

Current insecticide efficacy research in Virginia

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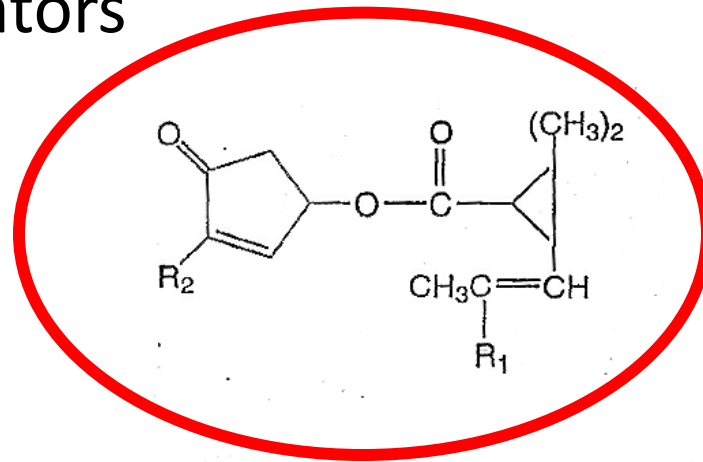


Outline

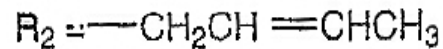
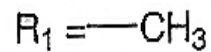
1. Evaluate insecticides for use on organic vegetables
2. Efficacy of sulfoxaflor
3. Efficacy of cyclaniliprole
4. Efficacy of structural pest control products applied to window screens

Pyrethrins

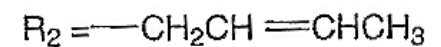
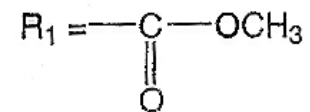
- Derived from chrysanthemum flowers
- Sodium channel modulators
- Knockdown reversible
- Unstable in sunlight



CINERIN I

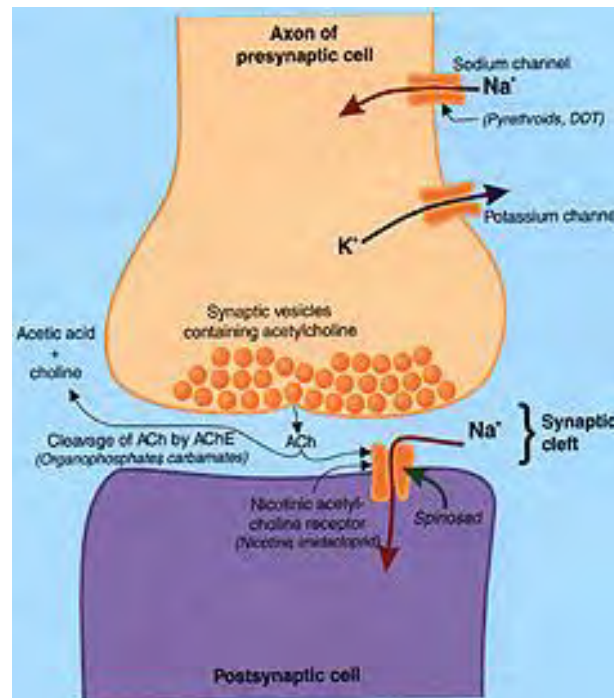
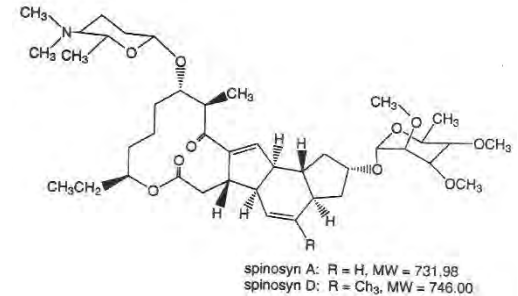


CINERIN II



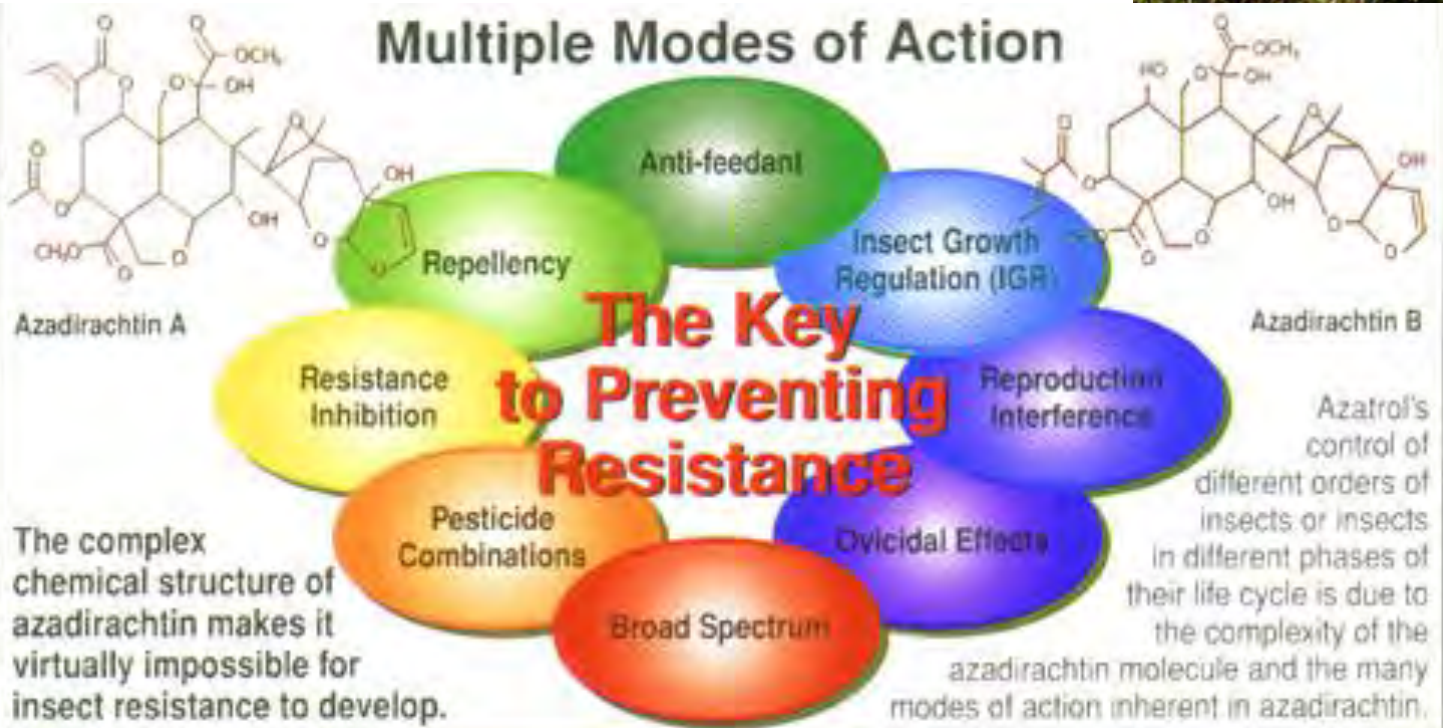
Spinosyns (derived from soil microbes):

- Spinosad
- Fermentation metabolite of actinomycete
 - *Saccharopolyspora spinosa*
 - Soil-inhabiting micro-organism found in the Carribean Islands
 - Mixture of two molecules spinosyns A & B
- Disrupts binding of acetylcholine in nicotiny receptors



Azadirachtins

- Derived from neem tree



Sabadilla

- Veratran D (MGK Inc.)
- Seeds from the South American lily plant *Schoenocaulon officinale*
- A complex group of alkaloids known collectively as **veratrine** are the active ingredients



Some biological insecticide options for organic growers

Veratran D (MGK)	Sabadilla alkaloids (.20%)
Pyganic (MGK)	Pyrethrins (5%)
Entrust SC (Dow Agrosciences)	Spinosad (22.5%)
Azera (MGK)	Azadiractins (1.2%) + Pyrethrins (1.4%)
Aza-Direct (Gowan)	Azadiractins (1.2%)
M Pede (Gowan)	Potassium salts of fatty acids (49%)
Venerate XC	Burkholderia (94.4%)(Chromobacteria)

Bean & filter paper dip bioassays



TRT	Active ingredient	Rate / Acre	Bean Dip			
			Adult (n=20)		Nymph (n=20)	
			Average % Mortality at		Average % Mortality at	
			24h	48h	24h	48h
UTC		0	0.0%	1.3%	5.0%	11.1%
Veratran D	Sabadilla Alkaloids (.20%)	240 oz	57.5%	57.5%	21.0%	59.0%
Pyganic	Pyrethrins (5%)	17 fl oz	82.5%	70.0%	47.5%	30.0%
Blackhawk	Spinosad (33%)	2.2 oz	42.5%	45.0%	17.0%	23.5%
Azera	Azadiractin (1.20%), Pyrethrin (1.40%)	56 fl oz	65.0%	50.0%	22.0%	23.0%
Aza-Direct	Azadiractin (1.20%)	56 fl oz	0.0%	5.0%	10.0%	10.0%
M Pede	Potassium salts of fatty acids (49%)	86 fl oz	5.0%	7.5%	0.0%	0.0%
Neudorff 1138	K Salts + Spinosad	86 fl oz	25.0%	22.5%	30.0%	45.0%
Venerate XC	Burkholderia (94.4%)	215 fl oz	12.5%	20.0%	0.0%	0.0%

Efficacy of organic insecticides for the control of BMSB in bell peppers, Blacksburg, VA 2014. Insecticides were applied 19, 25 Aug and 3 and 9 Sept (Kuhar data)

Treatment	Rate / Acre	% fruit with stink bug damage	
		29-Aug	17-Sep
UTC	-	10.0	18.8 A
Veratran D (sabadilla)	240 oz	7.5	1.3 B
Pyganic (pyrethrins)	17 fl oz	5.0	2.5 B
Blackhawk (spinosad)	2.2 oz	6.3	5.0 B
Azera (pyrethrins + azadirachtins)	56 fl oz	15.0	0.0 B
Aza-direct (azadirachtins)	56 fl oz	13.8	3.8 B
M Pede (K salts of fatty acids)	86 fl oz	15.0	2.5 B
Neudorff 1138 (K salts + spinosad)	86 fl oz	17.5	1.3 B
Venerate (Burkholderia Chromobacteria)	215 fl oz	26.3	3.8 B
P- Value from ANOVA		ns	0.0162

Efficacy of organic insecticides for the control of BMSB in tomatoes, Blacksburg, VA 2014. Insecticides were applied 19, 25 Aug and 3 and 9 Sept (Kuhar data)

% fruit with stink bug damage

Treatment	Rate / Acre	29-Aug	8-Sep	12-Sep	Cumulative average % damage
UTC	-	31.3	39.0	31.0	33.8
Veratran D (sabadilla)	240 oz	30.0	21.0	15.0	22.0
Pyganic (pyrethrins)	17 fl oz	20.0	37.0	20.0	25.7
Blackhawk (spinosad)	2.2 oz	42.5	33.0	29.0	34.8
Azera (pyrethrins+ azadirachtins)	56 fl oz	22.5	26.0	15.0	21.2
Aza-direct (azadirachtins)	56 fl oz	23.8	40.0	27.0	30.3
M Pede (K salts of fatty acids)	86 fl oz	23.8	32.0	6.0	20.6
Neudorff 1138 (K salts + spinosad)	86 fl oz	25.0	25.0	27.0	25.7
Venerate (Burkholderia Chromobacteria)	215 fl oz	25.0	21.0	26.0	24.0
P- Value from ANOVA		ns	ns	ns	ns

Conventional Insecticide Research on Vegetables

- Ongoing research to identify more IPM-friendly chemical control alternatives.



Sulfoxaflor

- New sap-feeding insecticide from Dow Agrosiences (2013)
- Closer 2SC™ for fruit and veggies
Transform 50WG™ for field crops
- IRAC classification of 4C . A nicotinic acetylcholine receptor agonist that binds at an entirely different site than the neonicotinoids (4A) or nicotine (4B)
- No cross-resistance to neonicotinoids or nicotine
- Demonstrated toxicity against several hemipteran pests such as aphids, leafhoppers, and Lygus bugs

Sulfoxaflor bean/leaf dip bioassays

Blacksburg, VA 2013-14



- Efficacious on harlequin bug & kudzu bug at ≥ 218 ppm
- Less toxic to BMSB, only killing 36-37% of bugs at 436 ppm
- Recommended Closer 2SC rate: 4.5 fl oz/A = 0.3 ppm

Concentration (ppm)	Harlequin bug		Brown marmorated stink bug		Kudzu bug	
	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
0	2.5	10.0	3.7	5.0	17.4	0.0
0.001	-	-	-	7.5	-	-
0.01	-	-	-	7.5	-	-
0.1	-	-	-	27.5	-	-
1	10.0	-	4.8	5.0	11.9	-
10	27.5	25.0	15.0	5.0	22.2	7.4
218	75.0	92.5	20.8	7.5	58.5	66.0
436	70.0	97.5	37.0	36.4	58.5	84.1

Sulfoxaflor bean dip bioassays on bugs, Blacksburg, VA 2013-14

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0	2.5	10.0	3.7	5.0	17.4	0.0
0.001	-	-	-	7.5	-	-
0.01	-	-	-	7.5	-	-
0.1	-	-	-	27.5	-	-
1	10.0	-	4.8	5.0	11.9	-
10	27.5	25.0	15.0	5.0	22.2	7.4
218	75.0	92.5	20.8	7.5	58.5	66.0
436	70.0	97.5	37.0	36.4	58.5	84.1

Field tests on bell Peppers

Blacksburg, VA, 2012

(Foliar treatments were applied on 6, 14, 21, and 29 Aug)

Treatment	Rate Fl. oz/ acre	% stink bug damage		
		16-Aug	23-Aug	5-Sep
UTC		42.5 a	30.0	30.0
Scorpion 3.24 EC	5.0	15.0 b	8.75	10.0
Closer 2SC	1.5	16.25 b	16.25	17.5
Closer 2SC	2.0	12.5 b	18.75	12.5
P-Value from ANOVA		0.0324	ns	ns

Field tests on bell peppers 2013, Blacksburg, VA (4 weekly sprays)

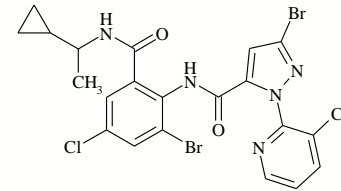
		% stink bug damage to peppers	
Treatment	Rate / acre	12-Aug	4-Sep
Untreated Control		15.0	7.5
Belay 2.13SC + NIS	6 fl. oz + 0.25% v/v	2.5	7.5
Danitol 2.4EC + NIS	21 fl. oz + 0.25% v/v	3.8	6.3
Closer 2SC + NIS	3 fl. oz + 0.25% v/v	2.5	3.8
Closer 2SC + NIS	5 fl. oz + 0.25% v/v	5.0	2.5

NS

NS



CYCLANILIPROLE 50SL



- IRAC Group 28

GROUP	28	INSECTICIDE
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 - Anthranilic diamide
 - Ryanodine receptor modulator
- Experimental: IKI-3106 50SL
- Broad spectrum control
- Highly effective against Lepidopteran, Dipteran, and Coleopteran pests at low use rate
- Long residual activity
- Manufactured by Ishihara Sangyo Kaisha, Ltd.



CYCLANILIPROLE 50SL

- Submitted for registration in US and CAN
- Registration expected 1Q 2016
- Labeled for key pests of:
 - Pome Fruits
 - Stone Fruits
 - Tree Nuts
 - Grapes
 - Fruiting Vegetables
 - Brassica Leafy Vegetables
 - Leafy Vegetables
 - Cucurbits

Side effects of Cyclaniliprole on beneficial arthropods



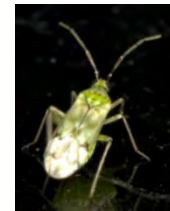
Phytoseiulus persimilis



Neoseiulus californicus



Orius strigicollis



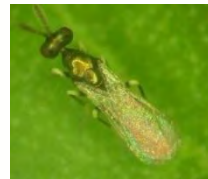
Amblyseius californicus



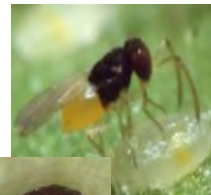
Chrysopa intima



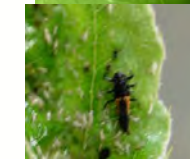
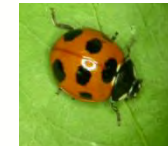
Aphidius colemani



Diglyphus isaea



Encarsia formosa



Harmonia axyridis

Cyclaniliprole has no to moderate impact on beneficial arthropods

Cyclaniliprole bioassays – harlequin bug: collard leaf dip



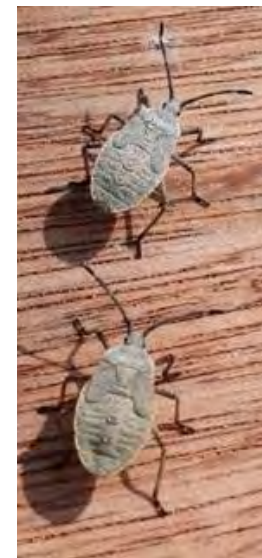
Treatment	Product field rate (fl oz/A)	Conc. (g ai/liter)	% mortality (at 48 hr)		
			Eggs (% not hatching) (n = 48)	Nymphs (n = 20)*	Adults (n = 20)*
UTC		0	16.7	10.0 c	5.0 b
Cyclaniliprole 50SL	11.00	0.127	14.6	63.8 b	95.0 a
Cyclaniliprole 50SL	16.40	0.190	14.6	100.0 a	90.0 a
Cyclaniliprole 50SL	22.00	0.254	71.8	100.0 a	80.0 a
Coragen 1.67 SC	5.00	0.244	45.8	30.0 c	4.2 b

Field efficacy test on collards

Blacksburg, VA, 2014

Treatment	Rate / acre	Mean no. harlequin bugs / 10 plants			
		Adult	Nymphs	Adult	Nymphs
		27-Oct (5 DAT)		30-Oct (8 DAT)	
Untreated control		10.0 a	2.5	8.8 a	2.5
Cyclaniliprole 50SL	11 fl. oz	4.5 ab	1.5	2.5 b	0.3
Cyclaniliprole 50SL	16.4 fl. oz	1.0 b	0.0	2.8 b	0.5
Cyclaniliprole 50SL	22 fl. oz	0.3 b	0.5	2.0 b	1.3
Coragen 1.67SC	5 fl. oz	5.3 ab	0.3	4.0 ab	0.5
P-Value from Anova		0.0246	ns	0.0153	ns

Cyclaniliprole bioassays – Squash bug: squash slice dip



Treatment	Product field rate (fl oz/A)	Conc. (g ai/liter)	% mortality (at 48 hr)
			Nymphs (n = 20)*
UTC		0	0.0 c
Cyclaniliprole 50SL	11.00	0.127	50.0 ab
Cyclaniliprole 50SL	16.40	0.190	55.0 a
Cyclaniliprole 50SL	22.00	0.254	65.0 a
Coragen 1.67 SC	5.00	0.244	20.0 bc

Cyclaniliprole bioassays – BMSB: squash slice dip



Treatment	Product field rate (fl oz/A)	Conc. (g ai/liter)	% mortality (72 hrs)	
			Nymphs 3 rd & 4 th instars (n = 20)	Adults (n = 20)
UTC		0	10.0 a	5.0 a
Cyclaniliprole 50SL	11.00	0.127	70.0 b	30.0 ab
Cyclaniliprole 50SL	16.40	0.190	95.0 c	45.0 b
Cyclaniliprole 50SL	22.00	0.254	100.0 c	40.0 b
Coragen 1.67 SC	5.00	0.244	25.0 a	10.0 a

Home Grounds and Animals

ENTO-36P

2014

PEST MANAGEMENT GUIDE

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Table 6.3 - Recommended Use (cont.)

Pests	Prevention	Pesticide	Application
Brown marmorated stink bugs (BMSB)	Stink bugs begin aggregating on structures soon after the first cool day in September. Prior to September plug openings in windows and vents that provide entry to these bugs.	Perimeter applications made during the first week of September: Fipronil (Termidor) ¹ Imidacloprid (Premise) ¹ Indoxacarb (Ariion) ¹	Indoors: Vacuum up individual insects, but be aware stink bugs will make the vacuum smell strongly of their odor. Outdoor: Well timed perimeter applications may help to reduce bugs indoors but cannot eliminate entry in most cases.

Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy

Treatment	Trade Name	Manufacturer	A.I.	Concentration	Rate to Mix
1	Untreated Control	n/a	n/a	0.00%	n/a
2	Demand	Syngenta	lambda cyhalothrin	9.70%	24mL/gal
3	Tandem	Syngenta	thiamethoxam + lambda cyhalothrin	11.6% + 3.5%	32mL/gal
4	Tempo	Bayer	betacyfluthrin	20%	16mL/gal
5	Temprid	Bayer	imidacloprid + cyfluthrin	21% + 10.5%	16mL/gal
6	Fenvastar Plus	Rockwell Labs	esfenvalerate	8.40%	24.5mL/gal
7	Termidor	BASF	fipronil	9.10%	47.3mL/gal
8	Premise 2	Bayer	imidacloprid	75%	17.7mL/gal
9	Alpine	BASF	dinotefuran	40%	30g/gal
10	Arilon	DuPont	Indoxacarb	20%	18.71g/gal

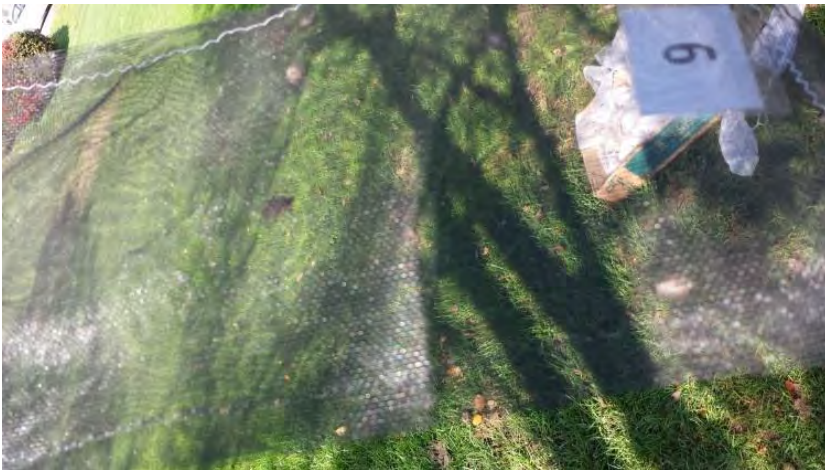
Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy



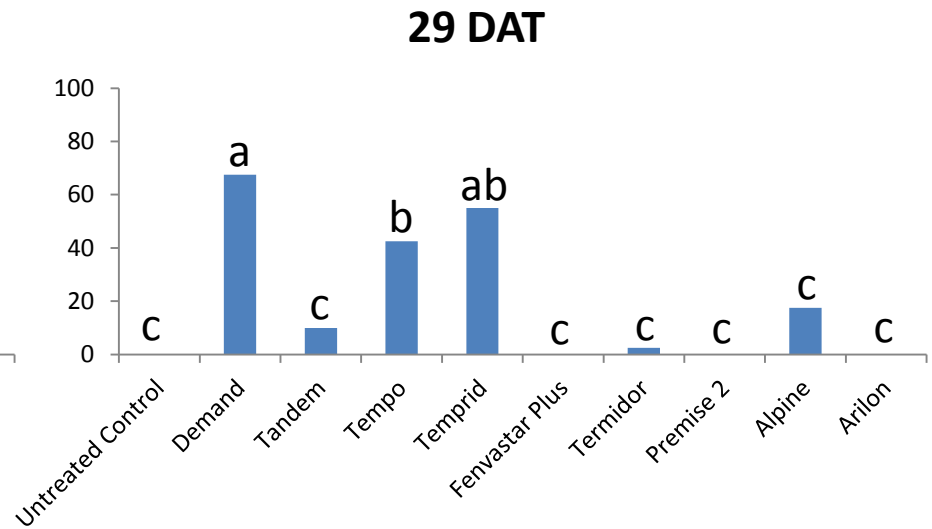
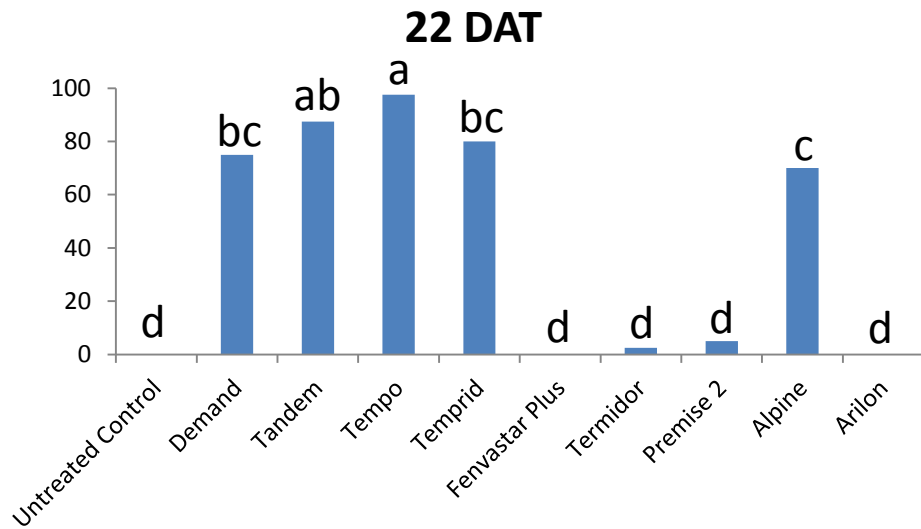
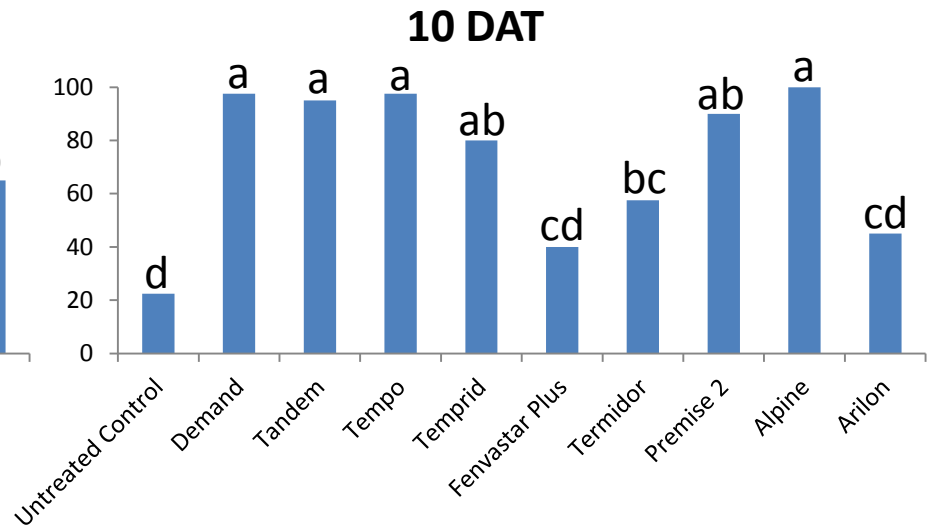
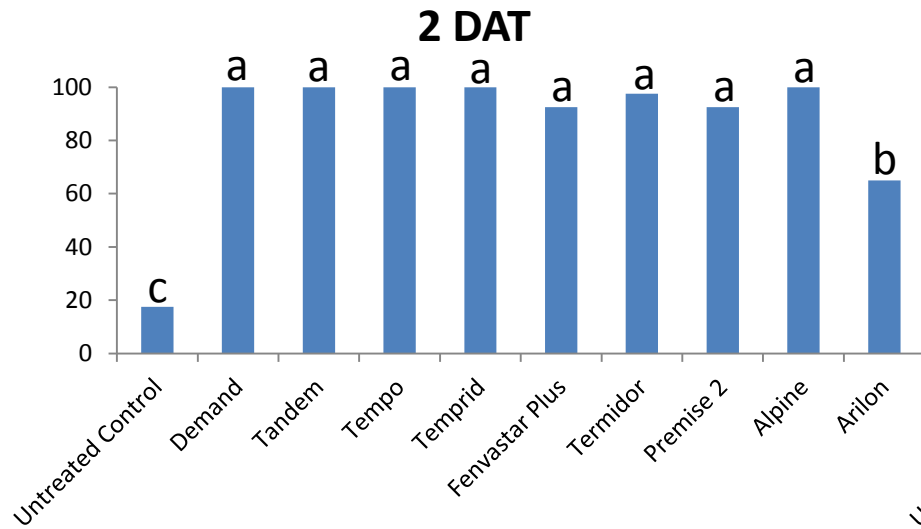
- 9 Insecticides labeled for pest management professionals (PMP's) to apply
- Each screen 20.32 cm x 40.64 cm
- Completely randomized design
- Exposed to ambient conditions from 0 DAT (Sept 24, 2014)
- Mortality assessed after 48h of continuous exposure



Evaluating Dip Treated Window Screen for Activity and Residual Field Efficacy

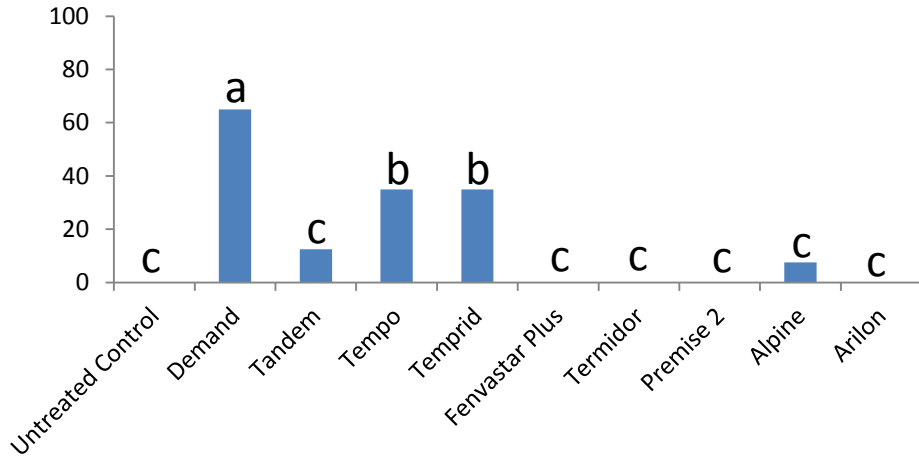


2014 Results

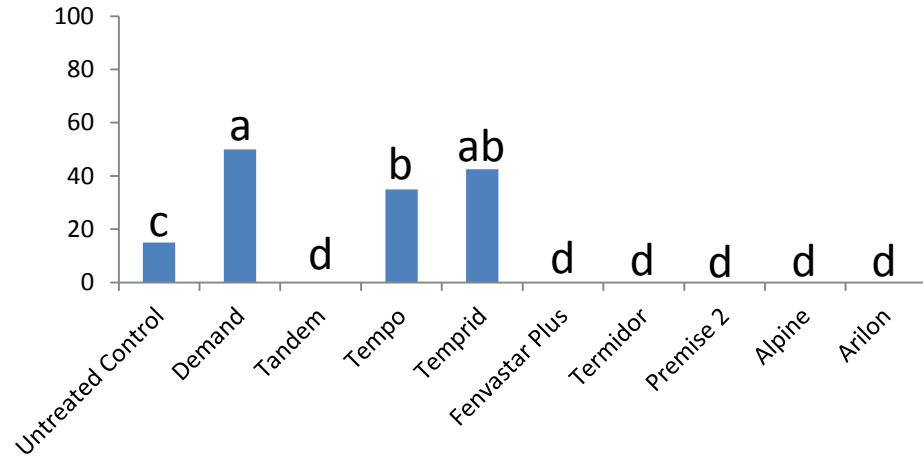


2014 Results

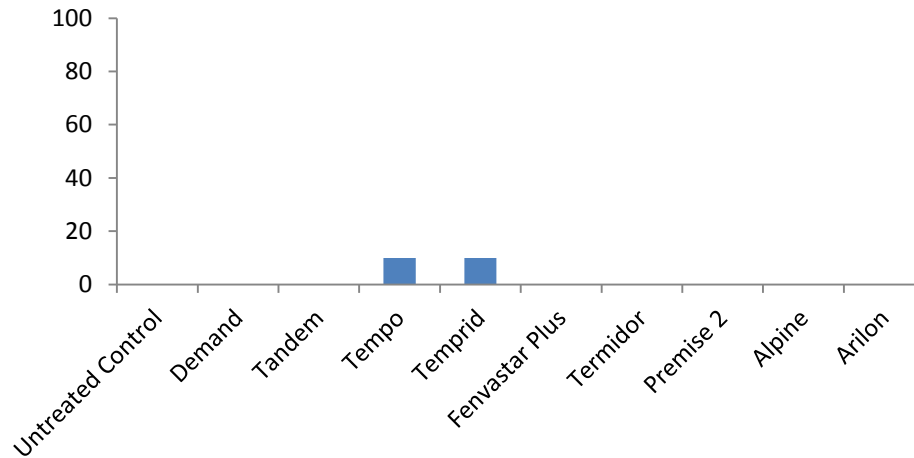
37 DAT



44 DAT



54 DAT



Summary

- Application to screens seems to be an effective delivery method
- Residual Activity
 - Lambda cyhalothrin (Demand)
 - >50% mortality for >44 days
 - Imidacloprid + cyfluthrin (Temprid)
 - >50%~29 days
 - Beta-cyfluthrin (Tempo)
 - ~44 days residual but low activity past 22 days
- Update Virginia Recommendations Guide?