An Examination of Kaolin Particle Film for Insect Pest Management in Organic Winter Squash

Dr. Kathleen Delate and A. McKern
Depts. of Horticulture & Agronomy
Iowa State University

Introduction

Organic farming has increased to a $13 billion industry in the U.S. and continues to expand approximately 20% annually (USDA-ERS, 2003). In Iowa alone, organic acreage has increased from 13,000 in 1995 to 100,000 in 2002 (IDALS, 2003). Farmers interested in transitioning some or all of their land to organic production require information on best management practices for these systems. Because the first year of transition to organic production is often considered the most challenging, methods to buffer the system against pests are needed to ensure yields similar to conventional production. Our research (Delate, 2002-2004) has demonstrated comparable yields to conventional crops, using certified organic practices. In 2001, we began an examination of one of the most important farmer-identified problem in organic squash production–insect pest management for the organic baby food market. Most pest problems in organic systems are managed through cultural and biological control techniques, but certain pests, such as the cucumber beetle transmitting bacterial wilt, may warrant additional controls in certain years.

In the first two years of the experiment (2001-2002) at Laura Krouse's Abbe Hills Farm in Mt. Vernon, Iowa, management strategies for the cucumber beetle, squash bug (*Anasa tristis*), and squash vine borer in cucurbits included Surround™ (kaolin clay product) (Engelhard Corp. Iselin, NJ), applied on a bi-weekly basis from plant emergence until 1 month prior to harvest; interplanting buckwheat to assist in increased parasitization of the squash bug by the natural enemy, *Trichopoda pennipes*; and applying Reemay™ row covers to prevent colonization by squash bugs, squash vine borer, and cucumber beetle. Row covers were the most effective method of reducing pest injury (Delate, 2002), with the lowest squash yields occurring in the buckwheat-interplant treatment. Although pests were not significantly reduced with the kaolin clay, we speculated that a formulation with a longer residual cover could potentially lower pest load.

In 2003 and 2004, we evaluated the effect of two formulations of the kaolin clay product. Because squash was destined for the organic baby food market, emphasis was placed on a high-yielding organic cultivar with minimal pest problems.

Materials and Methods

Organic 'Waltham Butternut' winter squash seeds (Johnny's Selected Seeds, Albion, ME) were planted on June 14, 2004, in rows at a spacing of 1.5 x 3 ft. at the Neely-Kinyon Research Farm in Greenfield, Iowa. In 2003 and 2004, we assigned the following treatments:

- Surround WP® applied on a bi-weekly basis from plant establishment until plant leaf senescence (approximately 1 month prior to harvest);
- Surround XP® applied on the same schedule; and
- A control (no treatment).

The total treated area of squash plants was 55 x 63 ft. There were 9 rows treated with Surround WP®, 9 rows treated with Surround® XP, and 18 untreated rows. The application rate for both formulations of Surround® was 50 lb. of kaolin clay to 100 gallons of water for the first two applications, then 25 lb/100 gallons of water for the last four applications. Plants were sprayed on July 24, and August 3, 10, 17, 23, and 30, 2004, with a Dramm™ gas-powered sprayer. Insect data was collected on August 3, 10, 17, and 30 by sampling ten random plants within each row for insect pest and beneficial species. Plant growth data was taken on ten random plants within each row on August 3. Squash were counted and weighed at harvest on October 11, 13, and 14, 2004.

Results and Discussion

Squash yields were higher in 2004 than in 2003, possibly due to increased rainfall and decreased squash bug and cucumber beetle populations. Crops may have also escaped pest populations through a later planting date. No insect pests were observed in plots on August 10, two months after planting. There was no significant difference in yields between the control and Surround XP® (Table 1). There were no significant differences in individual squash weight, averaging 2 pounds/fruit (Table 1). Number of fruit per acre did not vary by treatment (Table 1).

Squash bug and cucumber beetle populations remained low throughout the season (Table 2 and Figure 1). In 2004, the highest beetle populations reached 25 per 100 plants. Thus, no significant differences were found in insect populations among treatments, although there was a trend toward lower squash bug and cucumber beetle populations in the Surround XP® plots compared to the Surround WP® and control plots (Table 2). Beneficial insects (lady beetles) remained abundant during the growing season, with no apparent negative effect from the Surround® applications.

References

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Table 1. Squash harvest, Neely-Kinyon Farm, 2004.

Treatment	**Squash weight (lb/acre)**	**Fruit/acre**	**Individual squash weight (lb)**	**Residue rating**
Control	27,382a	12,075	2.27	0.00c
SurroundWP®	16,383b	8,178	2.02	1.92b
Surround XP®	21,154ab	10,251	2.07	2.67a
LSD (0.05)	7,390	NS	NS	0.25

Table 2. Insect populations, Neely-Kinyon Farm, 2004.

Treatment	August 3	August 10	August 17	August 30	Mean
	Squash bugs per 10 plants				
Control	0.00	0.00	0.08	0.00	0.02
SurroundWP®	0.00	0.00	0.17	0.00	0.04
Surround XP®	0.00	0.00	0.00	0.00	0.00
LSD (0.05)	NS	NS	NS	NS	NS
	Cucumber beetles per 10 plants				
Control	0.21	0.00	0.00	0.00	0.05
SurroundWP®	0.25	0.08	0.00	0.00	0.08
Surround XP®	0.00	0.08	0.00	0.00	0.02
LSD (0.05)	NS	NS	NS	NS	NS
	Beneficial insects per 10 plants				
Control	0.00	0.08	0.42	0.42	0.23
SurroundWP®	0.00	0.17	0.17	0.25	0.15
Surround XP®	0.00	0.17	0.25	0.08	0.13
LSD (0.05)	NS	NS	NS	NS	NS

Figure 1. Insect populations, Neely-Kinyon Farm, 2004.