

Effect of Organic Soil Fertility and Fungicide Treatments on Yield and Pest Management, Neely-Kinyon-2011

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Introduction

Annual organic soybean [*Glycine max* (L.) Merr.] production in the U.S. has risen to more than 150,000 acres (USDA-ERS, 2005). Critical challenges associated with organic soybean production include weed control, bean leaf beetles (*Cerotoma trifurcata* Förster), soybean aphid (*Aphis glycines* Matsumura), and soybean diseases, including the potential for soybean rust. Bean leaf beetle primarily vectors the seed-staining bean pod mottle virus (BPMV) and for providing sites for other seed-staining fungi such as purple stain [*Cercospora kikuchii* (Mastsumoto & Tomoyasu) M.W. Gardener] and *Fusarium* spp. According to Advisory Committee members, soil fertility could affect insect and disease pest pressure, so a study was established in 2009 to evaluate organic-compliant treatments to improve plant nutritional status and an anti-fungal disease product (Regalia[®], Marrone Bio Innovations, Inc., Davis, CA). Regalia[®] is made with an extract from the plant *Reynoutria sachalinensis* (giant knotweed) which, when sprayed on plants, activates natural plant defenses. This induced diseased resistance is not systemic (i.e., only treated green leaf area is protected), but there is a translaminar effect (i.e., when the product is sprayed on the top of a leaf, the bottom of that leaf also is protected). Reducing the extent of soybean staining was of great economic importance to organic producers who rely on the

premiums associated with unstained seed, and preventing diseases could also increase yields in organic soybeans.

Materials and Methods

Blue River 29AR9 soybean aphid-resistant soybeans were planted at the Neely-Kinyon Farm on May 19, 2011, at a rate of 200,000 seeds/acre. The experimental design consisted of a randomized complete block design of four treatments with four replications of each in plots measuring 20 x 10 feet with a 5-foot border between plots. The following treatments were studied: Chilean Nitrate (30 lb N/acre) applied on July 15) a soap-based product (; Regalia[®] applied at 4 quarts/acre; and a control (no sprays). Plots were maintained with rotary hoeings on May 30, June 2 and 6, and row cultivations on June 15, 20, and 29. Soybeans were “walked” on August 2 and August 18. Treatments were applied every 2 weeks from July 1 to August 10. Pest and beneficial insect sampling occurred in alternate weeks from July 8 to August 17. Soybeans were harvested on October 4. The percentage of stained soybeans was determined by counting the number of stained soybeans in a 200-g sample randomly collected from each plot at harvest.

Results and Discussion

Yields in the organic soybean trial were excellent in 2011, averaging 61 bu/acre over all treatments (Table 1), showing

great promise for the new aphid resistant variety. Yields were equivalent to 2010 yields. There were no significant differences in yields or grain quality among treatments in 2011 (Table 1). Grain quality was excellent for organic soybeans, with an average protein content of 35%, 18% oil, 4.9% fiber, and 24% carbohydrates.

For the most part, the organic treatments did not affect pest or beneficial insect populations compared to the control (Table 2). The seasonal average aphid population was less than one aphid per 8 sweeps, with peak aphid populations averaging 1 aphid per 8 sweeps, compared to 337 aphids per 8 sweeps on the non-resistant variety in 2008 (Table 2). These averages were lower than 2010 aphid populations. The seasonal average bean leaf beetle population was 10 beetles per 8 sweeps, and the peak bean leaf beetle population was 25 beetles per 8 sweeps. Thrips averaged 24 thrips per 8 sweeps, with a peak of 75 per 8 sweeps. Peak populations for aphids occurred on August 18 and peak populations for bean leaf beetles and thrips occurred on August 5, 2011.

The seasonal average of 12 and peak population of 39 beneficial insects per 8 sweeps represented numerous beneficial insects collected over the season. The most predominant beneficial insect was the minute pirate bug (MPB), *Orius insidiosus*, which attacks aphids, whiteflies and thrips. The seasonal average was 6 minute pirate bugs per 8 sweeps and peak population was 22 minute pirate bugs per 8 sweeps on August 5. Spiders were also observed and averaged 4 per 8 sweeps at peak population on August 5.

No soybean diseases were observed in sufficient quantities to warrant comparisons in 2011, including no signs of soybean rust. Seed staining averaged 1.1% in 2011, with no differences among treatments, similar to 2010 percentages (Table 2).

Although no significant differences were found among treatments, trends toward higher beneficial insect populations and lower bean leaf beetle populations were found in plots treated with Chilean nitrate, which was the only treatment not applied to the leaves (applied to the soil). We will continue this trail in 2012 with new organic-compliant products.

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Table 1. Yield and grain quality analysis in organic soybean fertility and disease treatment trial, Neely-Kinyon, 2011.

Treatment	Yield (bu/ac)	Moisture (%)	Protein (%)	Oil (%)	Fiber (%)	Carbohydrates (%)
Control	52.64	8.35	34.78	18.08	4.91	24.24
Chilean nitrate	61.21	8.35	34.13	18.35	4.95	24.57
Regalia	61.14	8.48	35.05	17.95	4.89	24.11
Soy Soap	68.67	8.46	34.90	18.04	4.90	24.17
LSD 0.05	NS	NS	NS	NS	NS	NS

Table 2. Insect populations and soybean staining in organic soybean fertility and disease management trial, Neely-Kinyon, 2011.

Treatment	Peak aphid population 8/18/11	Peak BLB population 8/5/11	Peak thrips population 8/5/11	Peak MPB population 8/5/11	Peak spider population 8/5/11	Peak beneficials population 8/5/11	Seasonal average aphids	Seasonal average BLBs	Seasonal average thrips	Seasonal average MPBs	Seasonal average beneficials	Staining (%)
Control	1.50	27.25	70.55	27.25	2.75	43.75	0.60	11.10	23.61	6.90	11.55	1.16
Chilean Nitrate	1.25	16.00	68.00	24.00	5.13	46.88	0.55	8.25	22.28	7.05	14.93	0.94
Regalia	1.25	30.25	74.21	18.00	4.25	31.75	0.63	10.79	26.08	5.89	11.16	1.20
Soy Soap	0.25	26.50	85.53	20.25	3.00	31.50	0.25	10.05	24.85	5.70	10.25	1.08
LSD 0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

¹MPB = minute pirate bug (predator)