

Effect of Organic Soil Fertility and Fungicide Treatments on Yield and Pest Management, Neely-Kinyon-2010

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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 28, 2010, 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 28; Soy Soap[®] (Biobased AG, East Bend, NC) applied at 6.8 quarts/acre; and Regalia[®] applied at 4 quarts/acre; and a control (no sprays). Plots were maintained with rotary hoeings on June 4 and 7, and row cultivations on June 17, 30, and July 10. Soybeans were “walked” on July 15 and July 28. Treatments were applied every 2 weeks from July 28 to August 25. Pest and beneficial insect sampling occurred in alternate weeks from August 5 to September 1. Soybeans were harvested on October 8. 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 2010, averaging 60.5 bu/acre over all treatments (Table 1), showing great promise for the new aphid resistant variety. Yields were 5 bu/acre greater than 2009 yields, despite drier weather in July-August. There were no significant differences in grain quality among treatments in 2010 (Table 1). Grain quality was excellent for organic soybeans, with an average protein content of 35%, 18% oil, 4.8% fiber, and 24% carbohydrates. The trial will be continued in 2011 with organic-compliant treatments.

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 10 aphids per 8 sweeps, with peak aphid populations averaging 18 aphids per 8 sweeps, compared to 337 aphids per 8 sweeps on the non-resistant variety in 2008 (Table 2). These averages were similar to 2009 aphid populations. The seasonal average and peak bean leaf beetle population was less than 1 beetle per 8 sweeps, slightly less than 2009 averages of 3 beetles per 8 sweeps, and much lower than 2008 peak populations of 27 beetles per 8 sweeps. Thrips averaged 6 thrips per 8 sweeps, with a peak of 11 per 8 sweeps. Peak populations for aphids and bean leaf beetles occurred on August 5 and September 1, respectively, in 2010.

The seasonal average and peak of 5 beneficial insects per 8 sweeps represented the total number of 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 and peak population was 3 MPB/8 sweeps.

Spiders were also observed but averaged <1 per 8 sweeps at peak populations. There were greater numbers of spiders on control plants, but differences were biologically small.

No soybean diseases were observed in sufficient quantities to warrant comparisons in 2010, including no signs of soybean rust. Seed staining averaged 0.4% in 2010, with no differences among treatments, similar to 2009 percentages (Table 2). This compares to 23% staining in 2008. With low populations of aphids from the aphid-resistant variety and low bean leaf beetles from potentially severe winter weather, disease and seed staining was not a problem in 2010. We will continue this trail in 2011 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, 2010.

Treatment	Yield (bu/ac)	Moisture (%)	Protein (%)	Oil (%)	Fiber (%)	Carbohydrates (%)
Control	59.3	9.1	35.2	18.2	4.8	23.8
Chilean Nitrate	61.3	9.1	35.2	18.2	4.8	23.7
Regalia	61.3	9.1	35.1	18.4	4.8	23.7
Soy Soap	60.2	9.2	35.1	18.4	4.8	23.7
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, 2010.

Treatment	Peak aphid population	Peak BLB population	Peak thrips population	Peak MPB population	Peak spider population	Peak beneficials population	Seasonal average aphids	Seasonal average BLBs	Seasonal average thrips	Seasonal average MPBs	Seasonal average beneficials	Staining (%)
Control	21.5	0.0	11.0	4.0	1.8a	5.8	11.1	0.0	5.8	3.6	5.0	0.41
Chilean Nitrate	15.3	0.5	8.5	3.0	0.8b	4.5	8.17	0.2	4.7	2.9	3.9	0.38
Regalia	18.3	0.5	9.5	2.3	0.5b	3.8	10.3	0.3	5.3	2.8	3.7	0.43
Soy Soap	15.8	0.5	13.0	3.3	0.0b	5.5	8.5	0.2	7.7	3.9	5.2	0.41
LSD 0.05	NS	NS	NS	NS	0.9	NS	NS	NS	NS	NS	NS	NS

¹MPB = minute pirate bug (predator)