Small Grains

Small Grain Insect and Disease Pest Management

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History and Significance of Problem

Currently, approximately 87,000 acres of small grains in Virginia are treated each year with insecticides at planting time for preventive control of aphids. Preventive treatments are not especially expensive to producers (ca. $6.00 per acre) but result in the application of several tons active ingredient (a.i.) of an extremely toxic pesticide (LD50 of >20 mg/kg) to the Virginia environment. Previous work indicates that the majority (over 90%) of fields do not develop economic aphid populations; therefore, preventive insecticide applications are in most cases unnecessary, resulting in unnecessary expense to producers and unnecessary use of pesticide. Further, earlier work has shown that application of known integrated pest management (IPM) practices, including scouting and use of economic thresholds, can be successfully substituted for preventive treatments without loss of crop yield or quality. Use of IPM practices reduces production costs and the total pesticides applied.

Description of Program

Profitability was compared for using preventive insecticide applications versus recommended IPM practices of scouting for aphid pests during the season and treating only if economic thresholds developed. Comparisons were conducted in 39 field tests done over several years throughout the major grain producing areas of Virginia. In addition, farmers’ fields not treated with insecticides (90 in 1991-1992, 63 in 1992-1993) were monitored throughout eastern Virginia to determine the number that developed economic aphid infestations. Information from these studies has been used to promote the advantages, both economic and environmental, of following IPM procedures for managing grain aphids.

Results

Ninety-four percent of the 39 field tests comparing preventive versus IPM practices showed that IPM practices were more profitable. Few fields developed threshold aphid populations so insecticide was not applied and yields were not affected. Money was saved and total pesticide usage was reduced. Surveys of untreated fields over the last two growing seasons have shown that an average of only 4% of fields actually develop economic aphid populations. The fields that do develop problems are invariably planted early (mid-October or before) and are usually barley. This information has been extended to farmers in meeting, field tour, teleconference and publication formats. To date, several farmers, some being the most progressive and influential, have adopted IPM practices on their farms and are pleased with the results.

Survey of Grain Aphid Infestations

A survey was conducted in the 1991-1992 small grain growing season to determine the percentage of fields that developed threshold levels of aphid infestations. Ninety fields, that did not receive preplant insecticide treatment, in 24 counties were scouted for aphids in early December, late January and again in late February. Scouting at different times allowed us to see how aphid populations changed over time. Fields were scouted by going to several areas in each field and determining the number of live aphids per foot of row. Planting dates were also recorded for each field, as well as other information, such as variety and fertility practices, that may have had an impact on aphid populations.

Less than 10 percent of the fields surveyed developed aphid infestations that exceeded economic thresholds (15-20 per row foot in the fall and 150 per row foot in the spring). Only fields planted before October 21 developed economic threshold populations. Also, aphid populations appeared to peak earlier in earlier planted fields. Although this was a one-year survey, results agree
with what we know to be true concerning aphid populations in small grains. Large aphid populations are relatively rare in small grain fields in Virginia. They are most likely to occur in early-planted fields. Therefore, if fields are planted early, before October 20 or so, scout within the first week after grain emergence and treat with insecticides if thresholds are found.

**Monitoring of Aphid Movement into Small Grain Fields**

The rapid occurrence of yellow flag leaf barley yellow dwarf virus (BYDV) symptoms in April of 1991 led to questions of where the infection had come from. Was it from BYDV brought into the field by a fall migration of winged adult aphids? To begin answering this question, yellow sticky traps were used to monitor adult aphid movement into grain fields at three locations (the Tidewater Ag. Exp. Sta. in Suffolk, the Eastern Virginia Ag. Exp. Sta. in Warsaw, and Renwood Farm in Charles City County). Traps were placed around the outer edges of fields and in a grid pattern throughout the fields and changed weekly from early November (1991) through April (1992). Data from all locations was similar. Only the data from the Charles City County location is presented (Fig. 2). Traps showed that the greatest movement of aphids occurred early in the fall. A second but lesser peak of activity occurred in the spring. We consider this data to be only preliminary. However, if additional studies confirm this fall movement, we may be able to use this information to improve aphid and BYDV management.

**Effects of Barley Yellow Dwarf Virus on Small Grain Yield and Quality**

Several field tests have been conducted to determine the effects of BYDV infection on small grain. BYDV infection is most severe when it occurs in the fall when plants are young and trying to establish new root, shoot and tiller growth. Plants infected in the fall typically become yellow and stunted and often never achieve full size or yield potential. In April of 1991, another type of symptom was seen occurring throughout Virginia small grain fields. Flag leaves, of otherwise normal size plants, began turning yellow or reddish. Several leaf samples sent to a diagnostic laboratory confirmed that yellowing plants had BYDV. A test was conducted in 1991 to compare the effect fall vs. spring BYDV infection on small grain yield and quality. Several disease foci (hits) were marked in a field and compared to an equal number of uninfected areas. Yield components such as head number, seed number and weight, plant height and grain weight were compared. Results (reported in Insect Pest Management in Virginia Small Grains, Soybeans and Peanuts-

![Fig. 2. Aphids on yellow card traps, Renwood Farm, Charles City Co., Va., 1991-92.](image-url)
showed that fall infection caused the greatest reduction in yield components. Two similar tests were conducted in 1992, one at the Eastern Virginia Ag. Exp. Sta. at Warsaw (Wakefield wheat), and another at Renwood Farm in Charles City County (Barsoy barley). Again, data indicated that BYDV can have a significant effect on small grain: BYDV infected wheat and barley plants were shorter, had significantly fewer seeds per head, lighter seed weight and reduced yield. These tests verify that BYDV can significantly reduce the yield and quality of small grain. The greatest reductions occur when plants are infected in the fall and become stunted early in the growth and development process.

Use of Insecticide Treatments to Control Aphids and BYDV

Barley yellow dwarf virus is only introduced and spread into grain plants by grain aphids. The virus is passed to plants as aphids feed on plants. Aphids pick the virus up from numerous weed reservoirs and pass it on to small grain hosts when they migrate into fields in the fall. Attempts have been made to control the spread of virus by controlling aphid populations using preplant treatments with traditional systemic insecticides. However, because aphids can successfully inoculate plants with the virus before picking up lethal amounts of insecticide, this management approach has not been successful.

Tests with a traditional systemic insecticide (Di-Syston; Miles, Inc., Kansas City, Mo.) and a new insecticide seed treatment (NTN33893; Miles, Inc., Kansas City, Mo.) were conducted at several locations to determine whether management of aphids and BYDV could be improved. Di-Syston 8E was applied at a 1 pint per acre rate just before planting. The insecticide was either lightly incorporated before planting or incorporated during the planting process. NTN33893 was applied to seed at the rate of 2.67 oz of product (2 oz active ingredient) per 100 lb. seed. Plots were planted, monitored for aphid populations, BYDV symptoms and measured for yield. Tests were conducted at the Tidewater Ag. Exp. Sta. in Suffolk, Renwood Farm in Charles City County and at the Lloyd Mundie farm in Richmond County. The test at the Lloyd Mundie farm did not include NTN33893 treatments.

Results indicated that plots with NTN33893 treated seed had fewer aphids than either Di-Syston treated or untreated plots. NTN33893 treated plots developed aphid populations later and populations never reached the level of those in other plots. There was also significantly less BYDV in NTN33893 treated plots compared with Di-Syston treated or untreated plots (Fig. 3).
in retrospect, unnecessary and not economic. The same was basically true at the Richmond County location. Very few aphids developed in the test field, so insecticide treatments were unnecessary and not economic. At the Charles City County location, aphid populations and BYDV did develop, but virus symptoms were only visible in the first 50-75 feet of the field—the 75 feet nearest the farm road. Yield samples were taken with a conventional farm combine on 500 foot length cuts. Because BYDV was only present in the first few feet of the combined area, differences in yield were diluted and no overall yield difference could be detected (Fig. 4).

![Bar chart showing yield response of grain after treatment with Di-Syston 8E and NTN-3893, 1991-92.]

*Fig. 4. Yield response of grain after treatment with Di-Syston 8E and NTN-3893, 1991-92.*