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Fall-applied Herbicides for Eliminating Endophyte-infested Fescue

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An endophytic fungus in tall fescue (*Festuca arundinacea* Schreb.) has been associated with poor performance in livestock that consume fescue forage or seed. Reduced animal gains, "summer slump" syndrome, and fescue foot are examples of production problems. The fungus (*Acremonium coenophialum* (Morgan-Jones & Gains) syn. *Epichloe typhina* (Fries) Tul.), which is found in fescue crowns, sheaths, stems, and seed, is not pathogenic to the host plant; i.e., it produces no harmful effects or visible symptoms. The fungus exists in fescue only in the asexual form, so appears to be transmitted solely as a seed-borne organism. The present method of eliminating the fungus is destruction of the infested host plant. Thus, the establishment of endophyte-free fescue stands must be preceded by elimination of endophyte-infested plants. Herbicides must be used to kill fescue on erodible land where tillage is not feasible.

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Several herbicides are reported to be effective on cool-season perennial grasses such as tall fescue. However, some may have residual soil effects, which limit the type of crop to be planted the following year. Postemergent herbicides have no such restriction, since they have no residual soil activity.

Timing of application could be critical, since grass vigor and the amount of stored energy reserves for regrowth vary during the year. This study tested effectiveness of fall applications of several grass-control herbicides, primarily postemergent types, at rates considered to be economically feasible.

Procedures

Plots of established tall fescue (25' x 8'.3 replications) at the Mound Valley Unit of the Southeast Kansas Experiment Station were treated on 7 November 1984. Postemergent foliar herbicides were applied in a volume of 9 gal/acre (low-volume) using flat-fan nozzles (Tee-Jet® 8001) at 40 p.s.i. on a 6' CO₂-pressured backpack sprayer boom. A split-application treatment of paraquat was included, with the spring, follow-up application on 9 April 1985. Root-absorbed materials (pronamide and diuron) were applied in a volume of 20 gal/acre, and a wick application treatment of 2:1 water:glyphosate was also included. Rates and surfactants used are listed in Table 1. Fescue control was assessed on 10 May 1985 as the percentage of dead plants in the total, established plant population.

A second experiment was performed at the Parsons Unit to test timing and method of postemergent herbicide application. Established tall fescue plots (25' x 8', 3 reps) were sprayed on 9 September or 22 November 1985 using a tractor-mounted sprayer to treat a 6' strip. Nozzles described above were used at 30 p.s.i. to apply a volume of 7.5 gal/acre (low-volume), or Tee-Jet® 8003 nozzles were used to apply herbicides in a volume of 20 gal/acre (standard). All applications were made in a 1 percent solution of crop oil concentrate (80 percent paraffin-20 percent surfactant) at rates listed in Table 2. Fescue plant control was estimated on 7 May 1986.

Table 1. Herbicides and Rates Used in Low-volume Fall Applications, and Their Effect on Plants in an Established Tall Fescue Stand.

Herbicide Name		Rate/acre		% Fescue
Chemical	Trade	Product	Formulation	Control
Glyphosate	Roundup	2 qt	3-S	100
		1 qt		100
		1 pt		98
		Wick		83
Paraquat ¹	Paraquat	1 qt	2-S	97
		1 pt		88
		1 pt ²		67
Pronamide ³	Kerb	1.0 lb	50WP	8
Diuron ³	Karmex	1.25 lb	80WP	0
Sethoxydin ⁴	Poast	1.0 pt	1.53 EC	87
		0.5 pt		40
Fluazifop ⁴	Fusilade	0.5 pt	4 EC	40
		0.25 pt		17
Haloxyfop ⁴	Verdict	0.5 pt	2 EC	87
		0.25 pt		55
DPX-Y6202 ⁴	Assure	.625 pt	0.8 EC	47
		.375 pt		43
LSD (.05)				16

¹Applied with 1 pt/100 gal X-77 surfactant.

²Applied in split application, 1/2 in fall, 1/2 in spring.

³Applied in normal volume of water (20 gal/acre).

⁴Applied with 1% crop oil in final spray.

Table 2. Effect of Herbicide Application Time on Control of an Established Tall Fescue Stand.

Name	Herbicide Application		% Fescue Control
	Rate ¹	Time	
Fluazifop	1.5 pt	9 Sept	24
		22 Nov	34
Paraquat	1 qt	9 Sept	78
		22 Nov	84
Glyphosate	1 pt	9 Sept	57
		22 Nov	71
Sethoxydin	1 pt	9 Sept	29
		22 Nov	70
Haloxifop	0.5 pt	9 Sept	18
		22 Nov	53
DPX-Y6202	0.75 pt	9 Sept	11
		22 Nov	21
LSD (.05)			11

¹Formulations the same as in Table 1, except that fluazifop was 1 EC in Experiment 2.

Results

Treatments and control percentages for the first experiment are shown in Table 1. Glyphosate at 2 and 1 qt/acre gave 100 percent fescue control. The 1 pt/acre rate of glyphosate was also very effective, but control by the wick methods was spotty because of difficulty in obtaining uniform application on the short-statured (4") fall vegetation. Paraquat at 1 qt/acre effectively eliminated establishment fescue plants, but the 1-pt rate was not as effective. The split fall-spring application of ½pt + ½pt was not effective, killing only two-thirds of the established plants.

Other herbicides in the trial (some not labelled for use on fescue) were much less effective at rates used. Sethoxydin and haloxifop had some activity on established fescue plants, but pronamide, diuron, fluazifop, and DPX-Y6202 had little effect (see Table 1 with trade names).

Herbicide treatments and control percentages for the second experiment are shown in Table 2. The single rate of each herbicide was selected, based on results of the previous experiment. Levels of fescue control were generally much lower compared to the first experiment, probably because of a milder winter. January 1985 had an average temperature at the Mound Valley Unit of 25.3°F and a minimum of -7°F, whereas January 1986 had average and minimum temperature of 36.2°F and 4°F, respectively, at the Parsons Unit. These averages represent deviations from the norm of -7.6°F and + 3.8°F at the two respective locations. Application of postemergent herbicide in the "standard" volume of 20 gal/acre did not improve fescue control significantly ($P < .95$) compared to the low-volume application, except that control with fluazifop seemed slightly enhanced with the low-volume application (data not shown).

Herbicide application at the later date (November) was generally more effective in killing fescue than was the early (September) application. The significant ($P > .99$) date x herbicide interaction resulted from the great relative increase in fescue kill by sethoxydin and haloxyfop applied on 22 November (compared to 9 September), when sethoxydin was almost as effective as glyphosate. Glyphosate effectiveness was also significantly increased at the later vs. the early application date, and DPX-Y6202 exhibited the same trend (Table 2).

Summary

Several postemergent herbicides were used at two or more rates in 9 gal/acre on 7 November 1984, and fescue control was evaluated on 10 May 1985. Glyphosate and paraquat were each effective in eliminating fescue, with acceptable control (97 percent or more) obtained with 1 pt and 1 qt/acre rates, respectively. A follow-up experiment to determine the effect of spray volume and of timing of fall application indicated that late (November) application was most effective, and that most herbicides were slightly more effective at the standard spray volume (20 gal/acre) than at a low volume. Although a mild winter apparently reduced levels of control, paraquat and glyphosate were again most effective at killing established fescue, but sethoxydin gave almost as much control as glyphosate at the late application date.

NOTE: Trade names are used to identify herbicides. No endorsement is intended, nor is any criticism implied of similar products not mentioned.

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