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TRIAZINE RESISTANT PIGWEEDS IN KENTUCKY CORN FIELDS

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INTRODUCTION

Smooth pigweed (Amaranthus hybridus) control from atrazine and/or simazine (Princep) has been unsatisfactory in some Kentucky corn fields. Many of these fields have grown corn where one or both of these herbicides have been used continuously for several years. These two triazine herbicides, particularly atrazine, are used annually on over 90% of the corn grown in Kentucky. Other areas in the U.S. and around the world have reported unsatisfactory control from atrazine where triazine resistant pigweed has developed.

Field and laboratory experiments were initiated to evaluate pigweed control from several triazines in fields with a history of poor pigweed control and to determine if triazine resistance had developed in these pigweeds. Non-triazine herbicides were evaluated as alternative control methods. A state-wide survey of county Extension personnel was conducted to determine if unsatisfactory pigweed control had become a major problem for corn producers in Kentucky.

SURVEY

The survey was conducted in 1987 to identify areas in Kentucky experiencing poor pigweed control and to assess production practices and other factors related to this problem. The survey was sent to all counties, and 69 agricultural Extension agents responded. When asked if poor pigweed control was a concern in corn production, 30 respondents indicated that it was a problem in some fields; whereas, 39 counties indicated it was not a major concern (Figure 1).

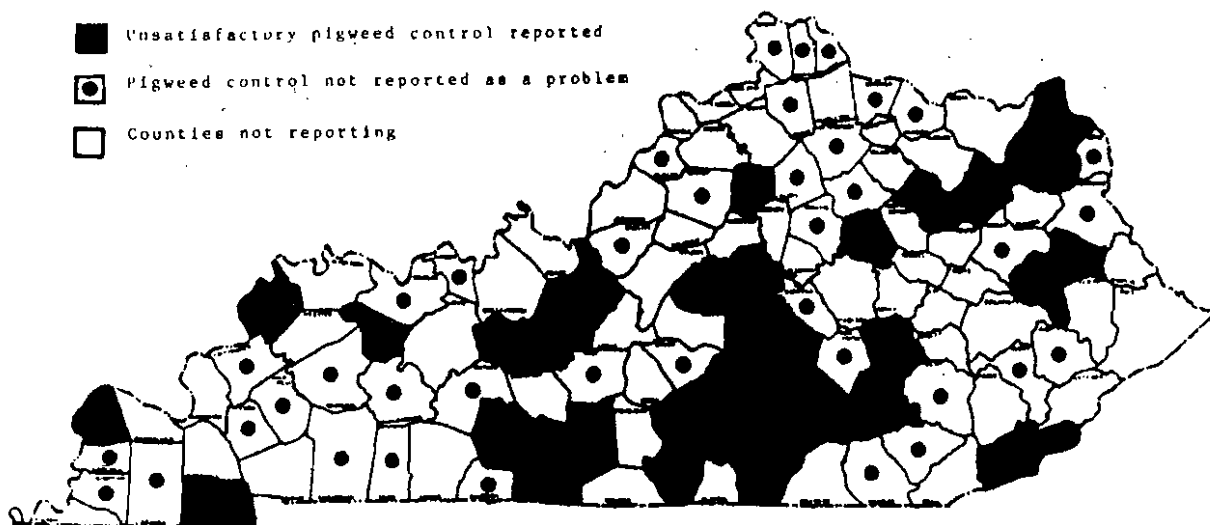


Figure 1. Results from a 1987 Pigweed Control Survey in Kentucky.

Production practices most often associated with unsatisfactory smooth pigweed control were 1) fields in continuous corn production, 2) minimum or no-tillage production systems, and 3) atrazine and/or simazine used as the primary herbicide program. Improper herbicide application and other factors were mentioned as causes for lack of control in some cases. Poor pigweed control did not appear to be a problem in fields which were rotated with soybeans.

A high incidence of dairy and/or hog producers are found in many areas where poor pigweed control has been reported, especially in south central Kentucky. Because of feed requirements these livestock producers are limited to continuous corn production.

FIELD STUDIES

Experimental Methods

Field studies were conducted during 1987 and 1988 in Wayne county, Kentucky. Different fields with a history of poor smooth pigweed control from triazines were used each year. Corn was grown under conservation tillage conditions where disking of previous crop residue was the only tillage used. Roundup at 3 pt/A was applied in 1987 for control of existing vegetation before planting; whereas, a knockdown herbicide was not needed in 1988. Corn was planted April 9, 1987 and May 7, 1988. Plot size consisted of 4 rows (36") by 40 feet with four replications. Smooth pigweed control was evaluated visually on June 29, 1987 and June 23, 1988.

Common herbicides used in corn were evaluated. Atrazine was applied alone at 2 and 5 qt/A (ie. 2 and 5 lb ai/A) and in a tank mixture with Princep. Extrazine, a package mixture of Bladex (cyanazine) and atrazine in a 2.7:1.3 ratio, was also evaluated in 1987. Postemergence treatments consisted of Atrazine plus Oil Concentrate alone and as a tank mixture with Tandem (tridiphane).

Alternative weed control programs evaluated were preemergence applications of Lasso (alachlor) or Dual (metolachlor) alone and in tank mix combinations with Atrazine. Banvel (dicamba) and 2,4-D Amine were applied postemergence following a preemergence application of Bladex. Postemergence treatments were applied when smooth pigweed was 1 to 2 inches tall and corn height was 8 to 10 inches.

Results and Discussion

Poor (45% or less) smooth pigweed control was obtained with Atrazine at 2 and 5 qt/A (Table 1). Tank mixture combinations of Atrazine at 1.5 qt/A plus Princep at 1.5 qt/A also resulted in unsatisfactory pigweed control. These herbicide treatments provided less than 50% control both years. Less than 25% control was obtained with Extrazine applied preemergence. These results indicated that adequate smooth pigweed control was not being provided by any triazine herbicide applied to the soil. Postemergence applications of Atrazine with Oil Concentrate did not satisfactorily improve smooth pigweed control. Better control was obtained in 1987 when Atrazine plus Oil Concentrate was tank mixed with Tandem, but control in 1988 was unsatisfactory. This indicates the possibility that the smooth pigweed population in these fields had developed a resistance to the triazine type herbicides.

Lasso at 2.5 qt/A and Dual at 2.5 pt/A, two acetanilide type herbicides, provided acceptable control. Lasso alone and in combination with Atrazine at 1.5 qt/A provided greater than 90% control. Smooth pigweed control with Dual alone in 1988 provided slightly less control than treatments containing Lasso. Postemergence Banvel and 2,4-D Amine applications provided acceptable smooth pigweed control.

Subsequent greenhouse tests showed smooth pigweed collected from these fields was not killed at atrazine rates as high as 10 lb ai/A (ie. 10 qt/A). Laboratory experiments demonstrated that the normal effect of atrazine toxicity in plants (ie. stopping photosynthesis) was not affected in these smooth pigweed plants. This research confirms that triazine resistant smooth pigweed is present in Kentucky. The poor control of smooth pigweed was due to the resistance of the weed and not application or environmental factors.

Table 1. Smooth pigweed control with preemergence and postemergence herbicide treatments in 1987 and 1988-Wayne County, KY.

Treatment	Product Rate/A	Time of Application	Control of Smooth Pigweed	
			1987	1988
			----- (%) -----	
1. Atrazine 4L	2 qt	PRE	45	20
2. Atrazine 4L	5 qt	PRE	28	20
3. Atrazine 4L + Princep 4L	1.5 qt + 1.5 qt	PRE PRE	12	28
4. Extrazine 4L	4 qt	PRE	22	--
5. Lasso 4EC	2.5 qt	PRE	100	92
6. Lasso 4EC + Atrazine 4L	2.5 qt + 1.5 qt	PRE PRE	100	95
7. Dual 8E	2.5 pt	PRE	98	72
8. Dual 8E + Atrazine 4L	2.5 pt + 1.5 qt	PRE PRE	98	82
9. Bicep 6L	2.4 qt	PRE	88	--
10. Atrazine 4L + Oil Concentrate	2.0 qt 2 pt	POST	52	20
11. Tandem 4E + Atrazine 4L + Oil Concentrate	1 pt + 1.5 qt + 2 pt	POST	95	58
12. 2,4-D Amine (Bladex 4L	1 pt 2 qt	POST PRE)	90	90
13. Banvel 4S (Bladex 4L	1 pt 2 qt	POST PRE)	98	--
LSD (0.05)			29	21

SUMMARY

Triazine resistance has developed in some Kentucky corn fields, where atrazine and/or simazine were used continuously. Alternative weed control programs will be necessary in fields infested with triazine resistant smooth pigweed. Rotation of crops and or rotating herbicides can help prevent the occurrence of triazine resistance. However, using alternative herbicides, other than triazines for smooth pigweed control, can increase the cost of the weed control program.

Herbicide treatments to control triazine resistant pigweed in corn should consist of a preemergence application of an acetanilide type herbicide, such as Lasso and Dual, or postemergence application of 2,4-D or Banvel. Higher rates of Lasso or Dual, such as those used in these experiments, may be needed to provide satisfactory smooth pigweed control. Proper timing based on weed and crop growth height are essential for optimum results when using 2,4-D or Banvel. Potential problems from spray or vapor drift to sensitive plants should also be considered before applying these postemergence herbicides.



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