CAN APHID CONTROL REDUCE BARLEY YELLOW DWARF INCIDENCE IN WHEAT? A CASE STUDY (CALDWELL CO., KY 1998-99)

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Pioneer 2510 wheat was planted using a no-till planter on Oct 22, 1998 following a corn crop on the University of Kentucky Research and Education Center in Caldwell Co. KY. The 4' by 15' plots were arranged in a randomized complete block design with five replications. Fertility was applied as 100 lbs of nitrogen on Feb 26, 1999 (Feekes GS 3-4). The treatments included three different insecticide application dates and an untreated control. Two treatments consisted of single applications of Warrior ® (lambda-cyhalothrin) at 3.2 fl. oz./ac, made with a backpack sprayer in 26 gal of spray per acre, on Nov 24, 1998 (Feekes GS 2-3) or Feb 17, 1999 (Feekes GS 3). The third set of plots were treated on both dates. These were compared to an untreated control. Regular aphid counts were not made but plots were checked for aphids just before applications were made. Plots were rated for BYD on May 5, 1999 (Feekes GS 10) by randomly selecting 50 individual plants and examining them for symptoms. Percent of plants displaying BYD symptoms were analyzed for differences using the SAS GLM. procedure.

Significant differences in percentages of plants displaying BYD symptoms, as related to insecticide treatments, were detected (F (3,12 df) = 3.83, Pr>F =0.039) (Table 1). Although very few aphids were seen before the final insecticide application; they were widespread and numerous during the spring.

TABLE 1. MEAN PERCENTAGES (± S.E.) OF WHEAT PLANTS SHOWING BYD SYMPTOMS IN PLOTS TREATED WITH WARRIOR INSECTICIDE ON SELECTED DATES TO CONTROL APHID VECTORS OF BARLEY YELLOW DWARF VIRUS.

Time of Application	% of Plants Showing BYD Symptoms ± SE[1]
No Insecticide	13.2 ± 5.0 a
24 Nov 98	5.6 ± 1.0 ab
24 Nov 98 and 17 Feb 99	1.6 ± 0.4 b
17 Feb 99	3.2 ± 1.2 b

[1]Means followed by the same letter are not significantly different. p = 0.5. Ryan-Einot-Gabriel-Welsch Multiple range test.

Variations in plant stands among plots due to establishment problems prevented valid yield comparisons. The variation due to stand difficulties would not have allowed a fair comparison of the yield effects.

The November treatment, often made as an 'insecticide only' application, costs about $11.00 per acre. The February insecticide application is often made in conjunction with other inputs, so the application cost may be saved. Therefore, in this location and in this year, the fall, winter, and combination treatments would have cost $11.00, $6.00 and $17.00 respectively.

Assuming the entire difference in percentage of plants showing BYD symptoms was a result of insecticide timing, and that a damaged plant would have about a 20% yield loss, we can compare the relative merits of treating -vs- not treating.

<u>No Insecticide Treatment</u>

Using an estimate of 13.2% damaged plants with a 20% yield reduction for each damaged plant, the effective yield loss was calculated to be 2.64%. If this were 100 bu/acre wheat, the resulting loss would be 2.6 bushels. At a price of $2.50/bushel, the untreated acre of wheat would bring about (97.4 bu at $2.50/bu) $243.50 or a loss of $6.60 per acre due to this aphid-vectored disease.

<u>Nov 24 & Feb 17 Insecticide Treatment</u>

The best insecticide treatment (two applications) contained an average of 1.65% damaged plants. This indicates that about 88% of the loss to BYD was prevented by the two treatments. As calculated above, this is a 0.3% yield loss per acre. For 100 bu/acre wheat, this loss would be 0.3 bushel, leaving a per acre yield of 99.7 bushels. At $2.50/bu the resulting loss would be $0.75, bringing a per acre return of (99.7 bu at $2.50/bu) $249.25. However, this level of protection was obtained by making two insecticide applications, at a cost of about $17.00 per acre.

Reducing the per acre return by this cost leaves a net return of ($249.25 - $17.00) $232.25.

Nov 24 Only Insecticide Treatment

The Nov 24 treatment had 5.6% damaged plants. Assuming the standard plant yield loss, this is the equivalent of a 1.1% yield loss per acre. For 100 bu/acre wheat, this loss would be 1.1 bushels, leaving a per acre yield of 98.9 bushels. At $2.50/bu the resulting loss would be $2.75, bringing a per acre return of (98.9 bu at $2.50 /bu) $247.25. However, this level of protection was obtained by making an insecticide applications which would cost about $11.00 per acre. Reducing the per acre return by this cost leaves a net return of ($247.25 - $11.00) $236.25.

Feb 17 Only Insecticide Treatment

The incidence of damaged plants in the Feb 17 treatment was 3.2%. For 100 bu/acre wheat, this loss would be 0.6 bushels, leaving a per acre yield of 99.4 bushels. At $2.50/bu the resulting loss would be $1.50 bringing a per acre return of (99.4 bu at $2.50/bu) $248.50. However, this level of protection was obtained by making an insecticide applications which would cost about $6.00 per acre. Reducing the per acre return by this cost leaves a net return of ($248.50 - $6.00) $242.50.

SUMMARY:

Under these test conditions, the insecticide applications did cause statistically significant differences in BYDV symptom expression. However, it is clear that the assumed associated protection of yields resulting from this level of symptom reduction was not cost effective. If all other things are equal, the cost of the insecticide applications was greater than the reduction in damage (Table 2).

TABLE 2. NET RETURN ($/AC) FROM PLOTS TREATED AT SELECTED TIMES WITH AN INSECTICIDE APPLICATION TO CONTROL APHID VECTORS OF BYDV IN CALDWELL CO., KY. 1999

Treatment	No-Insect.	Nov 24	Nov 24	Feb 17

		& Feb 17		
Net Ret/ac	$243.50	$232.25	$236.25	$242.50

The circumstances and yield potential on your farm will alter these figures. As prices and yields decline and treatment costs increase, the insecticide treatments will look even less appealing. However, a rise in prices and yields coupled with a lower treatment costs will make the returns from insecticide applications look much more favorable.

Choosing a 100 bushel per acre yield as a basis for comparison may be misleading. 'Intensive Wheat Management' has used 100 bushels as a benchmark; however, many fields will not support this level of production. When yields change so do the level of expenses that can be supported. Using the percent damage estimates, and assumed costs of control from the previous examples we have calculated the necessary value of a bushel of wheat needed to support the three treatments at various yield levels, using the BYD intensity seen in the 1998 experiment (Table 3).

TABLE 3. THE VALUE ($) OF A BUSHEL OF WHEAT REQUIRED TO OFFSET THE COSTS OF VARIOUS INSECTICIDE TREATMENTS.

Potential Yield (Bu/Ac)	Fall Treatment @ $11/Ac.	Winter Treatment @ $6/Ac.	Fall & Winter Treatments @ $17/Ac.
100	7.23	3.00	7.35
90	8.03	3.33	8.17
80	9.04	3.75	9.19
70	10.33	4.29	10.49
60	12.06	5.00	12.23
50	14.47	6.00	14.66
40	18.09	7.50	18.47
30	24.12	10.00	24.64

There is no consistently successful strategy to reduce losses to BYD virus by trying to control their aphid vectors with insecticidal sprays. While sprays may kill many aphids and reduce the percentage of infected plants, potential yield savings may not pay for the chemical and application. There are many other factors that impact the relative effect of BYDV infections.

BYDV infections developed very late in the 1998-1999 crop, probably because of very low aphid numbers during the fall. The aphids that were present did not arrive until December. The late aphid flight probably resulted from the late summer-early fall drought that affected Kentucky.

The lateness of the aphid/BYDV infections is illustrated by the fact that the late winter (Feb. 17) application was just as effective at reducing BYDV symptoms as either of the other two applications (Table 1). A larger than "normal" portion of the infections occurred after Feekes GS 3. Because of this, the data presented in Table 3 must be used very carefully. If you consider only Table 3, it appears that the most appropriate time to make an insecticide application is in the late winter. While this was true in 1998-99, this may not be the case in most years. If both aphids and BYDV had been present very early in the fall, the percentage of infected plants and the relative damage to each would have been much greater. While late infections may be important in a year of good prices and low costs, an early fall infection is always a more important consideration.

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