Evaluation of Organic Pest Management Treatments for Bean Leaf Beetle and Soybean Aphid—Neely-Kinyon Trial, 2004

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Introduction

Bean leaf beetles have continued to be a problem for organic tofu soybean producers throughout the Midwest because of the resulting seed staining, which can downgrade the quality of the soybeans at market. Beginning in 2000, we have evaluated organically approved treatments for bean leaf beetle and fungal control.

The soybean aphid (*Aphis glycines* Matsumura) is native to China and Japan, and it became a new pest in Iowa in 2000. Aphid numbers were high in the 2001, but in 2002 and 2003, aphids appeared to be less of a problem. This small yellow aphid has distinct black cornicles ("tailpipes") on the tip of the abdomen and develops colonies on soybean plants as winged and wingless forms. Aphids feed through piercing-sucking mouthparts. The winged form has a shiny black head and thorax with a dark green abdomen and black cornicles. The soybean aphid is the only aphid in North America that reproduces on soybeans. Therefore, any small colony of aphids found on soybeans must be soybean aphids. The aphid may have up to 18 generations a year, beginning with overwintering eggs on its alternate host of buckthorn trees. These eggs hatch into nymphs and two generations of wingless females develop on the buckthorn before the winged generation flies to soybean fields in the spring. Winged generations appear on soybean plants when crowded by the wingless colonies, and in the fall, a winged generation migrates back to the buckthorn. These females produce a wingless generation that mates with winged males and lay eggs on the buckthorn trees. Soybean aphid populations build and peak during the period between late seedling stage to blooming stage. Usually in late July, the aphids move from the terminal area of the plant to the underside, making control more difficult. Honeydew and sooty mold (which is the excrement of the aphid and the resulting black fungus that grows on it) are apparent in August and September. Stunted plants and reduced pods and seeds may result from aphid feeding. Also, soybean aphids can transmit viruses that cause mottling and distortion of the leaves and a reduced seed set. Discolored seeds may also result from this infection.

An economic threshold of 250 aphids/plant if the population is increasing and plants are in the late vegetative or early (R1–R4) reproduction stages has been established by ISU research in 2004. This incorporates a seven-day lead time before the aphid population would be expected to increase to 1,000 aphids/plant, which is the economic injury level (i.e., yield loss that exceeds the cost of control). There are several natural enemies that help manage the aphid, including lacewings, Asian lady beetles, and entomopathogens (fungi that infect insects, causing a reddish brown appearance and death). In 2001, we began to study natural spray treatments that could be used in certified organic production for control of the soybean aphid.

Materials and Methods

In 2004, Pioneer 9305 soybeans were planted at the Neely-Kinyon Farm on June 7 at 200,000 seeds/acre. Plots measuring 20 × 30 ft with a 20-ft cultivated border around each plot were laid out in a completely randomized design. There were four replications of the following treatments: Neemix® (Thermo Triliogy Corp.,

Columbia, MD) at 1 pt/acre, Pyganic® (McLaughlin Gormely King Corp, Minneapolis, MN) at 1 pt/acre, Hexacide® (EcoSMART Technologies, Inc., Franklin, TN) at 3 pt/acre, and Aphrid™ (TerraMax, Inc., Ham Lake, MN) at 45 grams/acre. All treatments were compared with a control. Treatments were applied every 2 weeks from July 6 to September 20 with the exception of Aphrid™ (*Paeciliomyces* spp.), which is a biological control for aphids. Aphrid™ was applied on August 4 as a one-time application per label recommendations, once aphids reached 10 aphids/plant. Bean leaf beetle and aphid sampling occurred on alternate weeks from July 13 to September 24, by sweeping across plants in each plot with a 15-in. diameter sweep net and examining plants for aphids. Insects were placed in reclosable bags and transported in coolers to Iowa State University. Insects were frozen until they were counted in the laboratory. Soybeans were harvested on October 12, 2004. The percentage of stained soybeans was determined by counting the number of stained soybeans in a 60-gram sample that was randomly collected from the harvest of each plot.

Results and Discussion

Very few beetles or aphids were apparent until July 30, two weeks after the 2003 season (Figure 1). Populations were significantly less than in 2002 and in 2003, with peak populations averaging 6 beetles/8 sweeps, compared with 20 in 2002 and 10 in 2003. As a result of low beetle populations, there were no differences in beetle numbers among treatments, and seed staining was reduced to an average of 4.96%. The average seed staining in 2003 was 2.7% (Table 1). Soybean aphid populations did not exceed 20 aphids/plant over the entire season, leading to the conclusion that there were no significant differences in insect numbers between the control and other treatments (Table 1). Yields were not affected by pest management techniques, with control plots averaging 49 bushels/acre, compared with a 51-bushel/acre average over all other treatments. There were no significant differences in grain quality among treatments in 2004 (Table 2). Both yields and grain quality were excellent for organic tofu-type soybeans.

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Table 1. Yield, soybean staining, and insect population in bean leaf beetle and soybean aphid treatments trial, Neely-Kinyon, 2004.

Treatment	Yield (bu/acre)	Staining (%)	Peak beetle population/ 8 sweeps	Seasonal average beetle population/ 8 sweeps	Peak aphid population/ 8 sweeps	Seasonal average aphid population/ 8 sweeps
Aphrid™	52.24	4.27	3.50	2.00	9.25	2.26
Control	49.36	4.20	5.00	3.26	1.75	1.22
Hexacide®	50.99	4.99	7.00	3.26	21.75	5.22
Neemix 4.5®	51.09	4.60	3.75	1.78	6.75	2.87
Pyganic®	50.61	6.72	8.50	3.00	19.50	4.63
LSD 0.05	NS	NS	NS	NS	NS	NS

Table 2. Grain quality in bean leaf beetle and soybean aphid treatments trial, Neely-Kinyon, 2004.

Treatment	Protein	Oil	Fiber	Carbohydrates	Moisture
Aphrid™	37.13	17.96	4.67	22.23	10.08
Control	37.15	17.95	4.68	22.23	10.03
Hexacide®	36.91	17.94	4.69	22.46	10.18
Neemix 4.5®	37.28	18.01	4.65	22.06	10.03
Pyganic®	36.95	17.98	4.69	22.38	10.04
LSD 0.05	NS	NS	NS	NS	NS

Figure 1. Average beetle, aphid, and beneficial insect populations over the 2004 season.