Evaluation of Organic Pest Management Treatments for Bean Leaf Beetle—Neely-Kinyon Trial, 2001

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Introduction

The majority of organic crops grown in Iowa are soybeans destined for the Japanese and domestic tofu and soymilk market. These soybeans are bred for a specific seed size and protein requirement. In addition, the market requires a white seed color. This requirement is more of an aesthetic than food quality distinction. The rejection rate for stained organic tofu beans increased from 1997 to 2000. Soybeans will enter the organic feed market at a reduced price if there is purple, brown or tan staining from one of the many factors associated with the soybean staining complex: *Cercospora kikuchii, Fusarium*, soybean mosaic virus, or bean pod mottle virus. Reducing the extent of soybean staining is therefore of great economic importance to organic producers who rely on the premiums associated with unstained seed.

Bean Leaf Beetle

The bean leaf beetle (*Ceratoma trifurcata*) is the main vector of bean pod mottle virus (BPMV) and may open infection sites for other seed-staining fungi. Organic farmers rely on biological insect control for managing most insect pests, but there are no known natural enemies of the bean leaf beetle (BLB). Because BLB adults overwinter in Iowa, survival is negatively impacted by low winter temperatures. A relatively large number of beetles were estimated to survive through the recent, warm winters of 1999-2000. High infestations of over-wintered beetles on soybean were observed during spring 2000, especially in early-planted soybean fields. Although winter 2001 was extremely cold, a moderate number of beetles survived in the 1997 through 2000 winters and their progeny led to 2001 populations. In addition, the leaf litter and heavy snow cover acted as an insulating layer and protected beetles from the extreme cold in 2001. The beetle has two generations a year in Iowa. The second-generation beetles of 2000 emerged from the soil to feed on pods in Fall 2000 and hibernated through the winter, before emerging from leaf litter to attack seedling soybeans in Spring 2001. The females of the 2001 generation oviposited eggs in the soil that developed into first-generation beetles that emerged in late June and July 2001. These first-generation adult populations usually peak in the late vegetative or the early reproductive soybean stages, whereas the second-generation adults peak during the pod-fill stage. The feeding by first-generation beetles on soybean leaves seldom results in economic yield losses, but the second-generation feeding on pods in late summer can be very significant. Both generations can transmit the BPMV, however.

Although certain varieties appear to resist staining, high rainfall during pod set may create ideal conditions for the spread of the disease in any variety. Management of bean leaf beetles in soybeans during the pod setting and filling stages may mitigate the farmer's losses. The use of organic pest management treatments may help organic farmers manage bean leaf beetles and transmission of virus or fungal agents responsible for seed coat staining. After consultation with local farmers of the Heartland Organic

Marketing Cooperative and support from the USDA-ARS National Soil Tilth Laboratory, six organic pest management treatments were selected and compared to a control (no treatment) for management of bean leaf beetle populations at the Neely-Kinyon Farm in 2000. Natural treatments tested for beetle control and disease control in 2000 included compost, fulvic and humic acids, rotenone, garlic, neem, hydrogen peroxide, and sodium bicarbonate. Soybean varieties were compared for BLB population numbers and BPMV prevalence in a separate trial. Surround™, a kaolin clay product, successfully used for codling moth and plum curculio control in organic apple production, was also tested in 2001.

Materials and Methods

Northrup King 2412 soybeans were planted on May 29, 2001, in a randomized complete block design with each plot measuring 20 x 30 ft. at the N-K Farm. Surround™ (Engelhard Corp., Iselin, NJ) and Garlic Barrier™ (Garlic Research Labs, Inc., Glendale, CA) were selected as repellants. Neemix™ (Thermo Triliogy Corp., Columbia, MD) was selected for insecticidal properties. Baking soda and 3% hydrogen peroxide were selected on the basis of their anti-fungal properties. The last treatment, molasses, was selected for reported effects on improving plant vigor and resistance to BLB. All treatments were compared to a control. Treatments were applied every 2 weeks beginning July 5. Bean leaf beetle sampling occurred on alternating weeks beginning June 28 by sweeping with a 15 in.-diameter sweep net. Insects were placed in Zip-loc bags and transported in coolers to Iowa State University. Insects were frozen until enumeration in the laboratory. Soybeans were harvested on Oct. 26, 2001. 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

Bean leaf beetle populations remained low until of the emergence of the second generation of beetles in early September (Figure 1). At the population peak on Sept. 6, 2001, the fewest numbers of beetles were collected from the Neemix™ -treated plots, although there were no significant differences among treatments (Figure 2). Over the season, the lowest beetle populations were observed in the Garlic Barrier™ treatment (Figure 3), although differences were not significant. The percentage of stained soybeans ranged from 12–22% with no significant differences among treatments (Figure 4). Yields ranged from 36.5 ± 2.5 to 42.2 ± 0.03bu/acre. No significant yield differences were found (Figure 5).

As was observed in 2000, bean leaf beetle numbers over the entire treatment site were less than BLB numbers in surrounding fields. Differences between treatments and control plots may be masked as a result of the proximity of treated plots to control plots. Volatile chemicals from the treatments may also affect beetles in control plots. In 2002, we will test a combination of the two most effective treatments (Garlic Barrier™ and Neemix™).

Stained organic soybeans can be sold as feed or blended with non-stained soybeans for the food market. With the continued development of the organic meat (livestock) market, the premium price for organic feed soybeans ($8–10/bushel) has encouraged organic farmers with stained soybeans to continue producing this crop.

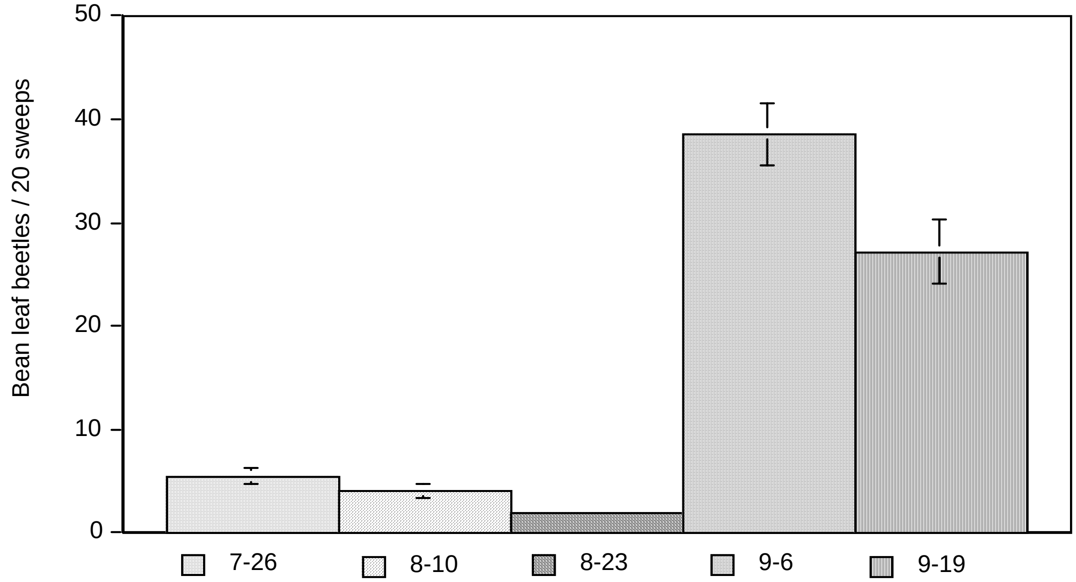

Figure 1. Seasonal bean leaf beetle populations, Neely-Kinyon, 2001.

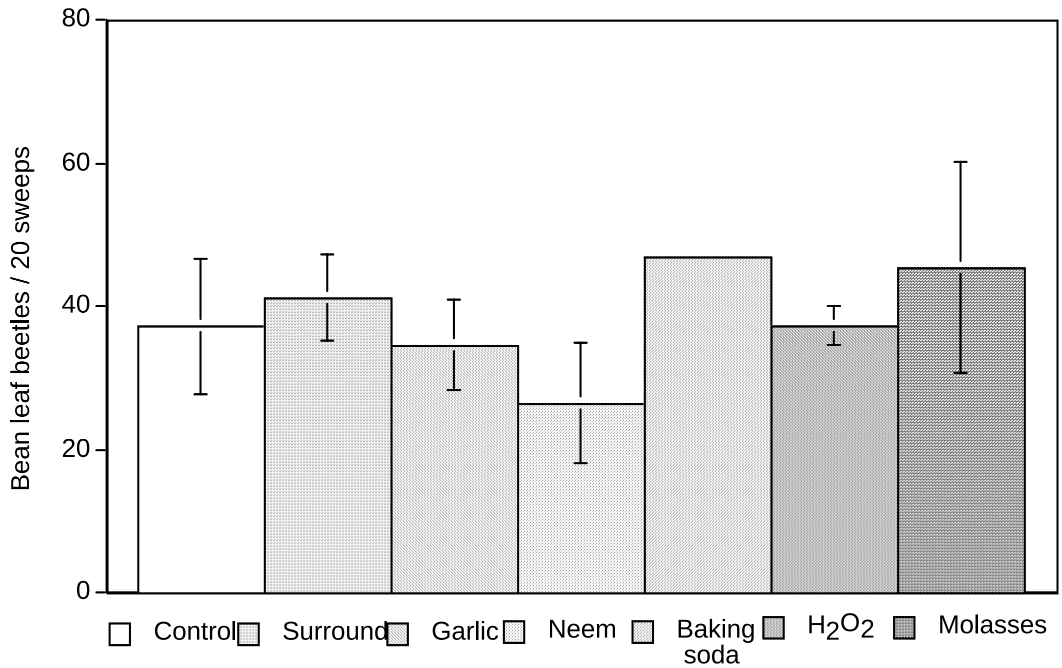

Figure 2. Peak populations of bean leaf beetle populations on Sept. 6, 2001, Neely-Kinyon, 2001.

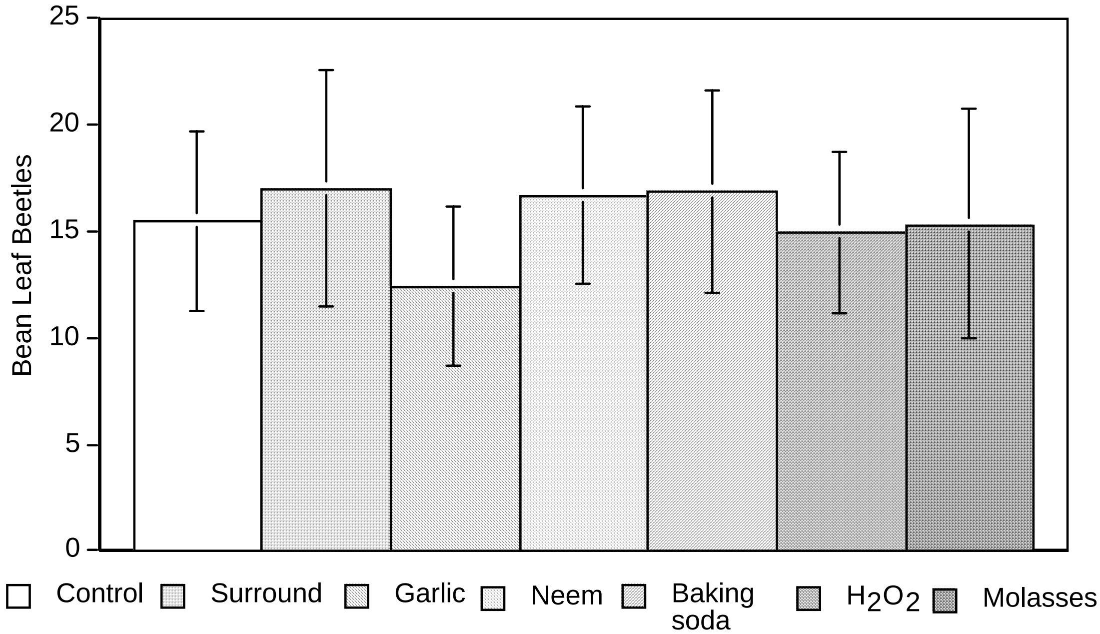

Figure 3. Average bean leaf beetle population over entire 2001 growing season, Neely-Kinyon, 2001.

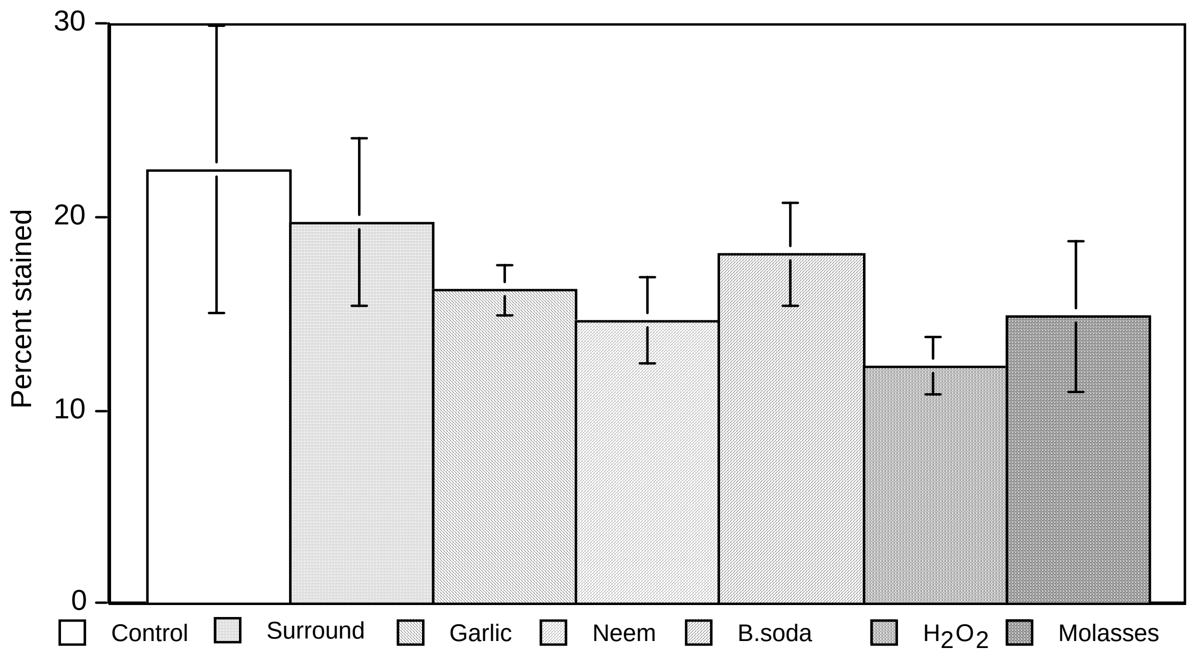

Figure 4. Percentage of stained soybeans, Neely-Kinyon, 2001.

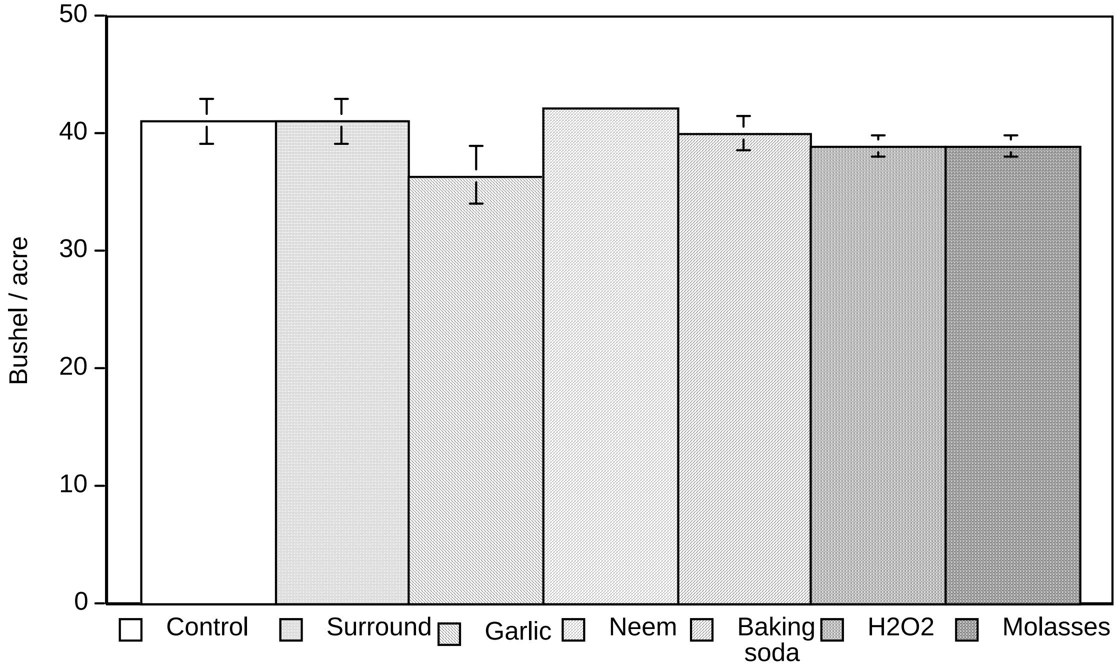

Figure 5. Soybean yields in organic pest management trial, Neely-Kinyon, 2001.