Winter squash *Cucurbita maxima* Duchesne, 'Blue Hubbard'

OXFORD

Laboratory Bioassay Evaluation of Insecticides Allowed for Organic Production Against Striped Cucumber Beetle, 2015

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Gourd (pumpkin, squash) | *Cucurbita* spp.

Striped cucumber beetle | *Acalymma vittatum* (Fabricius)

This trial was conducted to evaluate insecticides allowed for organic production. Blue Hubbard winter squash (*Cucurbita maxima*) was grown out of doors in flats using certified organic potting soil (Fort Light, Vermont Compost Company, Montpelier, VT) until first to second true leaf stage. Individual cotyledons were excised from the plants and dipped in premixed treatment solutions. Treatments included as follows: Azera (1.4% pyrethrin plus 1.2% azadirachtin), Grandevo (*Chromobacterium substugae* strain PRAA4-1 and spent fermentation media), Venerate (heat-killed *Burkholderia* spp. strain A396 cells and spent fermentation media), Veratran (Sabadilla alkaloids), each treatment above with the addition of Cidetrak (buffalo gourd root powder), and an untreated control. Each solution was amended with the adjuvant NuFilm P (Miller Chemical and Fertilizer, LLC) at 1.7 ml/L. Untreated checks were cotyledons dipped in water with the same concentration of adjuvant. The treated cotyledons were then placed on a piece of moistened filter papers within clear polystyrene arenas (7 × 7 × 3 cm) before digital photography of the top surface of the cotyledon. Ten field-collected striped cucumber beetles were introduced into each of the arenas, which were then sealed with a plastic cap with a mesh-covered portal to allow air exchange. Beetle mortality was evaluated after 24 h and each cotyledon was digitally photographed before and after exposure to beetles to allow calculation of the percentage of leaf area consumed by beetles. The total cotyledon area and the area consumed by beetles were quantified by using NIH ImageJ software (Rasband, W.S., ImageJ, U.S. National Institutes of Health,

Bethesda, Maryland, USA, http://imagej.nih.gov/ij/, 1997–2015) to assist with manually circumscribing both the undamaged cotyledons and subsequently the damaged areas for automated area calculation. There were six replicates of each treatment and the response variables were percentage beetle mortality and percentage of cotyledon area removed by beetle feeding. Leaf area–consumed data were logit transformed and analyzed with ANOVA, and Tukey–Kramer honest significant difference (HSD). Data from treatments including Cidetrak were excluded from the analysis. For the mortality data, confidence intervals were constructed around predicted means for treatments with nonzero mortality using a logistic model predicting the probablility of death based on the insecticide treatment. Data from the untreated control and Veratran treatments were excluded from this model.

We observed no mortality in the untreated control, Veratran, and Veratran plus Cidetrak treatments (Table 1). The 95% confidence intervals for the Azera, Azera plus Cidetrak, Grandevo, Grandevo plus Cidetrak, and Venerate treatments did not include zero, with the Azera treatment providing the highest level of mortality. Mortality in treatments including Cidetrak was generally lower than those not including Cidetrak, but the 95% confidence intervals overlapped. Percent leaf area consumed was significantly lower in the Azera treatments compared with all other treatments, and Grandevo was significantly lower than the untreated control, Venerate, and Veratran treatments. Venerate and Veratran were not significantly different from the untreated control (Table 2). This research was supported by industry gifts of pesticide.

Table 1

Treatment	Rate amt/L water	Percent beetle mortality	Percent mortality lower 95% confidence interval	Percent mortality upper 95% confidence interval
Azera	10.8 ml	76.7	64.3	85.7
Azera plus Cidetrak	10.8 ml + 0.57 g	51.8	38.9	64.5
Grandevo	9 g	13.6	6.9	24.8
Grandevo plus Cidetrak	9 g + 0.57 g	6.7	2.5	16.5
Untreated check		0	NA	NA
Venerate	10 ml	3.3	0.2	11.1
Venerate plus Cidetrak	10 ml + 0.57 g	1.7	0	11.1
Veratran	45 g	0	NA	NA
Veratran plus Cidetrak	45 g + 0.57 g	0	NA	NA

Table 2

Treatment	Rate amt/L water	Percent leaf area consumed
Venerate	10 ml	22.8 a
Veratran	45 g	17.7 ab
Untreated check		15.8 ab
Grandevo	9 g	7.0 b
Azera	10.8 ml	0.17 c