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Residual Herbicides for Use in the Wheat-Fallow System

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Several residual herbicides are suitable for controlling weeds during fallow in the wheat-fallow system. The most widely used herbicide for this purpose is atrazine. Atrazine persists in the soil for over a year, and should be applied as soon as possible after wheat harvest to avoid injury to the following wheat crop. Cyanazine (Bladex), metribuzin (Sencor or Lexone), and terbutryn (Igran) do not persist as long in the soil as does atrazine, and are usually applied in the spring. Cyanazine and terbutryn, however, can be tank mixed with atrazine and applied following wheat harvest.

Chlorsulfuron (Glean) is a new herbicide, which obtained full labeling for wheat and wheat-fallow in 1983. Chlorsulfuron is different from the other herbicides currently used in wheat-fallow in that it was developed specifically for use in wheat and barley. Thus, it does not injure wheat and can be applied either to growing wheat (between the 2-3 leaf and boot stages) or anytime during fallow. Its persistence in the soil for weed control purposes is similar to that of atrazine. However, small quantities can remain in the soil for long periods of time and cause injury to following crops. For this reason, chlorsulfuron is currently labeled only for weed control in barley, wheat, and wheat-fallow on soils having a pH of 7.5 or lower.

All of these herbicides have been tested extensively at the Garden City Experiment Station to determine their suitability for the wheat-fallow system. The results of the experiments reported here are intended

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Table 1. Fallow weed control from fall and spring applied herbicides, 1982.

Herbicide	lb/A a.i.	% Control ³			
		Redroot pigweed	Russian thistle	Kochia	Witchgrass
Atrazine ¹	0.5	19	40	79	0
Atrazine ¹	0.8	62	66	99	0
Atrazine ¹	1.0	91	87	100	0
Atrazine + cyanazine ¹	0.8 + 1.6	40	89	100	0
Cyanazine ²	2.4	91	97	100	100
Metribuzin ²	0.5	100	100	100	100
Atrazine ¹ + cyanazine ²	0.5 + 2.4	100	100	100	100
Atrazine ¹ + metribuzin ²	0.5 + 0.5	100	100	100	100
Control	---	0	0	0	0
LSD(.05)		32	15	16	-

¹Applied 8-13-81 ²Applied 5-17-82 ³% Control on 6-14-82

to apply to silt loam soils without regard to pH. For a specific discussion of herbicides for high pH soils, the reader is referred to Keeping Up With Research '65, Herbicides for Use on High pH Soils in Southwest Kansas.

Results

Postharvest, Spring, and Sequential Applications. Results of postharvest, spring, and sequential (postharvest + spring) applications are presented in Tables 1 and 2. Results from 1982, contained in Table 1, indicate that 1 lb of atrazine gave good broadleaf weed control for 10 months after application, with less control from lower rates. Spring applications of cyanazine and metribuzin controlled witchgrass, in addition to the broadleaf weeds. All rates of atrazine controlled weeds from application through winter freeze-up. Therefore, the best season-long control was obtained from a postharvest application of atrazine, followed by cyanazine or metribuzin in the spring. Data from 1983 are presented in Table 2. Only Russian thistle and kochia were rated, since pigweed and witchgrass were not present in any quantity. Weed control with atrazine, cyanazine, and metribuzin was similar to that obtained in 1982. The control resulting from these herbicides, however, lasted longer into the summer of 1983, because a cool spring delayed weed growth. The plots were rated twice in 1983, and several of the treatments required tillage on July 14, prior to the second rating, including all of the non-sequential atrazine treatments.

Chlorsulfuron was included in 1983, and the 0.375 oz rate, applied postharvest, resulted in longer lasting weed control than did 1 lb of atrazine. Conversely, plots receiving the 0.25 oz rate of chlorsulfuron, postharvest, required tillage on July 14, along

with the plots receiving atrazine. The sequential application of 0.25 oz chlorsulfuron following atrazine was still giving nearly perfect control on July 21, 1983. Spring (non-sequential) applications of chlorsulfuron resulted in better weed control than that obtained with cyanazine or metribuzin.

A comparison of tank mixes containing chlorsulfuron, cyanazine, and metribuzin is given in Table 3. Tank mixes of 0.125 oz chlorsulfuron with either cyanazine or metribuzin resulted in weed control as

Table 2. Fallow weed control from fall and spring applied herbicides, 1983.

Herbicide	lb/A(oz/A) a.i.	% Control			
		Russian thistle		Kochia	
		7-1-83	7-21-83	7-1-83	7-21-83
Atrazine ¹	0.5	75	T ³	77	T
Atrazine ¹	0.8	89	T	86	T
Atrazine ¹	1.0	90	T	92	T
Atrazine + cyanazine ¹	0.8 + 1.6	91	T	80	T
Atrazine + chlorsulfuron ¹	0.5 + (0.375)	91	85	87	65
Chlorsulfuron ¹	(0.25)	96	T	79	T
Chlorsulfuron ¹	(0.375)	97	96	94	89
Chlorsulfuron ²	(0.25)	99	91	99	99
Chlorsulfuron ²	(0.375)	100	98	100	100
Cyanazine ²	2.4	100	88	100	60
Metribuzin ²	0.5	99	T	100	T
Atrazine ¹ + cyanazine ²	0.5 + 2.4	100	92	100	87
Atrazine ¹ + chlorsulfuron ²	0.5 + (0.25)	100	100	100	99
Atrazine ¹ + metribuzin ²	0.5 + 0.5	99	93	100	73
Control		0	T	0	T
LSD(.05)		10	11	12	12

¹Applied 8-3-82

²Applied 4-28-83

³Tillage on 7-14-83

Table 3. Fallow weed control from spring applied herbicides, 1983.

Herbicide ¹	lb/A(oz/A) a.i.	% Control			
		Russian thistle		Kochia	
		7-1-83	7-21-83	7-1-83	7-21-83
Chlorsulfuron	(0.125)	98	72	100	95
Chlorsulfuron + cyanazine	(0.125) + 2.0	100	97	99	100
Chlorsulfuron + metribuzin	(0.125) + 0.38	100	98	100	100
Chlorsulfuron	(0.25)	98	87	100	98
Chlorsulfuron + cyanazine	(0.25) + 2.0	99	98	100	100
Chlorsulfuron + metribuzin	(0.25) + 0.38	99	97	99	98
Chlorsulfuron	(0.375)	100	98	100	100
Cyanazine	2.4	95	75	100	100
Terbutryn	2.4	98	95	100	92
Metribuzin	0.5	99	75	97	82
Control	0	0	0	0	0
LSD(.05)		10	11	6	5

¹Applied 4-15-83

good as that obtained with higher rates of chlorsulfuron applied alone, and better control than with higher rates of cyanazine or metribuzin applied alone. Although not evaluated in this test, such tank mixes can be expected to provide control of certain grassy weeds, in addition to broadleaf weeds.

Extended Control from In-Crop Applications. Of the herbicides suitable for reduced tillage, chlorsulfuron is unique in that it can be applied to growing wheat. It will control most broadleaf weeds in

Table 4. Extended weed control using chlorsulfuron, 1982.

Chlorsulfuron ¹ oz/A	Date rated					
	8-10-82		8-24-82		9-21-82	
	Ruth ²	KOCZ	Ruth	KOCZ	Ruth	KOCZ
	% Control					
0.125	0	100	0	89	0	89
0.18	86	100	50	89	26	89
0.375	100	100	92	89	85	89
Control	0	0	0	0	0	0

¹Applied to jointing winter wheat on 4-3-84

²Ruth = Russian thistle, KOCZ = Kochia

the growing wheat, and if a high enough rate is used this control can be extended into the fallow period. In Table 4 it can be seen that satisfactory control of Russian thistle and kochia was obtained in September 1982, from an application of chlorsulfuron made to jointing winter wheat on April 3, 1982. Kochia was controlled with only 0.125 oz, while the control of Russian thistle required 0.375 oz. When used in this manner, the maximum labeled rate (0.375 oz) is recommended if control until winter freeze-up is needed. A lower rate can be used if a shorter period of weed control is desired.

Control of Volunteer Wheat. The 1.0-lb rate of atrazine applied prior to emergence has given adequate control of volunteer wheat. Lower rates of atrazine, when used on high pH soils have also given satisfactory control. Occasionally, control of volunteer with atrazine has been less than satisfactory. In such instances, control has been improved when 1.6 lb of cyanazine was tank mixed with 0.8 lb of atrazine.

The use of chlorsulfuron alone will result in essentially no volunteer control; tank mixing chlorsulfuron with atrazine will aid in controlling volunteer. In the event that an excessive amount of volunteer escapes the residual herbicide, tillage or postemergence herbicides should be used. Delaying the application of the residual herbicides until the volunteer has emerged, and tank mixing the residual herbicide with a post-emergence herbicide also can be effective.

Conclusions

Herbicides for wheat-fallow can be applied post-harvest, in the spring, or sequentially. In addition, chlorsulfuron can be applied to growing wheat. All of these methods result in good weed control for varying periods of time. The length of time of weed control depends on the persistence of the particular herbicide in the soil, the application rate, and climatic conditions.

Atrazine and higher rates of chlorsulfuron can be applied after harvest for control that will last into the spring, while short-term residual herbicides such as metribuzin, cyanazine, or a low rate of chlorsulfuron are best suited for application in the spring, or for sequential treatments following a postharvest application.

Ideally, herbicides should be selected to control weeds during the entire fallow period. Unfortunately, there is no single herbicide that will control weeds for the entire time. The best control, therefore, will result from an in-crop or postharvest application followed by a spring application.

Trade names are used to identify products. No endorsement of these products or criticism of similar products not mentioned is intended.

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