**North Dakota Soybean Council**

**Management of Soybean Aphids and Interaction with Soybean Cyst Nematode**

**Technical Report – June 30, 2017**

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 The overall goal of this work is to provide soybean producers with the integrated pest management (IPM) strategies necessary to successfully manage soybean aphids and soybean cyst nematode (SCN) in their fields. By understanding and implementing IPM strategies to manage these pests, soybean yields can be maximized while minimizing environmental impacts due to unnecessary pesticide applications.

 Soybean aphid is well-established in the upper Midwest and continues to be a serious pest of soybean production in North Dakota. Soybean producers need to be vigilant and scout their fields regularly, especially from July through mid-August when soybean aphid populations can increase rapidly. In **objective 1,** different pest management strategies for soybean aphid control were studied, including the use of an insecticide seed treatment, a foliar insecticide applied at different timings, and the use of a *Rag1* soybean aphid resistant variety.

 Ten treatments (Table 1) were tested for soybean aphid control at three locations in eastern North Dakota with a history of high soybean aphid populations (Casselton, Harwood and Emerado).

Soybean trials were planted at cooperator fields near Emerado on May 19, near Harwood on May 18 and at the Casselton Agronomy farm on May 18. Plots were harvested at Emerado on September 2, and at Harwood and Casselton on October 1. At all locations, plots were arranged in a randomized complete block design with four replications. Plots were 10 feet wide (four 30-inch rows) by 25 feet long and planted at a target population of 150,000 plants per acre. The varieties used were Peterson Farms Seed 12R007 (group 00.7 maturity) at Emerado and 12R05 (group 0.5 maturity) at Harwood and Casselton. For the *Rag1* treatments, a NDSU breeder’s line was used at all locations. Treatments and application rates are listed in Table 1.

 Soybean aphids were sampled weekly by selecting 10 random plants from the center two rows of each plot and calculating an average number of aphids per plant per plot. These values were used to calculate cumulative aphid days (CAD) after each sampling date. Aphid sampling commenced at the late vegetative stages and continued through R6. All data were analyzed using SAS statistical software.

 Results: Due to repeated rounds of strong storms with heavy rainfall and high winds, soybean aphid populations throughout the area did not establish and remained very low throughout the growing season. Because of this, the economic threshold (ET) of 250 aphids per plant was not reached at any location and those treatments were dropped from the data analysis. Other treatments, including the use of an insecticide seed treatment, foliar insecticide application at R1 regardless of aphid numbers, and the use of a *Rag1* line were still included.

 The following conclusions were determined from results of Objective One.

* The use of an insecticide/fungicide combination seed treatment did not demonstrate a significant yield difference compared to the use of a fungicide seed treatment alone.
* Use of a fungicide only seed treatment should be considered in fields with a history of soil-borne fungal pathogens that can be controlled by the active ingredients in the seed treatment.
* The application of a foliar insecticide at R1 did not demonstrate a significant yield difference.
* Weather events can and do provide natural soybean aphid control.
* For best pest management, soybean producers should scout for soybean aphids regularly through the growing season and wait until the ET is reached before making an insecticide application.

**Table 1. Treatments and application rates for the soybean aphid management objective, 2016.**

|  |  |
| --- | --- |
| **Treatment** | **Application Rate** |
| Bare Seed | --- |
| Apron Maxx (fungicide check) | 5 fl oz per 100 lbs seed |
| Cruiser Maxx (insecticide/fungicide combination) | 2.95 fl oz per 100 lbs seed |
| Apron Maxx + Warrior II applied at R1 | 5 fl oz per 100 lbs seed + 1.6 fl oz per acre |
| *Rag1* Bare Seed | --- |
| *Rag1* + Apron Maxx | 5 fl oz per 100 lbs seed |
| *Rag1* + Cruiser Maxx | 2.95 fl oz per 100 lbs seed |

**Table 2. Treatment means for cumulative aphid days (CAD) and yield for the soybean aphid management objective, combined across locations, 2016.**

|  |  |  |  |
| --- | --- | --- | --- |
| **Treatment** | **CAD1** | **Treatment** | **Yield1****(bu/acre)** |
| Bare Seed | 242.5 a | Cruiser Maxx | 67.9 a |
| Apron Maxx | 213.2 ab | Apron Maxx | 66.8 a |
| Cruiser Maxx | 158.4 abc | Apron Maxx + Warrior II R1 | 65.3 a |
| Rag1 + Apron Maxx | 122.3 bc | Bare Seed | 63.5 a |
| Rag1 Bare Seed | 97.0 bc | Rag1 + Cruiser Maxx | 48.9 b |
| Apron Maxx + Warrior II R1 | 86.6 c | Rag1 Bare Seed | 47.1 b |
| Rag1 + Cruiser Maxx | 62.3 c | Rag1 + Apron Maxx | 47.0 b |

1Means within a column that share the same letter are not significantly different.

 Soybean cyst nematode (SCN) is a major threat to soybean production in the upper Midwest and has expanded significantly in North Dakota, particularly in the eastern part of the state. Recent research suggests that there is a relationship between soybean aphid density and SCN reproduction, and soybean aphid feeding may result in increased SCN, even in SCN resistant varieties.

 **Objective 2** was to determine the relationship between soybean aphids and SCN, specifically how soybean aphids might affect SCN reproduction and to measure corresponding yield differences for SCN resistant and susceptible varieties in North Dakota growing conditions.

 Trials were conducted near Absaraka and Wyndmere on fields with established SCN populations. Unfortunately, we were unable to assess the interaction between soybean aphids and SCN due to the lack of soybean aphids at both locations. However, we were still able to assess SCN population growth and soybean yield in a SCN susceptible versus an SCN resistant variety.

 Trials were planted on May 7 at Wyndmere and May 9 at Absaraka. Plots were harvested on October2 and October 3 at Wyndmere and Absaraka, respectively. Plots were arranged in a randomized complete block design with split-plots. Soybean varieties were the whole plots and soybean aphid treatment timings were the subplots. Two soybean varieties were used – one SCN-resistant and one SCN-susceptible. The SCN-resistant variety was Peterson Farms Seed 15R05N, and the susceptible variety was Peterson Farms Seed 12R05. The two varieties were selected based on SCN resistance and similar maturity and yield performance in prior varietal trials. Three soybean aphid treatment timings were proposed – an aphid-free (AF, multiple foliar insecticide applications), a single foliar application at ET, and no foliar insecticide treatment (UT, untreated). The foliar insecticide was Warrior II (lambda-cyhalothrin) applied at 1.6 fl oz per acre. All seed was treated with Apron Maxx fungicide at a rate of 5 fl oz per cwt.

 SCN was sampled in early June and again in late September just prior to harvest. Sampling was conducted by taking 12-inch deep soil cores from 10 random locations within the center two rows of each subplot, and combining the subplot cores to obtain a single SCN value (eggs + juveniles per 100 cc of soil) for each subplot. Soybean aphids were sampled weekly by selecting 10 random plants from the center two rows of each subplot and calculating an average number of aphids per plant per subplot. Aphid sampling began at the late vegetative stages and continued through R6. All data were analyzed using SAS statistical software.

 Results: For best pest management of SCN, the use of a SCN resistant variety significantly decreased SCN population growth through the growing season, and resulted in a highly significant yield gain, average of 14 bu per acre, over the SCN susceptible variety.

**Table 3. Treatment means for June and September SCN egg counts and yield at Absaraka and Wyndmere, 2016.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Location** | **Treatment1** | **June SCN****(eggs/100 cc soil)2** | **September SCN****(eggs/100 cc soil)2** | **Yield****(bu/acre)2** |
| Absaraka | Peterson Farms Seed 12R05 | 2,132.1a | 4,909.3a | 35.9b |
|  | Peterson Farms Seed 15R05N | 1,580.9a | 2,094.7b | 49.8a |
|  |  |  |  |  |
| Wyndmere | Peterson Farms Seed 12R05 | 282.7a | 4,790.7a | 62.3b |
|  | Peterson Farms Seed 15R05N | 318.8a | 1,029.3b | 76.8a |

1SCN susceptible variety = 12R05, SCN resistant variety = 15R05N

2Means within a column that share the same letter are not significantly different.

**Figure 1. SCN egg counts for June and September. 12R05 is the SCN susceptible variety and 15R05N is the SCN resistant variety.**

