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Research Project Report for the Ohio Vegetable and Small Fruit Research and Development Program

Project Title
Disease Management in Organic Cucurbit Crops

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Objectives of the Research

The goal of this research project was to develop disease management strategies for cucurbit crops that can be used on certified organic vegetable farms. The principle diseases of cucurbits in this area are powdery mildew, bacterial wilt, Phytopthora blight, downy mildew, and gummy stem blight. **The specific objective of this project was to evaluate products that are or soon will be approved for use in organic systems, and can be used to control the principle cucurbit diseases.**

We focused on squash as a representative cucurbit crop. Products were tested in a transitional organic field at OARDC, in a replicated experiment.

Experimental Design and Methods

The experiment was conducted at the Ohio Agricultural Research and Development Center, Badger Farm near Wooster, OH in a transitional organic field with Wooster silt loam soil. Composted poultry manure (4-0-0, 15 123 lb/A, 75% moisture; Daylay Egg Farm Inc., West Mansfield, OH) was incorporated into the test field on 7 Jun. Certified organic squash seeds (cv. Buttercup) were sown on 19 May into 50-cell plug trays containing Paygro organic potting mix #423 (35% composted pine bark, 50% Canadian sphagnum peat, 15% perlite v/v/v; Paygro Co./Garrick Ind., South Charleston, OH). The field was cultivated, beds prepared and black plastic laid on 8 Jun. Squash seedlings were hand-transplanted on 9 Jun. Treatments were arranged in a randomized complete block design with two rows and four replications per treatment. Each row consisted of 15 plants spaced 2 ft apart on 5 ft centers. Treatment rows were alternated with untreated border rows. One of the two rows per treatment was covered with a floating row cover (Johnny's Selected Seed, Winslow, ME) on 10 Jun. Floating row covers were removed on 8 Jul. Pyrethrum (Diatect V (6 lb/A)) was applied to plots that previously had been

covered, on 8, 16 and 30 Jul, and 6 Aug using a CO_2 backpack sprayer (146 gal/A, 40 psi). Treatments were applied on 22 and 29 Jul and 5, 12, and 19 Aug, using a CO_2 backpack sprayer (143 gal/A, 40 psi) for a total of five applications. The surfactants BioLink (0.5 fl. oz/gal) and Nu-Film-17 (12 fl. oz/A) were added to Armicarb 100 and Serenade Max treatments respectively. Severity of powdery mildew was determined on 3 and 18 Aug using a modified Horsfall-Barratt rating scale. Disease ratings were converted to midpoints (% powdery mildew) prior to statistical analysis. Fruits were harvested from the entire row of each plot on 25 Aug and sorted into three categories: healthy, diseased culls and healthy culls. The number and weight of fruits in each category were determined. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test. Average maximum temperatures for 9-30 Jun, Jul, and 1-25 Aug were 77.7, 81.4, and 78.5 ºF; minimum temperatures were 56.5, 60.8, and 55.6 ºF; and total rainfall was 6.3, 3.6, and 3.8 in., respectively.

Results

Heavy rains early in the season flooded one block. As a result transplants were killed and data were collected for three blocks only. Bacterial wilt pressure was low, and there were no significant differences in the number of plants killed between protected (with row covers followed by pyrethrum treatment) and non-protected plots. Powdery mildew pressure was moderate to high. No other diseases were observed. Except for the two concentrations of SoilSoup compost tea, all treatments significantly reduced powdery mildew on squash compared to the untreated control. Serenade Max plus Kocide 2000 and the sulfur treatment were most effective in reducing powdery mildew severity, irrespective of the presence of row covers and treatment with pyrethrum. However, the protected control plots had significantly less powdery mildew on 18 Aug than the non-protected control plots.

Protected plots treated with either rate of SoilSoup compost tea, the low rate of Armicarb 100 (2.5 lb/A), or the high rate of Serenade Max (2 lb/A) plus Kocide 2000, and non-protected plots treated with the high rate of Armicarb 100 (5.0 lb/A), sulfur or the low rate of Serenade Max (1 lb/A) plus Kocide 2000 produced significantly higher marketable yield than the non-protected, untreated control. The proportion of marketable fruit was significantly higher in the protected, untreated plots than in the non-protected, untreated plots. With the exception of Armicarb 100 (2.5 lb/A, non-protected; 5.0 lb/A, protected), SoilSoup compost tea (full strength, protected), and Serenade Max (1 lb/A + Kocide 2000, protected) all treatments resulted in significantly higher proportions of marketable fruit than in the untreated, non-protected control. Among the non-protected plots, those treated with the high rate of Armicarb 100, sulfur, both rates of Serenade Max plus Kocide 2000 or the low rate of SoilSoup compost tea produced more marketable fruits than the non-protected, untreated control. There were no significant differences among any of the treatments in the weight of marketable fruit produced (data not shown).

Conclusions

Although bacterial wilt pressure was too low to evaluate the effectiveness of row covers in preventing this disease, the use of row covers appeared to result in other benefits, including larger, healthier-appearing plants and a higher percentage of marketable fruit compared to the non-covered control. All of the products tested except compost tea were effective at some level in powdery mildew control, although sulfur and Serenade Max + Kocide treatments were most effective.

Treatment and rate/A	Row cover + pyrethrum	% powdery mildew[z]		Marketable yield (ton/A)	% marketable fruit
		3 Aug	18 Aug		
SoilSoup Compost Tea 1/3 strength	-	22.2 a[y]	89.5 ab	1.9 cd	63.3 a-e
Control	-	19.0 ab	96.0 a	1.5 d	42.1 f
SoilSoup Compost Tea full strength	-	12.7 abc	94.3 ab	2.1 bcd	55.6 def
Armicarb 100 2.5 lb	-	2.0 d	40.0 de	1.8 cd	52.2 ef
Armicarb 100 5.0 lb	-	3.0 cd	40.0 de	2.4 abc	67.6 a-e
Sulfur 16 lb	-	3.0 cd	15.8 ef	3.0 a	72.9 a-d
Serenade Max 2 lb +[x] Kocide 2000 2 lb	-	3.0 cd	15.8 ef	2.2 bcd	64.3 a-e
Serenade Max 1 lb + Kocide 2000 2 lb	-	3.0 cd	11.2 f	2.4 abc	67.6 a-e
SoilSoup Compost Tea 1/3 strength	+	19.0 ab	87.8 ab	2.4 abc	81.0 a
Control	+	11.2 bcd	70.2 bc	2.2 a-d	67.3 a-e
Sulfur 16 lb	+	5.5 cd	15.8 ef	2.3 a-d	79.1 ab
SoilSoup Compost Tea full strength	+	4.0 cd	87.8 ab	2.8 ab	66.8 a-e
Armicarb 100 2.5 lb	+	3.0 cd	48.3 cd	2.5 abc	77.7 abc
Armicarb 100 5.0 lb	+	2.0 d	46.2 cd	1.9 cd	58.3 c-f
Serenade Max 2 lb + Kocide 2000 2 lb	+	2.0 d	15.8 ef	2.4 a-d	69.8 a-e
Serenade Max 1 lb + Kocide 2000 2 lb	+	2.0 d	12.7 f	2.2 bcd	59.4 b-f

[z]Disease rating based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%; 2= 1-3%; 3= 4-6%; 4=7-12%; 5= 13-25%; 6=26-50%; 7=51-75%; 8= 76-87%; 9=88-94%; 10= 95-97%; 11=98-99% and 12= 100% powdery mildew coverage of leaves (upper surface).

[y]Values are the means of three replicate plots; means followed by the same letter within a column are not significantly different at $p \leq 0.05$.

[x]Treatments tank mixed together.