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HERBICIDE CARRYOVER TO WHEAT

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Grain producers often express concern about herbicide carryover to cause injury to rotational crops during periods of dry weather. Parts of Kentucky have experienced below average rainfall this year, and as the wheat planting season approaches, wheat producers should consider if some fields have the potential for herbicide carryover problems.

The potential for herbicide carryover depends on the herbicide degradation rate, the amount of herbicide applied per acre, and the sensitivity of a rotational crop, such as wheat, to the herbicide applied to the previous crop. The duration of herbicide persistence is determined by the rate at which the herbicide degrades in the soil. This rate of degradation depends on the chemical structure of the

herbicide, and soil characteristics such as pH, clay content and organic matter. Climatic conditions play a large role in regulating this rate of degradation. Maximum chemical and

microbial degradation occurs in warm, moist soils. Extreme conditions, such as long periods without rain, slow the degrading process.

Herbicide carryover to cause rotational crop injury has not been a widespread problem in Kentucky during the past 25 years. Instances of carryover injury have occurred each year and will occur again this year. What is the likelihood of herbicide carryover problems in wheat this planting season? Unfortunately, there is not a simple answer to this question.

According to the rotational intervals on product labels, those herbicides with the greatest risk of carryover to wheat in Kentucky include those with the active ingredient atrazine (AAtrex), simazine (Princep), or clomazone (Command). The rotational intervals are based on risk of crop injury and residue tolerances for feed or food.

Injury is the issue in cases with atrazine and simazine, whereas, both crop injury and tolerances for feed and food uses of wheat are the issues dealing with clomazone. Historically, herbicide injury to wheat has occurred only in instances of where the total amount of atrazine and simazine exceeded 3 pounds active ingredient (ai). Rates of

atrazine and simazine this high have not been used for many years. As the amount of atrazine and simazine has declined, so has the occurrence of wheat injury from these commonly used corn herbicides. However, this is not to say that carryover injury to wheat will not occur this year.

The following items should be considered in determining the potential for herbicide carryover injury to wheat.

Rainfall. The most important time of rainfall for herbicide degradation is the first month following herbicide application. Fields receiving normal rainfall during this time will be much less likely to have herbicide carryover.

Soil pH. If the pH is above 7.0, the likelihood of atrazine and simazine carryover will increase greatly. Conversely, carryover of clomazone will increase when the soil pH is below 6.

Herbicide rate and timing. Fields in which atrazine, at less than 2 LB ai per acre, was applied in April and had normal, or near normal rainfall, will usually not persist to cause wheat injury. The later in the season that atrazine was applied, the greater the potential for wheat injury. Many atrazine-containing products recommend rotating to only corn or sorghum when applications are made after June 10. Remember that atrazine is an ingredient in many corn herbicides (see AGR-6, Chemical Control of Weeds in Kentucky Farm Crops).

Tillage. Any herbicide remaining in the soil will be distributed throughout the zone of tillage and this results in the herbicide concentration being diluted in this tilled zone. This dilution decreases the potential for herbicide injury but does not eliminate the injury potential.

Date of wheat planting. Fields suspected of herbicide carryover should be planted as late as possible.

Herbicides of concern. The following herbicides should be considered the most likely to cause carryover problems in wheat.

CORN HERBICIDES:

Atrazine (especially at 2 lb ai or more)-
Products containing atrazine include:
AAtrex, Atrazine, Bicep II, Bicep II Magnum, Buctril/Atrazine, Extrazine II, FieldMaster, Fultime, Guardsman, Laddok, Leadoff, Marksman, Surpass 100

Princep (especially at 2 lb ai or more)

SOYBEAN HERBICIDES:

Command

More specific information on herbicide persistence and carryover can be found in the following University of Ky publications:

AGR-6, Chemical Control of Weeds in Kentucky Farm Crops

AGR-139, Herbicide Persistence and Carryover in Kentucky

AGR-140, Herbicides with Potential to Carryover and Injure Rotational Crops in Kentucky

CAN APHID CONTROL REDUCE BARLEY YELLOW DWARF INCIDENCE IN WHEAT?

A case study (Caldwell Co., KY 1998-99)
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Extension Entomologists

Pioneer 2510 wheat was planted using a no-till planter on 22 Oct 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 26 Feb 99 (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 24 Nov 98 (Feekes GS 2-3) or 17 Feb 99 (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 5 May 99 (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 ($F(3,12 \text{ df}) = 3.83, Pr > F = 0.039$) (Table 1). Although very few aphids were seen before the final insecticide application; they were widespread and numerous during the spring.

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

¹Means 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.

Table 1. Mean percentages (\pm 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.

No Insecticide Treatment

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.

24 Nov & 17 Feb Insecticide Treatment

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.

24 Nov. Only Insecticide Treatment

The 24 Nov. 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.

17 Feb. Only Insecticide Treatment

The incidence of damaged plants in the 17 Feb. 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 County, KY, 1999

Treat.	No-Insect.	24 Nov & 17 Feb	24 Nov	17 Feb
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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CALIBRATE DRILLS TO CONTROL SEED COSTS

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Drill calibration is one of the most important steps in obtaining uniform desirable stands and holding down seed costs. Just as no two drills are alike, each seed lot/variety can

differ in seed size, purity and germination level. A few minutes spent calibrating your drill with each seed lot can be the difference between economical seed use and replanting!

Drills should be calibrated either in the field or by counting wheel revolutions that equal 100 to 200-ft of linear distance. Start by using the drill settings suggested by the manufacturer for the desired seeding rate (usually listed in pounds of seed per acre). Operate the drill in a test strip and collect seeds from 3 to 5 drop tubes to measure the actual seeding rate at a given setting. Record the total weights from all drop tubes and compare it to the desired weight. Adjust the drilling setting up or down according to the first run and repeat the process until you have achieved a seeding rate within 3 percent of the target rate. Record drill settings that match the desired seeding rate for a given seed size because this information will be a useful starting point when different seed lots/varieties of similar size and quality are used each season.

Table 1 contains a summary of 28 calibration trials with four different no-till drills that were used in a recent study to compare drill performance. Note that the range in desired seeding rates was between 110 and 183 pounds of seed per acre and that all drills were within 3 percent of the desired rate. The important result of this study was that the difference in the average error (difference between the target rate and actual rate) between drills was not significant. The Kentucky Small Grain Growers Association provided support for this study, which also led to the refinement of a spreadsheet (illustrated in Table 2) that was originally developed by Mike Ellis, a no-till farmer and crop manager in Shelby County. It calculates calibration weights based on the desired plant population, row spacing, and seed tag data (seed weight, germination and purity). It was modified to serve as a record keeping tool to keep track of seed needs and costs for each variety/lot used in a given operation.

Free copies of this spreadsheet may be obtained from the authors through county extension offices to help calibrate drills, compute the amount of seed needed, and compare seed costs at different seeding rates. Note that with all other factors equal (yield potential, seed quality and cost), lots/varieties with smaller seeds are a better buy.

Table 1. Summary of 28 calibration tests with four no-till drills.

Drill	Width ft	Number of Tests	Variance from target	Average	Standard Deviation	Average
GP	10	10	1.3 %		7.4	
	30	3	1.2 %	1.3 %	12.9	8.7
JD	10	11	1.3 %		4.5	
	30	4	1.3 %	1.3 %	5.9	4.9

Note: Seeds collected from 5 drop tubes on the 10-ft drills and 10 drop tubes on the 30-ft drills.

Table 2. Calibration seeding rates, total number of bags needed, and cost of seed for different wheat varieties based on seeding rate, row spacing and seed properties.

Seeding rate:		Variety / lot	No. Seed / lb	gm / 1000	Germ %	Purity %	Lb./ Acre	gm / 200 ft row	No. acres	No. bags	Cost	
Per sq yd	per sq ft										per bag	per seed lot
375	42											
Row Spacing in	Seeds per ft	Clark	13765	33	90	99.50	147	192	134	395	\$ 6.00	\$ 2,368
		Foster	17089	27	97	99.97	110	143	208	456	\$ 7.50	\$ 3,417
7.5	26	Justice	16453	28	90	99.00	124	161	47	116	\$ 6.00	\$ 698
		P2552	9700	47	92	99.84	204	265	111	452	\$ 13.00	\$ 5,879
								Total	500	1419		\$ 12,362

Note: Enter items shown in **bold** to compute desired values for each variety/seed lot based on desired plant population, row spacing, seed tag and cost data.

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