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Section C: Small Fruits

SOUTHERN HIGHBUSH BLUEBERRY: *Vaccinium corymbosum*, L. X *Vaccinium darrowi*

Efficacy Test of Various Insecticides to Control *Scirtothrips dorsalis* in Southern Highbush Blueberries

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Blueberry | *Vaccinium* spp.

Chilli thrips | *Scirtothrips dorsalis*

This experiment tested the efficacy of four insecticides for controlling *S. dorsalis* in southern highbush blueberry. The treatments and rates were Apta™ 15SC (tolfenpyrad) at 27 oz/acre, Assail 30SG (acetamiprid) at 5.3 oz/acre, Delegate WG (spinetoram) at 7 oz/acre, Sivanto Prime (flupyradifurone) at 14 oz/acre, Sivanto Prime with Induce (a nonionic adjuvant, 0.25% v:v) and a non-treated control. All insecticides were used at the recommended label rate for the crop. The experiment was conducted in two blueberry fields, located in Plant City, FL and Clermont, FL with southern highbush cultivars: cv. 'Arcadia' and 'Jewel', respectively. The experimental design was complete randomized block with six treatments and four replicates. Each plot consisted of five blueberry bushes separated by at least two buffer bushes and a buffer row. Applications were made with a CO_2 backpack sprayer, using 2-liter plastic bottles. The sprayer was calibrated to deliver 50 gal of volume per acre at 40 psi, using a double-nozzle hand-held wand sprayer yielding 200 ml of volume per bush. Treatments were applied between 8 and 10 AM when thrips activity was low. In both field locations, treatments were applied twice, first on Jun 14, 2019 and second on Jun 28, 2019. Data were collected on Jun 14, 17, 21, 28, Jul 1 and 5 (0, 3, 7, 14, 17, and 21 DAT, respectively). Plant damage rating (0–4 scale: 0, no damage; 1, <10% bronzing of leaf and petiole; 2, 10–30% damage (bronzing); 3, 31–60% damage (bronzing and curling); and 4, >60% damage (bronzing, curling and darkening) and leaf samples, from inner three blueberry bushes from each plot. Six young blueberry shoots containing 5–6 leaves were collected in Ziploc bags, stored in cooler and transported to Small Fruits IPM lab in Wimauma, FL for processing the samples. Samples were washed with 70% ethanol solution to dislodge thrips from leaves and filtered through fine nylon mesh cloth. Thrips were identified as *Scirtothrips dorsalis*, then adults and larvae were counted. An ANOVA was conducted using generalized linear mixed model with block as random effect and sample date as repeated measure in SAS 9.4 (SAS Institute Inc. 2018). Damage ratings were fitted to normal distribution and thrips counts were fitted to Poisson distribution with *log* link. Thrips count and standard error of mean shown in table are back-transformed obtained through *ilink* function in SAS 9.4 and standard errors of the estimate of the mean are approximate values obtained by applying the delta method. Tukey's HSD test was used for post hoc mean comparisons.

Tolfenpyrad and spinetoram significantly suppressed *S. dorsalis* adults and larvae compared to non-treated control, although effects were variable for two cultivars, two thrips stages and sampling dates (Table 1). Prior to insecticide application on Jun 14, there were no differences in *S. dorsalis* adults and larvae and damage ratings among treatments. In leaf samples, there were a greater number of larvae than adults. *Scirtothrips dorsalis* adults and larvae were significantly affected by treatment and sample date and their interaction. The effect of insecticides on *S. dorsalis* adults and larvae did not differ among sample dates except in the field with cv. 'Jewel' where larval population among treatments differed only on Jun 28 (14 DAT); Assail had fewer larvae than non-treated control on this date. All other samples were pooled across sampling dates to compare the seasonal mean values. Delegate had significantly fewer adults and larva than non-treated control in the field with cv. 'Arcadia' for the seasonal mean, whereas in field with cv. 'Jewel', Apta had significantly fewer adults than non-treated control. In both cases, the effects of Apta and Delegate were similar on adults and larva on seasonal means. Although the effect of Sivanto was not significantly different from non-treated control, it did better when applied without adjuvant.

Plants treated with insecticides had significantly less damage than control at seasonal means, except in field with cv. 'Jewel' where Sivanto+adjuvant had similar damage as control plots (Table 2). Delegate in both fields and Apta in field with cv. 'Jewel' accounted for lowest amount of damage than all other treatments. The amount of damage in plants receiving Delegate was significantly lower than control plots on Jun 17 (3 DAT) and 21 (7

DAT) but was not different on Jun 28 (14 DAT). After the second foliar insecticide application on Jun 28, plants sprayed with Delegate were able to overcome damage, and damage was significantly lower than control plots on Jul 1 (17 DAT) and 5 (21 DAT). The amount of damage in plants receiving Apta was consistently lower than control plots except on Jun 17 (3 DAT) in field with cv. 'Jewel', where damage was similar with control plots. Both Apta and Delegate performed better than other insecticides, although Apta performed better in field with cv. 'Jewel' compared to cv. 'Arcadia'. No phytotoxicity was observed.[1]

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Table 1.

Treatment	Rate per acre (oz)	Number of chilli thrips per shoot sample (SEM)					
		3 DAT	7 DAT	14 DAT[a]	17 DAT	21 DAT	Seasonal mean
Stage=adult cv. 'Arcadia'							
Apta	27	0.04 (0.04)	0.88 (0.22)	0.63 (0.18)	0.08 (0.07)	0.58 (0.18)	0.26 (0.09)ab
Assail	5.3	0.21 (0.11)	0.63 (0.18)	0.42 (0.15)	0.88 (0.22)	0.42 (0.15)	0.46 (0.09)ab
Delegate	7	0.04 (0.05)	0.38 (0.14)	0.50 (0.16)	0.04 (0.04)	0.21 (0.11)	0.15 (0.06)b
Sivanto	14	0.25 (0.12)	0.79 (0.20)	0.42 (0.15)	0.79 (0.20)	0.25 (0.12)	0.44 (0.09)ab
Sivanto+adjuvant	[b]	0.33 (0.13)	0.75 (0.20)	0.58 (0.18)	0.54 (0.17)	0.33 (0.13)	0.48 (0.09)ab
Control	-	0.21 (0.11)	0.96 (0.23)	1.08 (0.24)	0.67 (0.19)	0.79 (0.20)	0.65 (0.12)a
F		1.55	1.20	2.99	5.51	0.89	2.75
P		0.23	0.35	0.04	0.00	0.51	0.02
Stage=adult cv. 'Jewel'							
Apta	27	0.20 (0.12)	0.36 (0.17)	0.56 (0.22)	0.08 (0.07)	0.48 (0.20)	0.27 (0.10)b
Assail	5.3	0.67 (0.25)	0.56 (0.22)	0.79 (0.27)	0.67 (0.25)	0.99 (0.32)	0.72 (0.18)a
Delegate	7	0.12 (0.09)	0.32 (0.16)	0.67 (0.25)	0.75 (0.26)	0.75 (0.26)	0.43 (0.13)ab
Sivanto	14	0.64 (0.24)	0.75 (0.26)	0.71 (0.26)	0.36 (0.17)	1.03 (0.33)	0.66 (0.17)ab
Sivanto+adjuvant	[b]	0.71 (0.26)	0.87 (0.29)	0.91 (0.30)	0.60 (0.23)	0.87 (0.29)	0.78 (0.19)a
Control	-	0.52 (0.21)	0.91 (0.30)	0.91 (0.30)	0.44 (0.19)	1.27 (0.38)	0.75 (0.19)a
F		1.55	2.26	0.55	1.63	1.46	2.96
P		0.23	0.10	0.74	0.21	0.26	0.02
Stage=larva cv. 'Arcadia							
Apta	27	0.33 (0.23)	1.61 (0.53)bc	2.72 (0.71)ab	1.07 (0.43)	3.17 (0.78)ab	1.37 (0.32)ab
Assail	5.3	0.04 (0.08)	2.10 (0.61)a-c	4.16 (0.91)ab	2.35 (0.65)	3.59 (0.83)ab	1.25 (0.55)ab
Delegate	7	0.66 (0.33)	0.49 (0.29)c	1.40 (0.49)b	0.87 (0.38)	1.73 (0.55) b	0.93 (0.24)b
Sivanto	14	0.08 (0.12)	3.59 (0.83)ab	3.59 (0.83)ab	1.73 (0.55)	3.05 (0.76)ab	1.41 (0.47)ab
Sivanto+adjuvant	[b]	0.33 (0.23)	5.11 (1.03)a	4.20 (0.92)ab	3.50 (0.82)	2.93 (0.74)ab	2.36 (0.49)a
Control	-	0.62 (0.32)	4.33 (0.93) ab	5.81 (1.12)a	3.13 (0.77)	5.32 (1.06) a	3.04 (0.54)a
F		2.93	5.22	2.35	5.32	2.14	4.97
P		0.05	0.01	0.09	0.01	0.12	0.00
Stage=larva cv. 'Jewel'							
Apta	27	0.24 (0.18)	0.55 (0.29)	5.66 (1.46)ab	0.43 (0.26)	2.16 (0.70)	0.93 (0.28)
Assail	5.3	0.24 (0.18)	2.24 (0.72)	2.47 (0.77)c	0.63 (0.32)	3.73 (1.05)	1.25 (0.36)
Delegate	7	0.16 (0.15)	0.51 (0.28)	3.61 (1.02)bc	0.82 (0.37)	3.61 (1.02)	0.97 (0.31)
Sivanto	14	0.31 (0.21)	1.02 (0.43)	5.85 (1.50)ab	0.16 (0.15)	2.55 (0.79)	0.94 (0.31)
Sivanto+adjuvant	[b]	0.39 (0.24)	1.57 (0.56)	7.66 (1.88)a	0.86 (0.38)	2.47 (0.77)	1.59 (0.42)
Control	-	0.67 (0.33)	1.14 (0.46)	6.64 (1.67)ab	0.35 (0.23)	3.34 (0.96)	1.43 (0.39)
F		1.59	2.70	2.87	1.77	1.12	1.34
P		0.22	0.06	0.04	0.18	0.39	0.26

Means followed by same letters within the same columns are not significantly different according to Tukey's HSD. Means in columns with no letters are not significantly different from each other.

[a]Second spray date.

[b]0.25% v.v adjuvant.

Table 2.

Treatment	Rate per acre (oz)	Mean damage rating (0–4 scale[a])					
		3 DAT	7 DAT	14 DAT[b]	17 DAT	21 DAT	Seasonal mean
cv. Arcadia							
Apta	27	0.6c	0.6c	0.4b	0.5c	0.5b	0.5cd
Assail	5.3	1b	1b	0.4b	0.5c	0.3b	0.6c
Delegate	7	0.4c	0.2d	0.6ab	0.3c	0.3b	0.4d
Sivanto	14	1.3a	1.2b	0.6ab	1ab	0.5b	0.9b
Sivanto+adjuvant	[c]	1.2ab	1.7a	0.8a	0.9b	0.6b	1.1b
Control	-	1.4a	1.9a	0.6ab	1.3a	1.1a	1.3a
F		17.84	46.45	2.68	14.96	9.40	72.42
P		0.000	0.000	0.025	0.000	0.000	0.000
cv. Jewel							
Apta	27	1.8a–c	0.4c	0.1a	0.2d	0.2bc	0.6d
Assail	5.3	1.7c	1.2ab	0.2a	1ab	0.4a-c	0.9bc
Delegate	7	1.5c	0.4c	0.2a	0.4cd	0.2c	0.5d
Sivanto	14	1.8bc	0.9b	0.2a	0.7bc	0.6a–c	0.8c
Sivanto+adjuvant	[c]	2.2ab	1ab	0.4a	1.3a	0.6ab	1.1ab
Control	-	2.3a	1.4a	0.4a	0.8bc	0.8a	1.1a
F		5.20	9.54	1.10	9.51	3.33	24.52
P		0.000	0.000	0.364	0.000	0.007	0.000

Means followed by same letters within the same columns are not significantly different according to Tukey's HSD.

[a]Damage ratings (scale of 0 = no damage, 1 = <10%, 2 = 10–30%, 3 = 31–60%, and 4 = >60% damage).

[b]second spray date.

[c]0.25% v.v adjuvant.