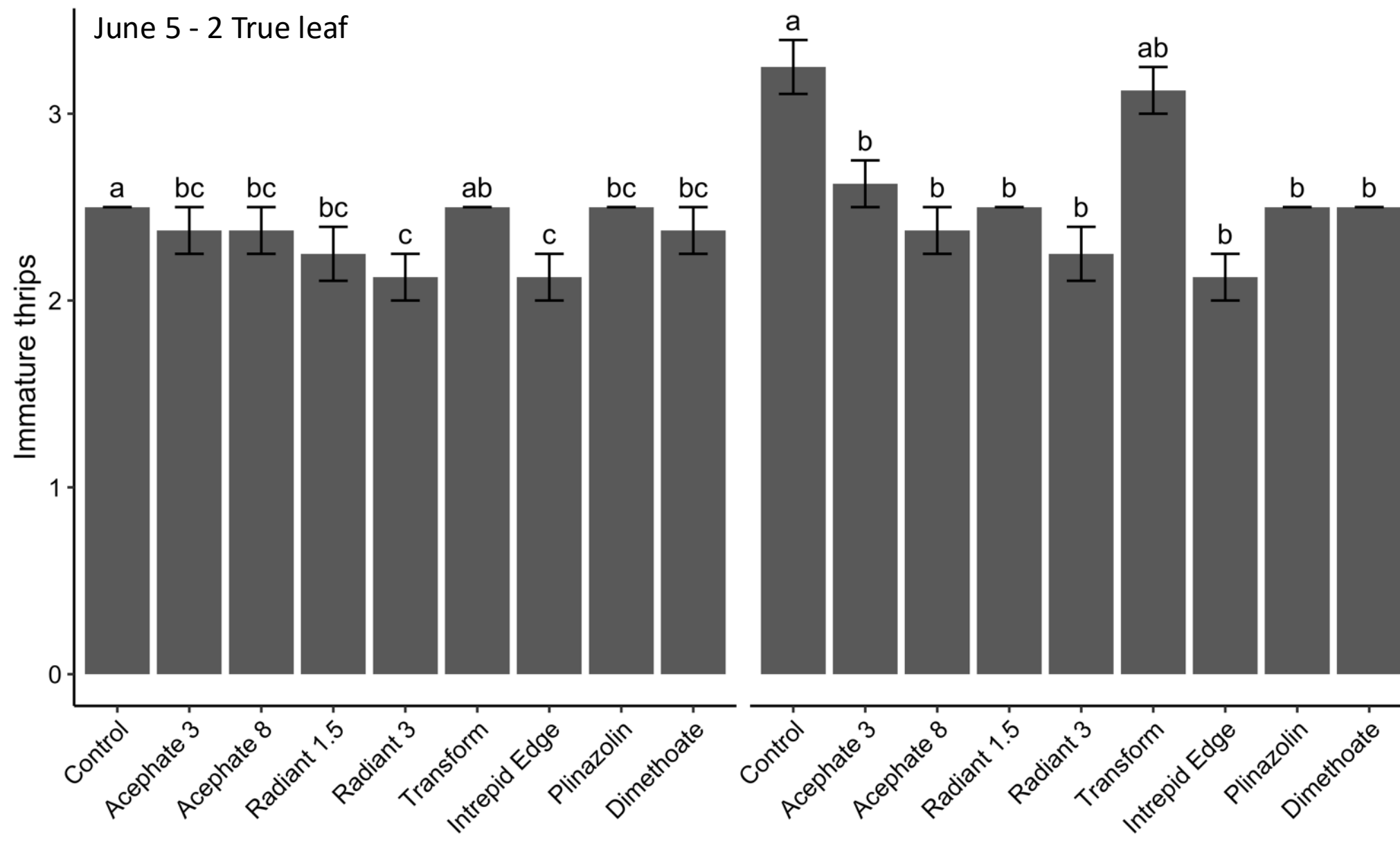
**Bollgard<sup>3</sup>**  
**Thryv<sup>ON</sup>**  
With **XTENDFLEX<sup>®</sup>**  
TECHNOLOGY

# Virginia cotton board 2024– Evaluating foliar thrips products

Sprayed at early 1<sup>st</sup> true leaf, May 31

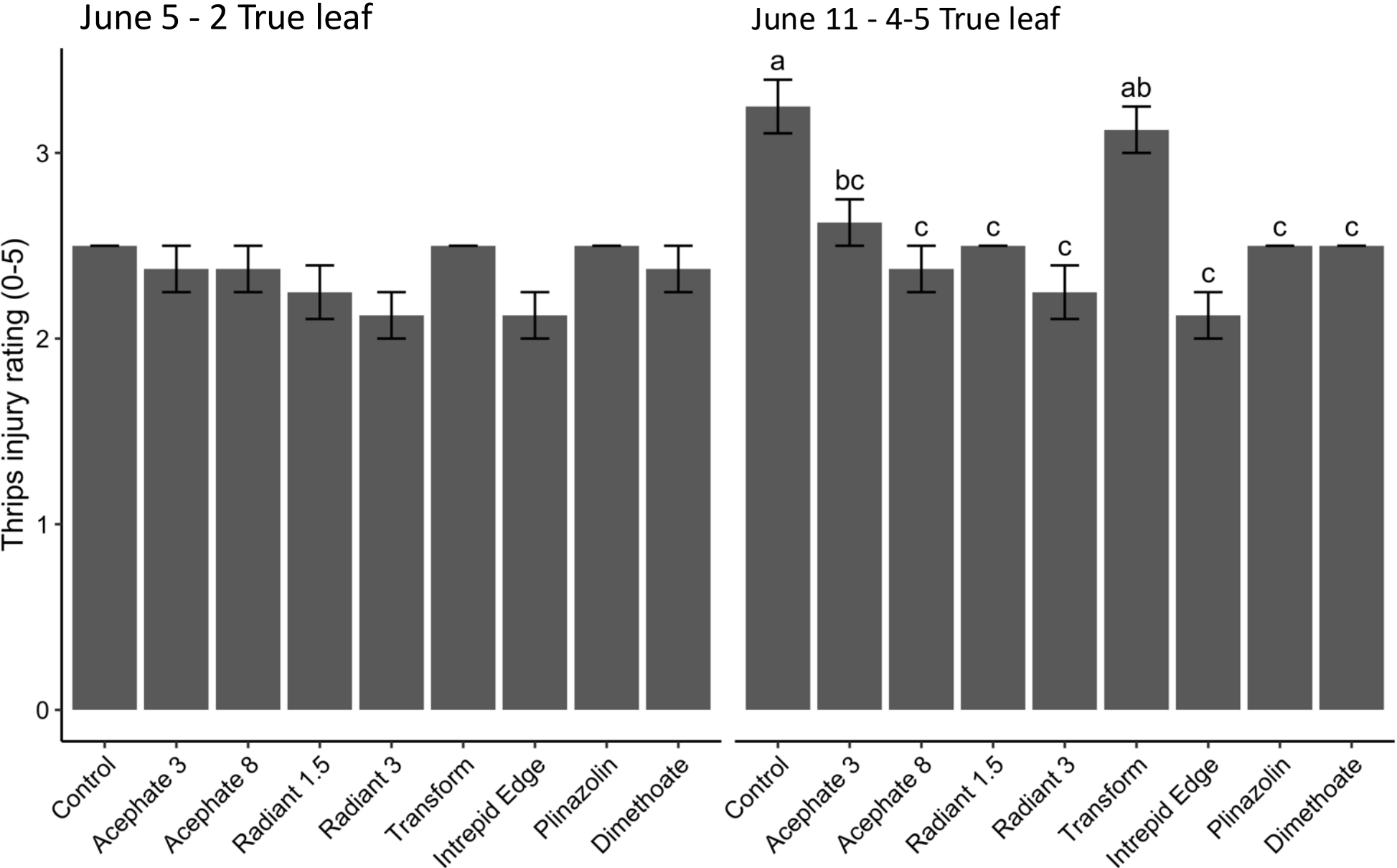
June 11 - 4-5 True leaf

June 5 - 2 True leaf



# Virginia cotton board 2024 – Evaluating foliar thrips products

Sprayed at early 1<sup>st</sup> true leaf, May 31



**Radiant<sup>®</sup> SC**  
INSECTICIDE



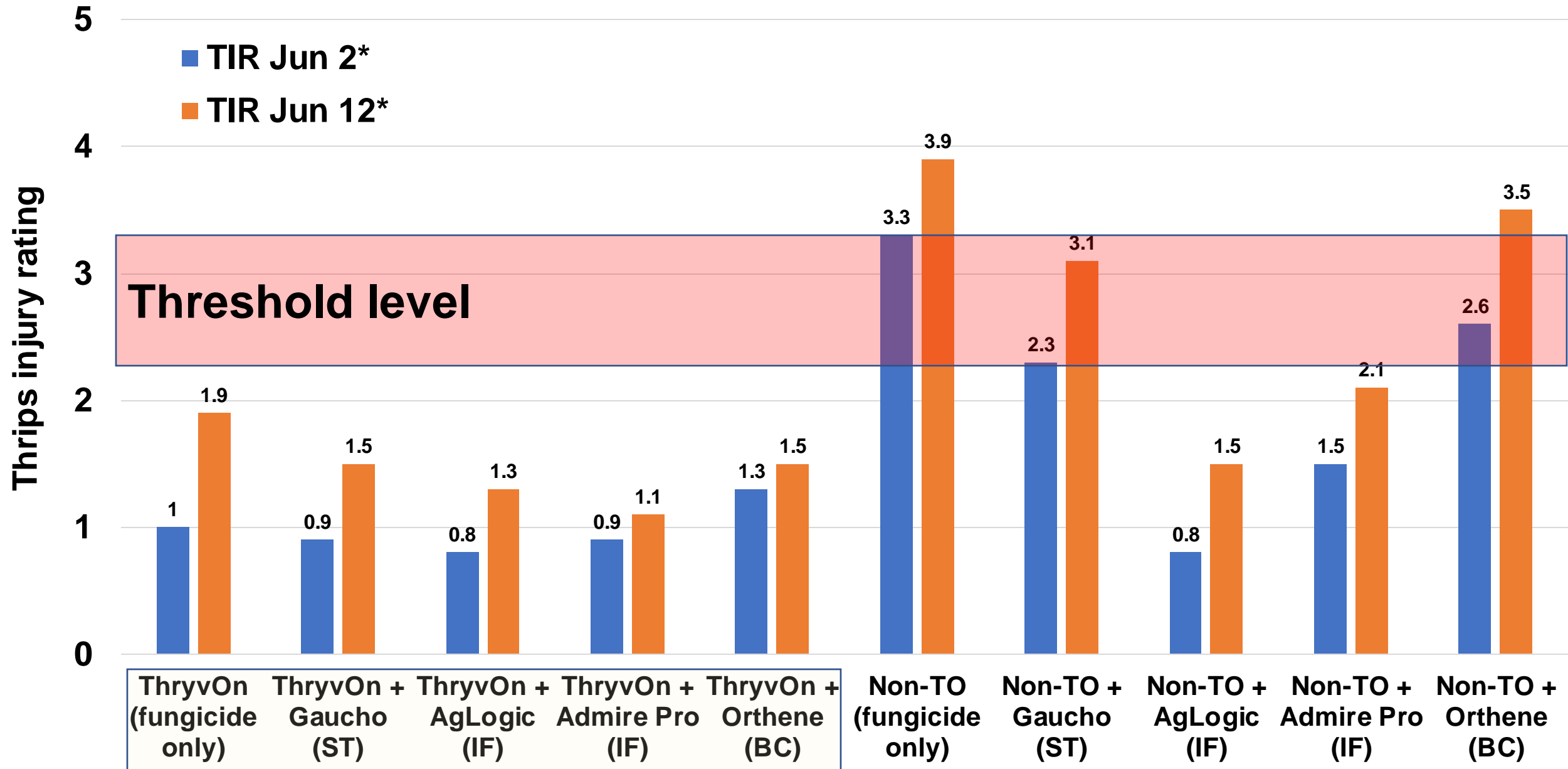
**Hemi<sup>™</sup> SC**  
Jemvelva<sup>™</sup> active

# Thryvon Cotton

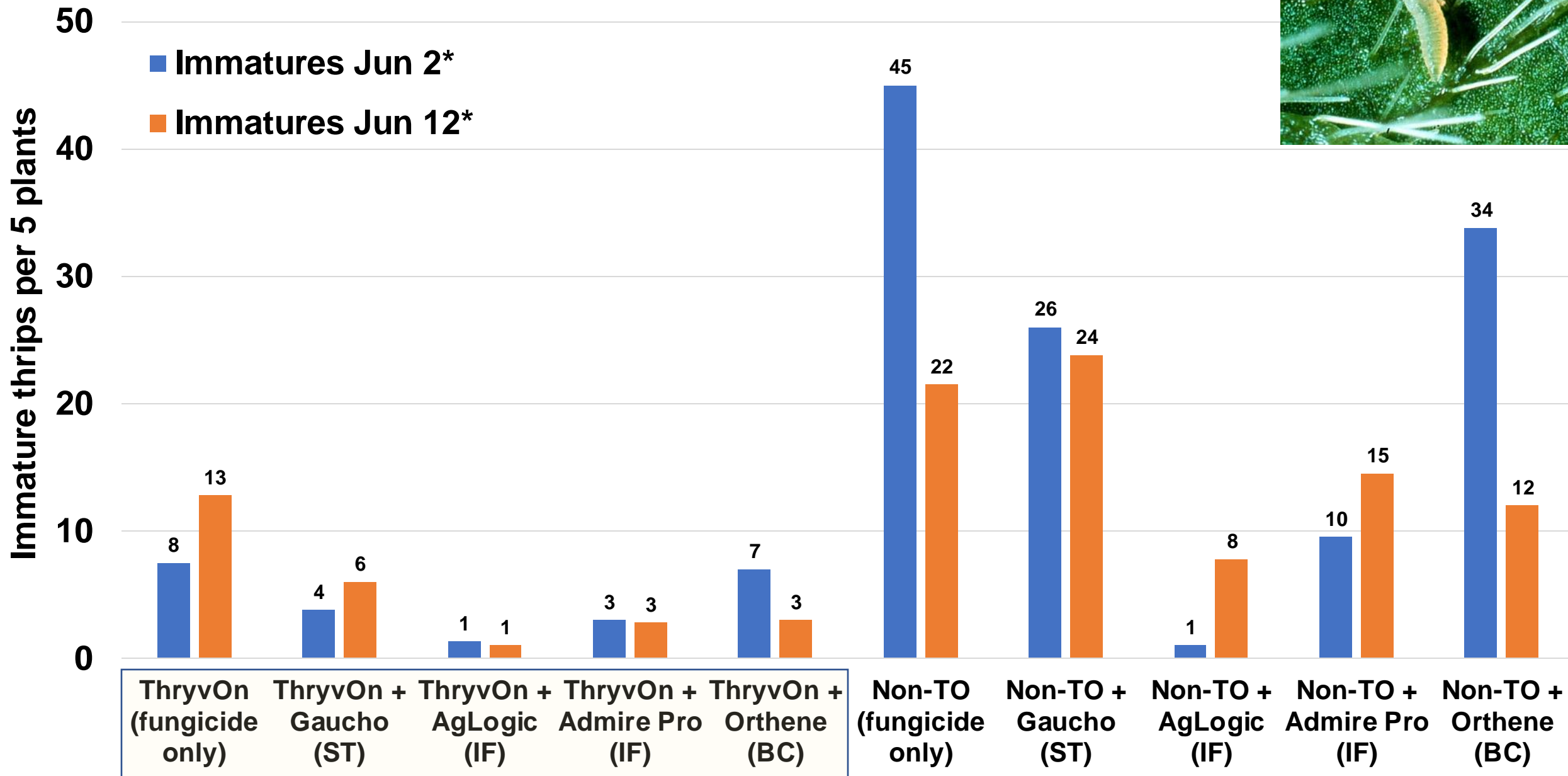
- Plant incorporated protectant - Cry51Aa2
- Activity for piercing-sucking pests;
  - Thrips
  - Plant bugs
  - Stink bugs (?)



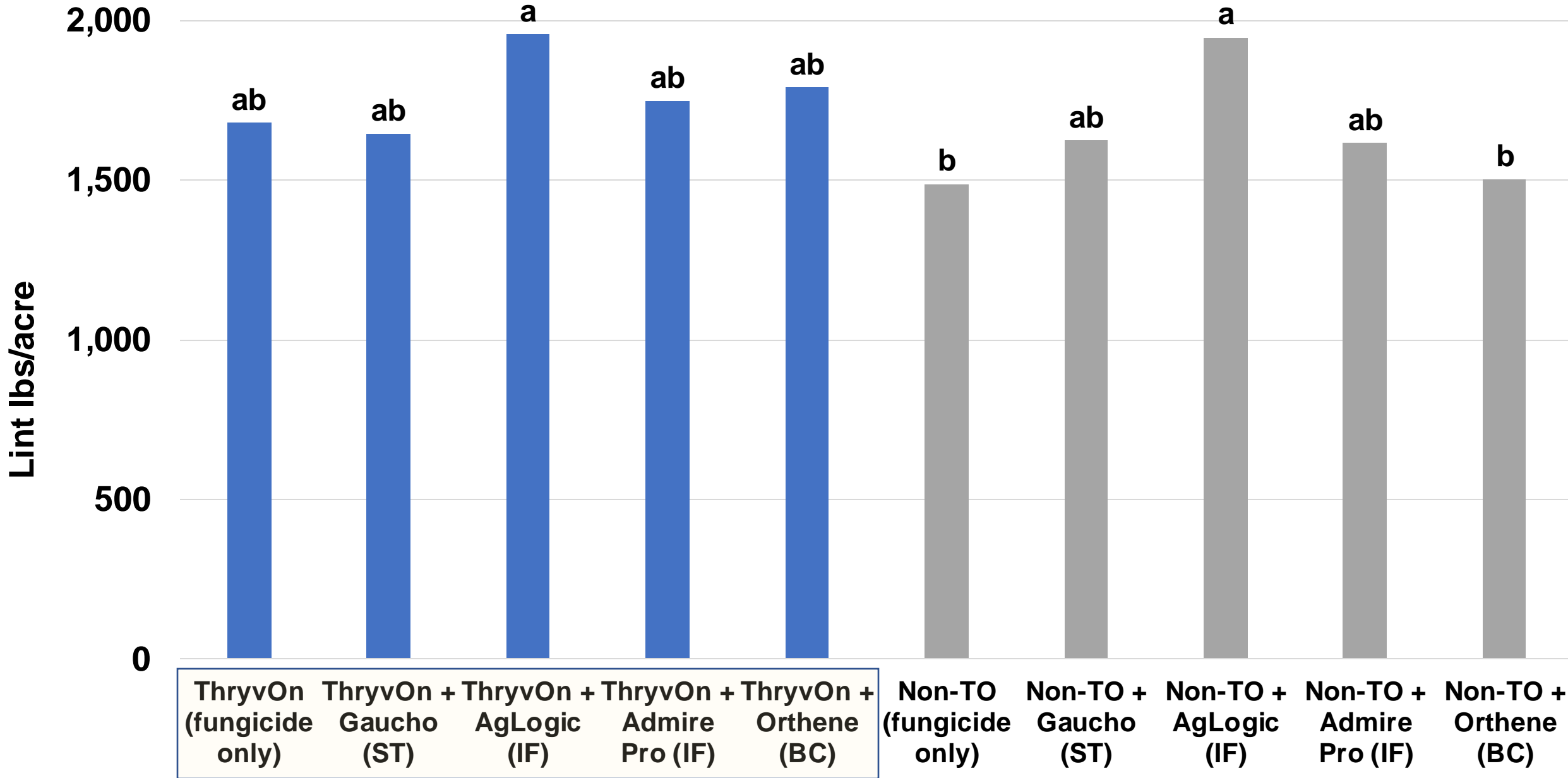
# Foliar and at-plant thrips management with Thryvon – Thrips injury



# Immature thrips populations



**Yields (based on 45.9% lint)**

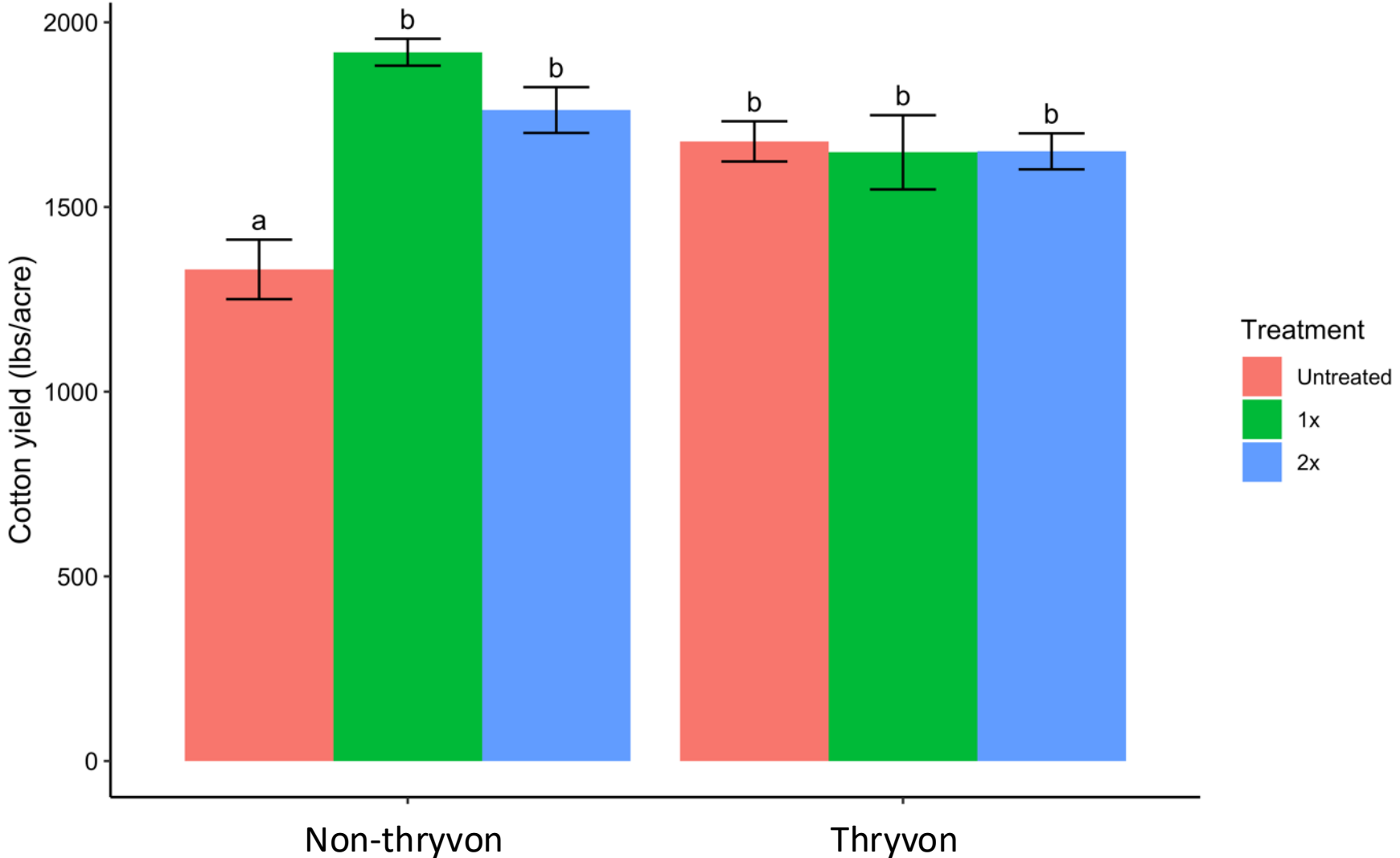






# Early planted - yield

#	Treatment	Jul 3	Jul 11	Jul 31	Aug 7	Aug 14
1	DP 2211 B3TXF, untreated	-	-			
2	DP 2211 B3TXF, 1x threshold	-	T	B+A		
3	DP 2211 B3TXF, 2x threshold	T	T			B+A
4	DP 2127 B3XF, untreated	-	-			
5	DP 2127 B3XF, 1x threshold	-	T	B+A	B+A	
6	DP 2127 B3XF, 2x threshold	-	T		B+A	B+A



## Total sprays at 1x threshold

Thryvon: 2

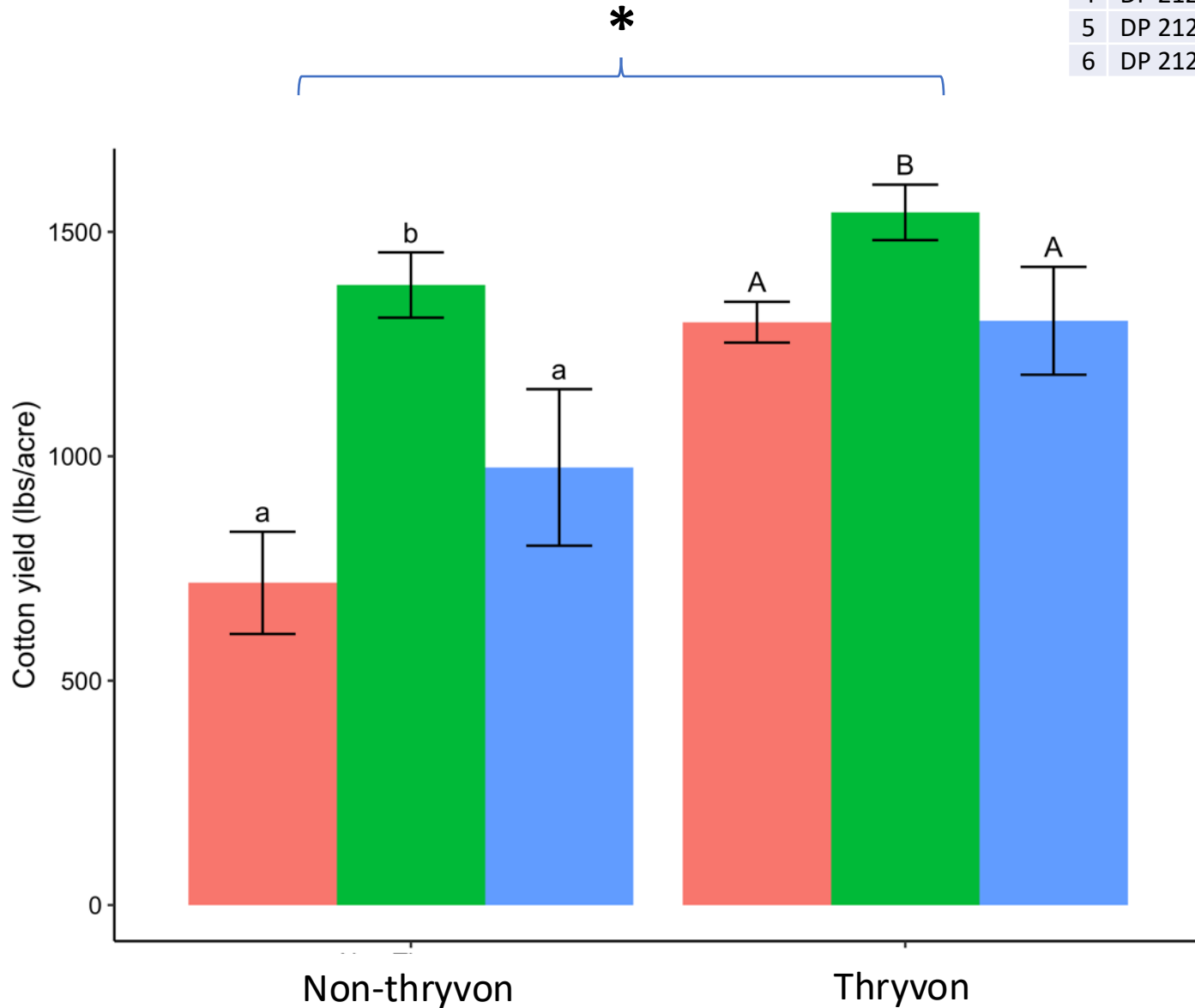
Non-Thryvon: 3

### Economic Threshold:

- 8 per 100 sweeps (first two weeks of bloom)
- 2.5 per drop (third week of bloom and later)

# Late planted - yield

#	Treatment	Jul 17	Jul 24	Aug 7	Aug 14	Aug 20	Aug 27	Sep 11
1	DP 2211 B3TXF, untreated							
2	DP 2211 B3TXF, 1x threshold	T		T	B+A		B+A	
3	DP 2211 B3TXF, 2x threshold							
4	DP 2127 B3XF, untreated							
5	DP 2127 B3XF, 1x threshold	T	T	T	B+A	B+A		B+A
6	DP 2127 B3XF, 2x threshold			T	B+A	B+A		



**Total sprays at  
1x threshold**

Thryvon: 4

Non-Thryvon: 6

# Limiting broad spectrum insecticide applications for plant bugs helps preserve beneficial insects



Lady bug



Minute pirate bug



Big-eyed bug



Tachnid fly



Hover fly



Lacewing



Soldier beetle



Assassin bug



Predatory wasps



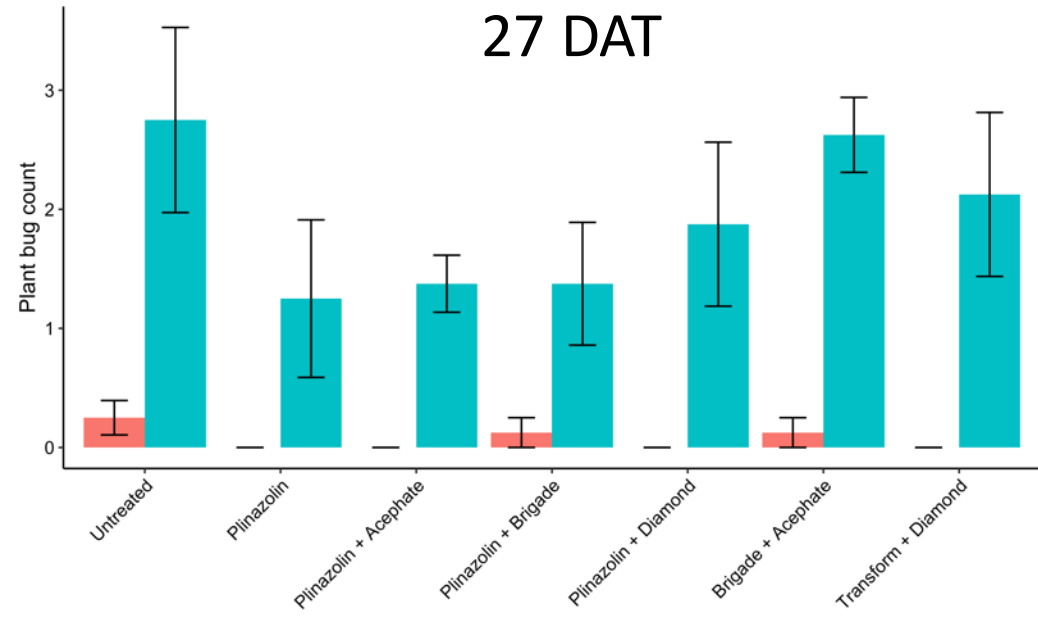
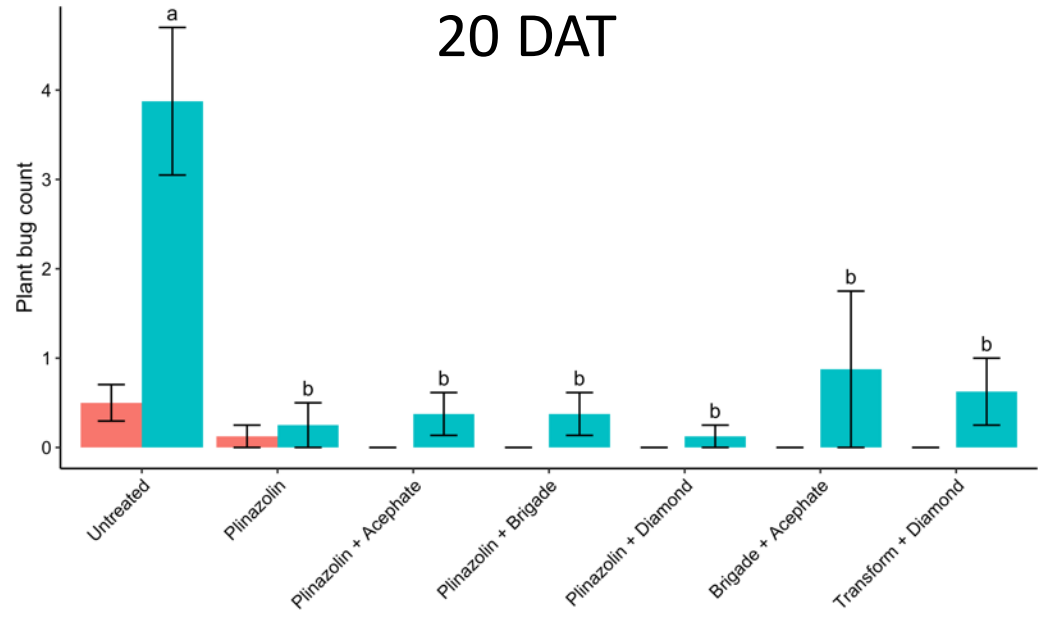
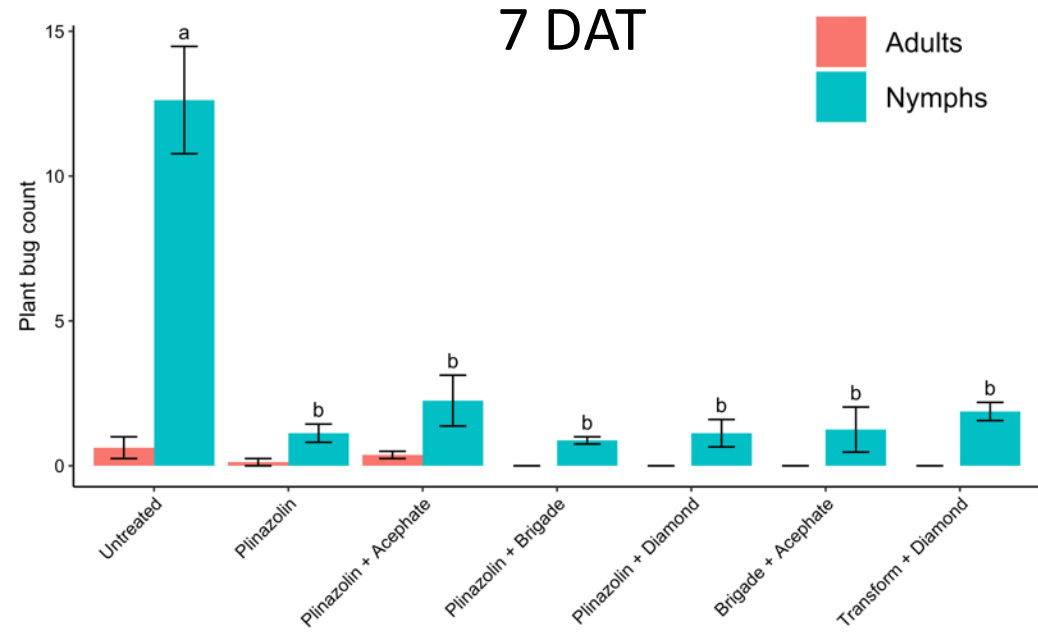
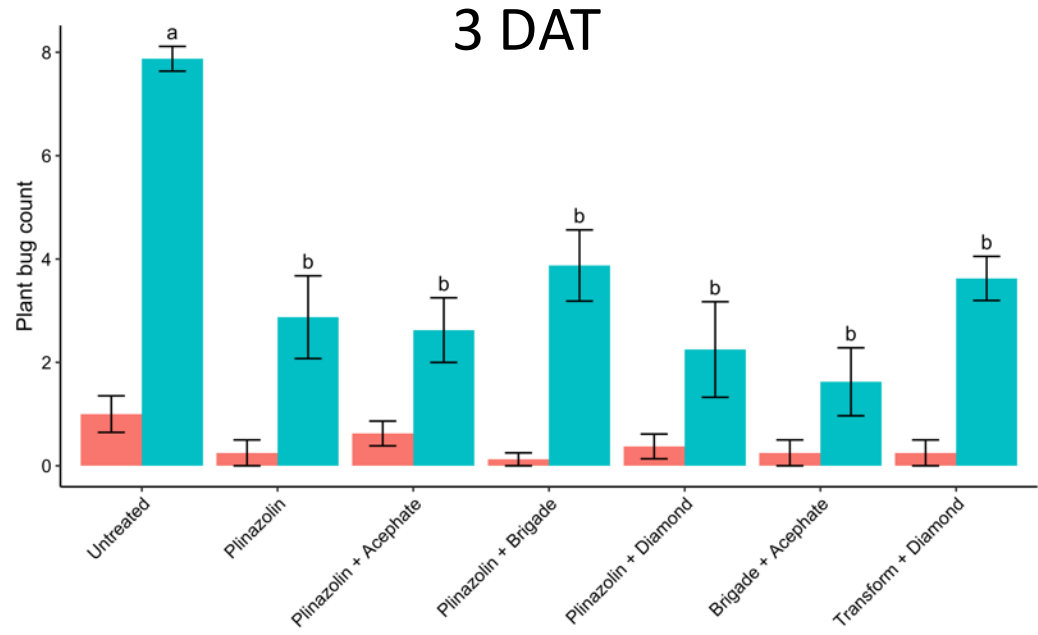
Parasitic wasps



# Thryvon cotton summary

- Thrips = **NO** additional management needed
- Tarnished plant bugs = **TREAT** at economic threshold

# Foliar plant bug experiment – including Plinazolin



# Transgenic Bt cotton

- Cotton hybrids expressing Cry1Ac released in 1996
- Highly effective for tobacco budworm and pink bollworm
- Modern varieties express two or three (or four) Bt toxins



Table 1. Survival of tobacco budworms, bollworms, and fall armyworms on *Bt* and non-*Bt* cotton genotypes

Insect	Percent survival	
	1994	1995
Tobacco budworm		
on <i>Bt</i> cotton leaf	1	0
on <i>Bt</i> cotton square	2	0
on non- <i>Bt</i> cotton leaf	86	84
on non- <i>Bt</i> cotton square	69	67
Bollworm		
on <i>Bt</i> cotton leaf	7	23
on <i>Bt</i> cotton square	5	4
on non- <i>Bt</i> cotton leaf	80	74
on non- <i>Bt</i> cotton square	63	52
Fall armyworm		
on <i>Bt</i> cotton leaf	61	76
on <i>Bt</i> cotton square	33	25
on non- <i>Bt</i> cotton leaf	76	92
on non- <i>Bt</i> cotton square	45	42

Source: Modified and reprinted with permission from Jenkins et al. 1997.

# Corn Handy Bt trait table

The Handy Bt Trait Table for U.S. Corn Production

Version: March 2024

Currently available trait packages, A-Z (alternate name)	Bag tag code	Proteins in package ***** Font type denotes target: caterpillar or rootworm	Marketed to control:											Species w/ resistance to all Bts in package	Refuge, northern states (higher in south)	Herbicide tolerance (? = check the bag tag)		
			B	C	E	F	S	S	T	W	C	W	C				W	
AcreMax	AM	Cry1Ab Cry1F	x	x	x	x	x	x	x	x						CEW FAW WBC	5% RIB	GLY LL
AcreMax1	AM1	Cry1F Cry34/35Ab1	x	x	x	x	x	x	x	x					x	ECB FAW NCR SWCB WBC WCR	10% RIB 20% ECB	GLY LL
AcreMax Leptra	AML	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x						CEW FAW NCR WBC WCR	5% RIB	GLY LL
AcreMax Xtra	AMX	Cry1Ab Cry1F Cry34/35Ab1	x	x	x	x	x	x	x	x					x	CEW FAW NCR WBC WCR	10% RIB	GLY LL
AcreMax Xtreme	AMXT	Cry1Ab Cry1F Cry34/35Ab1 mCry3A	x	x	x	x	x	x	x	x					x	CEW FAW WBC WCR	5% RIB	GLY LL
Agrisure 3000GT	3000GT	Cry1Ab mCry3A	x	x										x	CEW WCR	20%	GLY LL	
Agrisure 3010 (Agrisure GT/CB/L1)	3010	Cry1Ab	x	x											CEW	20%	GLY LL	
Agrisure Above (Agrisure 3120E2)	AA	Cry1Ab Cry1F	x	x	x	x	x	x	x						CEW FAW WBC	EZ: 5% RIB Renew: 5%	GLY LL?	
AA Refuge Renew (Agrisure 3120)	?	mCry3A												x	WCR	20%	GLY (if GT)	
Agrisure Total (Agrisure 3122E2)	AT	Cry1Ab Cry1F Cry34/35Ab1 mCry3A	x	x	x	x	x	x	x	x					x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Agrisure Viptera 3110	3110	Cry1Ab Vip3A	x	x	x	x	x	x	x	x						20%	GLY LL	
Agrisure Viptera 3111	3111	Cry1Ab Vip3A mCry3A	x	x	x	x	x	x	x	x					x	WCR	20%	GLY LL
Duracade (Agrisure 5122E2)	D	Cry1Ab Cry1F eCry3.1Ab mCry3A	x	x	x	x	x	x	x	x					x	CEW FAW WBC WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera (Agrisure 5222E2)	DV	Cry1Ab Cry1F Vip3A eCry3.1Ab mCry3A	x	x	x	x	x	x	x	x					x	WCR	EZ: 5% RIB Renew: 5%	GLY LL?
Duracade Viptera Z3 (Agrisure 5332E2)	DVZ	Cry1Ab Cry1A.105 Cry2Ab2 Vip3A eCry3.1Ab mCry3A	x	x	x	x	x	x	x	x					x	WCR	EZ: 5% RIB Renew: 5%	GLY LL?
DVZ Refuge Renew (Agrisure 5332)																		
Herculex XTRA	HXX	Cry1F Cry34/35Ab1	x	x	x	x	x	x	x						x	ECB FAW NCR SWCB WBC WCR	20%	GLY LL
Intrasect	YHR	Cry1Ab Cry1F	x	x	x	x	x	x	x						CEW FAW WBC	5%	GLY LL	
Leptra	VYHR	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x	x						5%	GLY LL	
Powercore	PW	Cry1A.105 Cry2Ab2 Cry1F	x	x	x	x	x	x	x						CEW WBC	5%	GLY LL	
Powercore Refuge Adv.	PWRA	Cry1A.105 Cry2Ab2 Cry1F	x	x	x	x	x	x	x						CEW WBC	5% RIB	GLY LL	
Powercore Enlist Refuge Adv.	PWE	Cry1A.105 Cry2Ab2 Cry1F	x	x	x	x	x	x	x						CEW WBC	5% RIB	GLY LL Enlist	
QROME	Q	Cry1Ab Cry1F Cry34/35Ab1 mCry3A	x	x	x	x	x	x	x						x	CEW FAW WBC WCR	5% RIB	GLY LL
SmartStax/Genuity SmartStax	SS SX	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1	x	x	x	x	x	x	x						x	CEW NCR WBC WCR	5%	GLY LL
SmartStax Enlist or SS Enlist Refuge Advanced	SSE	Same as SmartStax	x	x	x	x	x	x	x						x	CEW NCR WBC WCR	5% Adv: 5% RIB	GLY LL Enlist
SmartStax Refuge Adv. or SmartStax RIB Complete	SXRA	Same as SmartStax	x	x	x	x	x	x	x						x	CEW NCR WBC WCR	5% RIB	GLY LL
SmartStax PRO	SSPro	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1 dvSnf7	x	x	x	x	x	x	x						x	CEW WBC	5%	GLY LL
SmartStax PRO Enlist or SSPro Enlist Refuge Advanced	SSPro	Same as SmartStax Pro	x	x	x	x	x	x	x						x	CEW WBC	5% Adv: 5% RIB	GLY LL Enlist
SmartStax PRO Refuge Adv. RIB Complete, or w/RNAi Tech	SSPro	Same as SmartStax Pro	x	x	x	x	x	x	x						x	CEW WBC	5% RIB	GLY LL
Trecepta RIB Complete	TRERIB	Cry1A.105 Cry2Ab2 Vip3A	x	x	x	x	x	x	x							5% RIB	GLY	
Viptera (Agrisure 3220E2)	V	Cry1Ab Cry1F Vip3A	x	x	x	x	x	x	x							EZ: 5% RIB Renew: 5%	GLY LL?	
Vip Refuge Renew (Agrisure 3220)																		
Viptera Z3 (Agrisure 3330E2)	VZ	Cry1Ab Cry1A.105 Cry2Ab2 Vip3A	x	x	x	x	x	x	x							EZ: 5% RIB Renew: 5%	GLY LL?	
VZ Refuge Renew (Agrisure 3330)																		
Vorced Enlist	V	Cry1A.105 Cry2Ab2 Cry1F Cry3Bb1 Cry34/35Ab1 dvSnf7	x	x	x	x	x	x	x						x	CEW NCR WBC	5% RIB	GLY LL Enlist
VT Double PRO	VT2P	Cry1A.105 Cry2Ab2	x	x	x	x	x	x							CEW	5%	GLY	
VT2 PRO RIB Complete	VT2PRIB	Cry1A.105 Cry2Ab2	x	x	x	x	x	x							CEW	5% RIB	GLY	
VT3 PRO RIB Complete	VT3PRIB	Cry1A.105 Cry2Ab2 Cry3Bb1	x	x	x	x	x	x							x	CEW NCR WCR	10% RIB	GLY
VT4 PRO w/RNAi Tech.	VT4PRO	Cry1A.105 Cry2Ab2 Vip3A Cry3Bb1 dvSnf7	x	x	x	x	x	x	x						x		5% RIB	GLY

# Cotton

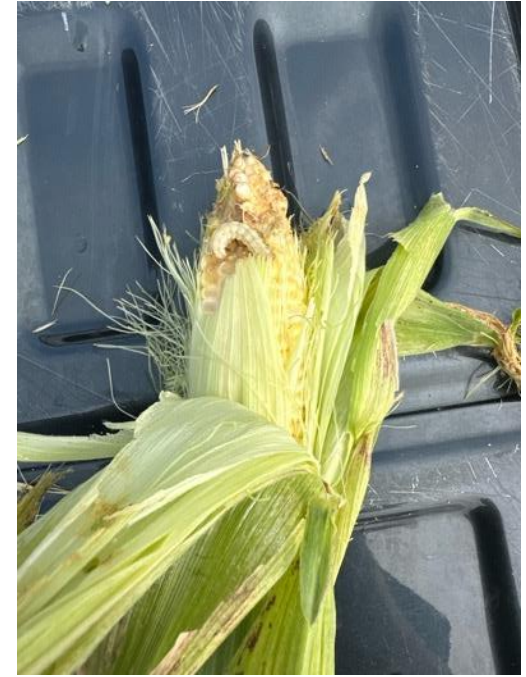
Commercial name	Bt toxins
Bollgard 2	Cry1Ac, Cry2Ab2
Bollgard 3	Cry1Ac, Cry2Ab2, Vip3A
Bollgard 3 Thryvon	Cry1Ac, Cry2Ab2, Vip3A, Cry51Aa2
Twinlink	Cry1Ab, Cry2Ae
Twinlink Plus	Cry1Ab, Cry2Ae, Vip3A
Widestrike 2	Cry1F, Cry1Ac
Widestrike 3	Cry1F, Cry1Ac, Vip3A



# *Helicoverpa zea* (Boddie)

## Corn earworm or Bollworm

- Not a yield limiting pest of field corn under normal conditions, with properly timed planting
- Can be a major yield limiting pest of cotton
- Single-toxin Bt hybrids only provided poor to fair control, pyramided hybrids with better performance initially
- Vip3A only toxin which provides excellent control



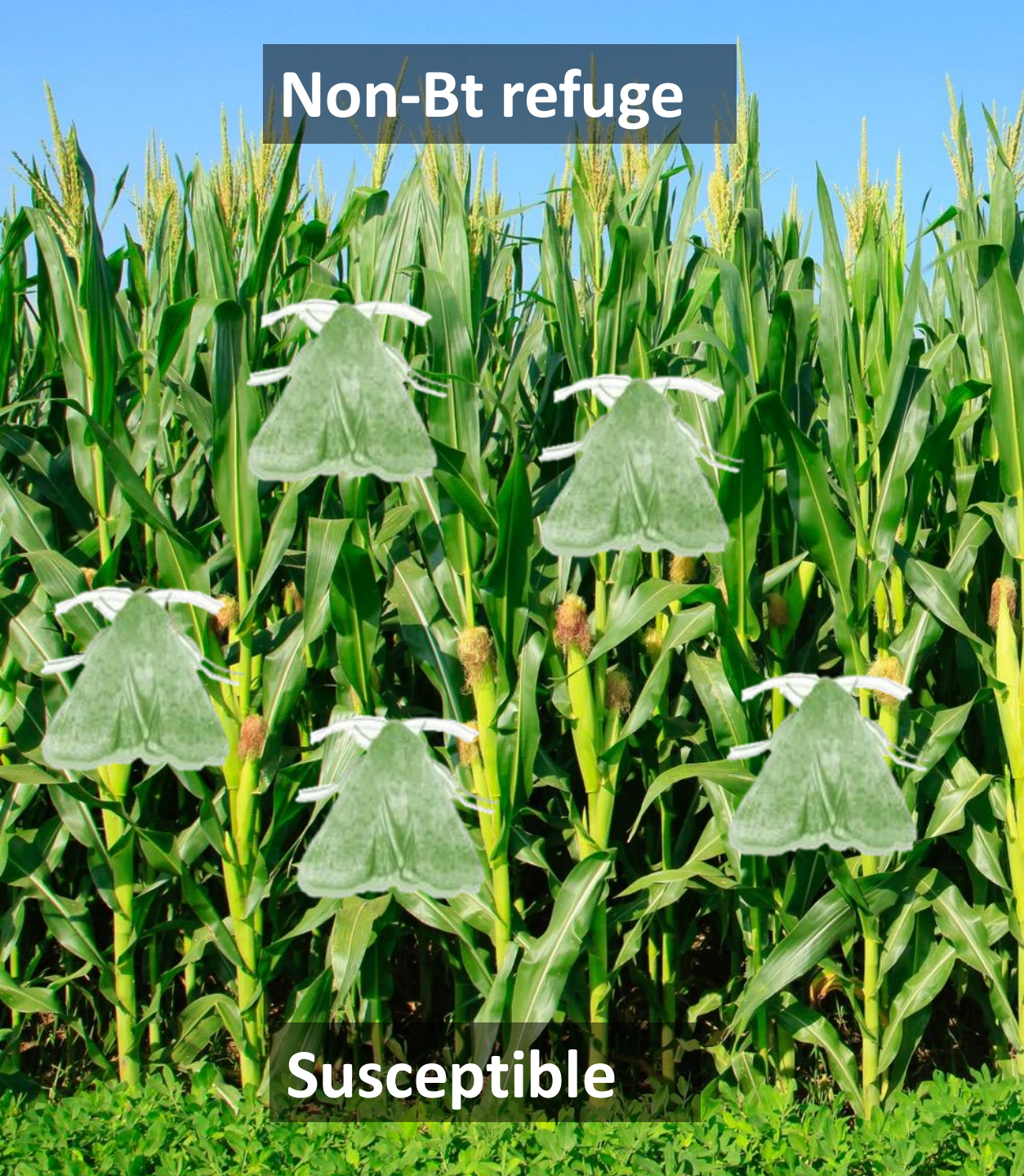


# Vip3a resistance monitoring of corn earworm in field corn and cotton in Virginia (2024)

Location	Source	LC50 (ug/cm2)	Lower FL	Upper FL	Res. Ratio	% mortality at 10 ug/cm2	% inhibition (instar at 10 ug/cm2)
Susceptible	Lab SS-Tx	2.08	1.46	2.91	.	83	
Jasper, FL	Corn	0.58	0.45	0.73	0.28	95	99
Florence, SC	Corn, DKC63-57	0.30	0.22	0.40	0.15	95	99
Blackwell, SC	Corn	0.72	0.57	0.92	0.35	89	97
Tifton, GA	Corn	0.45	0.33	0.62	0.22	86	100
Plains, GA	Corn	1.27	.98	1.66	0.61	81	95
Colquitt, GA	Corn	0.62	0.47	0.822	0.30	91	97
Roper, NC	Hartstack Trap Moth by Cotton/corn fields	0.09	0.07	0.12	0.04	95	98
<b>Suffolk, VA</b>	<b>Non-Bt sweet corn</b>	<b>0.54</b>	<b>0.40</b>	<b>0.72</b>	<b>0.26</b>	<b>81</b>	<b>94</b>
Belle Mina, AL	Non-Bt corn	0.23	0.13	0.38	0.11	80	98

Acknowledgement: **USDA-NIFA EIP** grant # 2024-70006-43753

**Non-Bt refuge**



**Susceptible**

**Bt**

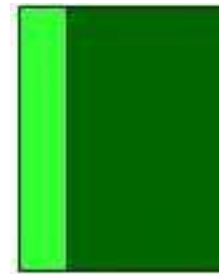


**Resistant**

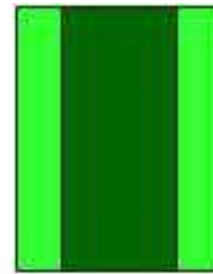
# Refuge in a bag (RIB)



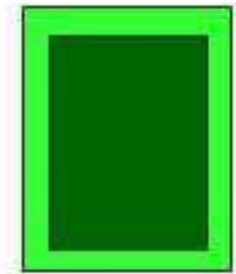
# vs. Structured refuge



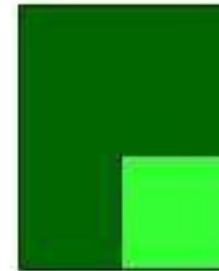
Linear Block



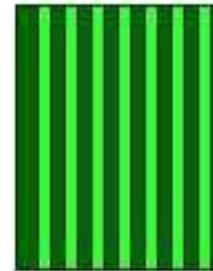
Bracket



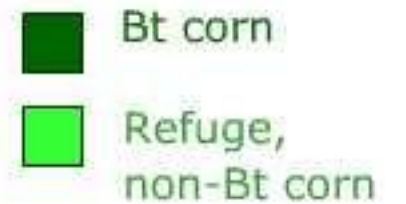
Border  
(Perimeter)



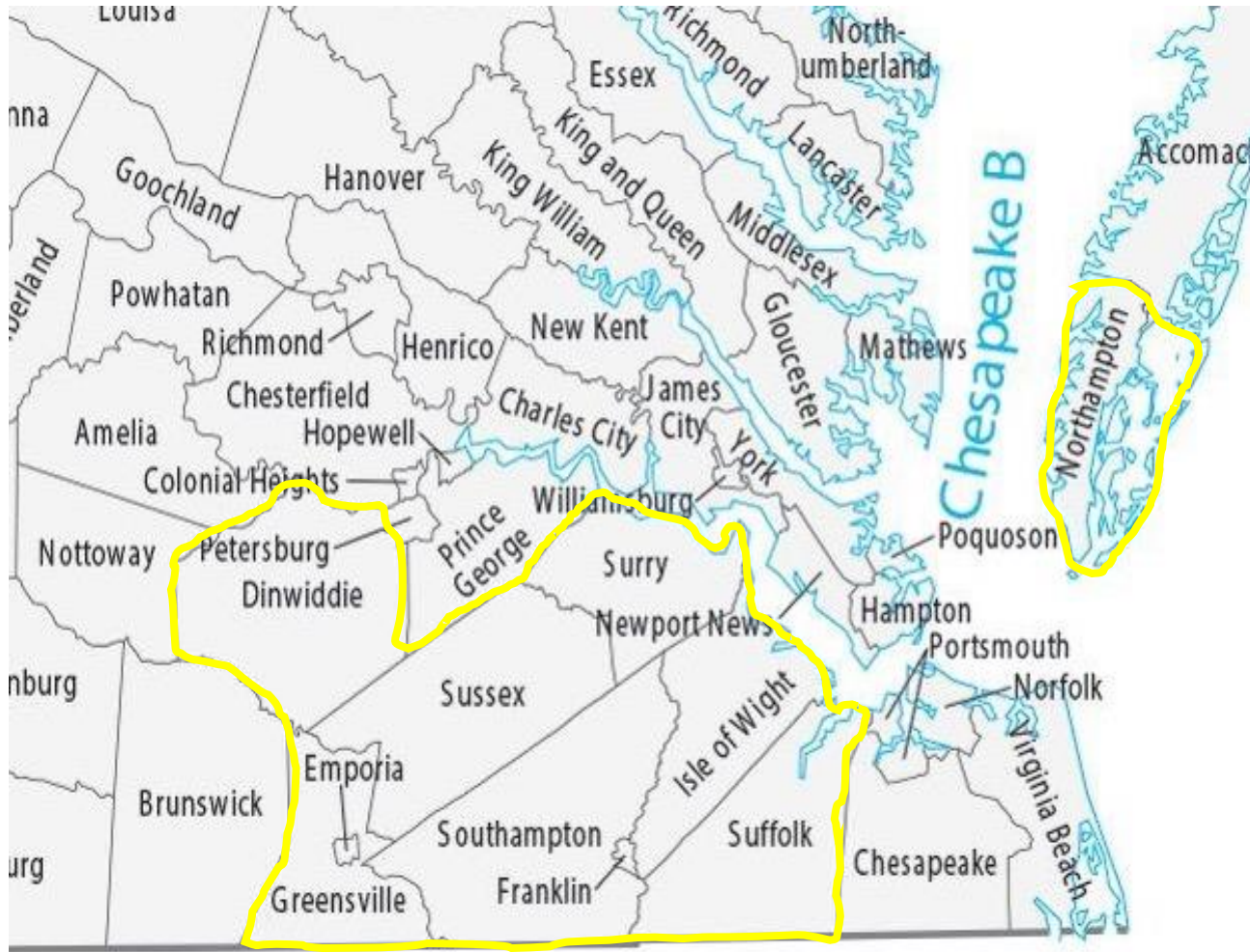
Block



Strips  
(Split Planter)



# Structured refuge requirements in Virginia



**Dinwiddie, Sussex,  
Greensville, Isle of Wight,  
Suffolk, Franklin City, Emporia  
City, Northampton**

20% structured refuge

# How does non-Bt refuge planting impact yield?

**Suffolk, VA results, 2023 (Tidewater AREC; plot size = 0.4 acres)**

Hybrid	Bt trait	% injured ears	Bu/acre
P 1197 YHR	Intrasect	18	204
P 1197 LR	None	28	207
DKC 65-99	Trecepta	0	200
DKC 67-70	None	60	194

## TAREC 2024

Hybrid	Trait	Yield (bu/ac)
DKC 62-05	RR2	130.9
DKC 62-68	RR2	157.0
DKC 63-56	RR2	188.0
DKC 65-93	RR2	182.6
DKC 68-67	RR2	126.4
DKC 68-94	RR2	133.7
DKC 70-25	RR2	169.8
DKC 67-44	VT2P	178.3
DKC 68-35	VT2P	199.6
DKC 66-06	Tre	159.8

# New (potential) pest alerts

## Asiatic garden beetle



## Two spot cotton leafhopper

# PEST ALERT

FDACS-P-02229  
Pest Alert created December 2024

Florida Department of Agriculture and Consumer Services  
Division of Plant Industry

Two-spot cotton leafhopper, Hemiptera: Cicadellidae, Typhlocybinae, Empoascini; *Amrasca biguttula* (Ishida) – A serious pest of cotton, okra and eggplant that has become established in the Caribbean Basin



# MyIPM for Row Crops



Download for Apple



Download for Android

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Virginia Cotton Board  
Cotton Incorporated