Evaluation of Organic Pest Management Treatments for Bean Leaf Beetle and Soybean Aphid—Neely-Kinyon Trial, 2005

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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 was 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 will reproduce 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 the alternate host of buckthorn trees. These eggs hatch into nymphs and two generations of wingless females develop on buckthorn, before the winged generation flies to soybean fields in the spring. Winged generations appear on soybean plants in the case of crowding from wingless colonies, and in the fall, a winged generation migrates back to 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 undersides, making control more difficult. Honeydew and sooty mold (the excrement of the aphid and the resulting black fungus that grows on it) are apparent in August and September. Stunted plants, 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 per plant if the population is increasing and plants are in the late vegetative or early (R1-R4) reproduction stages has been established (ISU, 2004). This incorporates a seven-day lead-time before the aphid population would be expected to increase to 1,000 aphids per plant, which is the economic injury level and the population size that would be expected to cause economic damage (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 soybean aphid.

Materials and Methods

In 2005, Pioneer 9305 soybeans were planted at the Neely-Kinyon Farm on May 27, 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: Entrust® (Dow Agrosciences LLC, Indianapolis, IN) at 2 oz/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, which is a biological control (*Paeciliomyces* spp.). All treatments were compared with a control. Treatments were applied every 2 weeks from July 6 to September 16 with the exception of Aphrid™, which was not applied because aphid numbers did not reach 250 aphids per plant. Bean leaf beetle, aphid and other beneficial or pest insect sampling occurred on alternate weeks from June 20 to September 23, by sweeping across plants in each plot 8 times with a 15 in.-diameter sweep net and examining plants for aphids. Insects were placed in Zip-lock bags and transported in coolers to Iowa State University. Insects were frozen until enumeration in the laboratory. Soybeans were harvested on October 11, 2005. The percentage of stained soybeans was determined by counting the number of stained soybeans in a 200-gram sample that was randomly collected from the harvest of each plot.

Results and Discussion

Very few insects were found in the 2005 season until July 28, approximately at the same time as the 2004 season (Fig. 1). Populations were significantly less than in 2002, 2003, and 2004, with peak populations averaging 5 beetles/8 sweeps, compared with 20 in 2002, 10 in 2003, and 6 in 2004. As a result of low beetle populations, there were no differences in beetle numbers among treatments Seed staining was low and did not differ significantly among treatments (Table 1). No soybean aphids were apparent in any treatment over the entire season, leading to no differences in insect numbers between the control and other treatments (Table 1). Yields were not affected by pest management techniques, with control plots averaging 58.86 bushels/acre, compared with a 59.13-bushel/acre average over all other treatments. There were no significant differences in grain quality among treatments in 2005 (Table 2). Both yields and grain quality were excellent for organic, tofu-type soybeans.

References

ISU-Dept. of Entomology. 2004. http://www.ipm.iastate.edu/ipm/icm/

Acknowledgments

We would like to thank the Leopold Center for Sustainable Agriculture for their support of the Neely-Kinyon projects. We thank the Wallace Foundation for their input and support. Thanks also go to Alzbeta Novotna, Cynthia Salas, Greg Lilly, and Mark Rosmann for their help. We also thank Eric Gross of Pioneer Hi-Bred International, McLaughlin Gormely King Corp, Minneapolis, MN, EcoSMART Technologies, Inc., Franklin, TN, Dow Agrosciences LLC, Indianapolis, IN, and TerraMax, Inc., Ham Lake, MN; and Charles Hurburgh and Glen Rippke of the ISU Grain Quality Lab for grain analysis.

Table 1. Yield, soybean staining, and insect populations in bean leaf beetle and soybean aphid treatments trial, Neely-Kinyon, 2005

Treatment	Yield (bu/acre)	Staining (%)	Peak beetle population/ 8 sweeps	Seasonal average insect populations/ 8 sweeps			
				Beetles	All Pests	Beneficial Insects	Aphids
Control	58.86	1.00	2.00	1.46	4.21	3.14	0.00
Hexacide®	58.90	1.10	4.25	1.93	5.29	1.82	0.00
Entrust®	60.40	1.20	2.00	1.75	5.07	2.93	0.00
Pyganic®	57.92	1.50	5.25	1.61	4.54	2.32	0.00
Aphrid™	59.31	1.10	9.00	2.43	5.46	2.54	0.00
LSD 0.05	NS	NS	NS	NS	NS	NS	NS

Table 2. Grain quality in bean leaf beetle and soybean aphid treatments trial, Neely-Kinyon, 2005.

Treatment	Protein	Oil	Fiber	Carbohydrates	Moisture
Control	33.78	19.98	4.80	23.45	11.33
Hexacide®	33.38	20.05	4.83	23.75	11.28
Entrust®	33.55	20.03	4.78	23.68	11.13
Pyganic®	33.80	19.85	4.80	23.55	11.30
Aphrid™	33.38	20.05	4.85	23.75	11.33
LSD 0.05	NS	NS	NS	NS	NS

Figure 1. Bean leaf beetle, and beneficial and pest insect populations, Neely-Kinyon, 2005.