Controlling Sixweeks Fescue on Shortgrass Range

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Highlight: *Sixweeks fescue is an unpalatable annual grass that, when abundant, may seriously reduce grazing on associated species, limiting livestock gains and causing spot overgrazing. In this study, abundance was affected more by seasonal precipitation patterns than grazing or nitrogen fertilization. Either atrazine and simazine herbicides, applied at 1.1 kg/ha in either fall or spring, effectively controlled sixweeks fescue.*

Sixweeks fescue (*Vulpia octoflora* (Walt.) Rydb.) is a winter annual plant with subspecies distributed throughout the 48 contiguous states (Harrington, 1954). In Colorado, it is found on plains and mountains up to elevations of 2,600 m (8,500 ft). Ranchers on the shortgrass plains listed sixweeks-fescue control as one of their greatest needs in about 1960, following several successive years of serious problems with this weedy grass.

Problems associated with sixweeks fescue on shortgrass plains were investigated at the Central Plains Experimental Range. Hylton and Bement (1961) estimated a loss of $25 per head in liveweight gains of yearling cattle in 1958. The loss was due to overgrazing of bottomland range sites and undergrazing on upland range sites where the sixweeks fescue was abundant. Both avoidance and rejection habits of cattle were reported by Hyder and Bement (1964). Cattle avoided untreated plots infested with sixweeks fescue and preferred those treated with simazine (2-chloro-4,6-bis(ethylamino)-*s* triazine). During the latter part of the summer, the cattle also preferred nitrogen-fertilized plots, even though fertilization increased the stands of sixweeks fescue. However, cattle never grazed the fescue itself even on preferred plots.

Cattle rejected sixweeks fescue in two ways: first, by grazing carefully around the plants, and second, by dropping the plants inadvertently included in a bite. Although it appeared that cattle dropped the plants because they were pulled up with considerable soil attached, the cattle also tended to avoid concentrations of sixweeks fescue even when the plants were too short to be grazed. As a result, the blue grama (*Bouteloua gracilis* (H.B.K.) Lag. ex Steud.) was used poorly and unevenly.

Sixweeks fescue fluctuates greatly in abundance from year to year. Above-average precipitation in the spring appears to promote plant growth and seed production. With abundant seed supply, above-average precipitation in the early fall promotes seed germination, seedling emergence, and thick stands the next year. In 4 of 11 years (1963–73, inclusive), the stands of sixweeks fescue on upland sandy loam soils were thick enough to interfere seriously with grazing (unpublished data). Thus, effective control practices may widely apply on the Central Great Plains. Both simazine (Hyder and Bement, 1964) and atrazine (2-chloro-4-ethylamino-6-isopropylamino-*s*-triazine) (Houston and van der Sluijs, 1973) have effectively controlled sixweeks fescue, but minimum rates and times of application have not been determined.

This paper compares cyanazine (2-(4-chloro-6-ethylamino-*s* triazin-2-ylamino)-2-methylpropionitrile), simazine, atrazine, and potassium hexafluoroarsenate at various rates for effectiveness in controlling sixweeks fescue.

Methods

Two separate studies on shortgrass range in north-central Colorado included responses of sixweeks fescue abundance to triazine herbicides. The first study compared how atrazine, simazine, and cyanazine herbicides combined with nitrogen (N) fertilizer affected species composition of rangeland over 3 years, 1970–72. This study was conducted on Ascalon sandy loam soil on a loamy plains range site. The second study compared the effects of atrazine and potassium hexafluoroarsenate herbicides combined with N fertilizer on ecology and species composition of shortgrass range, 1971–73. This study was conducted on Manter sandy loam and Vona fine sandy loam soils on sandy plains range site.

Both studies were conducted at the U.S. Department of Agriculture, Central Plains Experimental Range, located 20 km northeast of Nunn, Colorado. The long-time average annual precipitation is 31 cm (12.2 inch), with 73% occurring during the growing season of May through September.

The vegetation is dominated by blue grama. Other important species are plains pricklypear (*Opuntia polyacantha* Haw.), scarlet globemallow (*Sphaeralcea coccinea* (Pursh) Rydb.), red threeawn (*Aristida longiseta* Steud.), sand dropseed (*Sporobolus cryptandrus* (Torr.) A. Gray), woody

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This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed have been registered.

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Table 1. Monthly precipitation (cm) for the cropyears (September through August) of 1969–73, cropyear totals, and 35-year mean at Central Plains Experimental Range, Nunn, Colo.

Cropyear	Month												Cropyear total[1]
	S	O	N	D	J	F	M	A	M	J	J	A	
1968–69	1.0	2.4	1.7	0.5	0.3	0.7	0.6	4.0	5.7	11.8	4.4	3.5	36.8
1969–70	3.1	7.1	0.3	T	0.1	0.1	3.3	3.4	2.1	2.9	4.0	0.6	27.1
1970–71	3.8	2.9	0.4	0.6	1.1	0.8	2.3	7.2	4.2	3.1	1.5	0.9	28.8
1971–72	5.4	0.4	0.1	T	0.9	T	1.0	1.5	3.1	8.3	4.5	9.7	34.9
1972–73	4.3	1.4	1.6	1.0	0.3	T	1.8	3.5	1.5	2.3	6.8	1.5	27.3
35-year mean, 1939–73	2.9	1.8	0.7	0.4	0.7	0.5	1.5	2.8	5.3	6.1	4.7	3.8	31.2

[1] Totals may not agree with sum of monthly precipitation because of rounding off.

buckwheat (*Eriogonum effusum* Nutt.), and sun sedge (*Carex heliophylla* Mackenz.).

In the first study, atrazine, simazine, and cyanazine were applied at 0, 1.1, and 3.4 kg/ha of active ingredient in factorial combination with 0, 22, and 45 kg N/ha of ammonium nitrate fertilizer. Beginning the spring of 1970, the treatments were applied in four replicates in both spring and fall on the same plots each year. Plot size was 4.6 m by 15.2 m (15 ft × 50 ft). The herbicides were applied as an 80% wettable power in aqueous solution at a rate of 187 liters/ha (20 gallons/acre) with a compressed air sprayer. A nonionic surfactant was added to the spray solutions at a rate of 0.15%. The fertilizer was broadcast on the surface in pellet form. Frequency of sixweeks fescue was recorded in June each year on 25 .41×41 m–(16×16-inch) quadrat frames per plot (Hyder et al., 1965).

In the second study, four plots of 30.5 m × 22.9 m (100 ft × 75 ft) were established for each treatment. Atrazine and potassium hexafluoroarsenate at 0 and 2 kg/ha and N at 0, 22, and 45 kg/ha were applied in all factorial combinations. Atrazine was applied on the same plots each fall in 1970, 1971, and 1972. Potassium hexafluoroarsenate was applied only in the fall of 1970. The herbicides were applied in aqueous solution with a commercial sprayer at 140 liters/ha (15 gallons/acre). The fertilizer was applied by a truck-mounted spreader. Frequency of sixweeks fescue was recorded on 250 quadrat frames on each plot each year in June.

Precipitation was above average during the summer and fall of 1969 before establishment of the first study (Table 1). It was below average during the summers of 1970 and 1971 and continued low from the fall of 1971 through spring of 1972. It was above average during the summer and fall of 1972 and then below average through the summer of 1973 (except for July).

Results

In the first study, both rates of all three triazine herbicides significantly reduced frequency of sixweeks fescue in 1970, except the 1.1-kg rate of atrazine (Table 2). Results from the fall and spring applications of herbicides were essentially the same. Therefore, only the results from the spring applications are shown. During 1971, all herbicides reduced sixweeks fescue while its average frequency on untreated plots increased substantially. During 1972, cyanazine did not reduce sixweeks fescue, but both simazine and atrazine completely controlled it. N fertilizer did not significantly affect its frequency.

In the second study, atrazine reduced frequency of sixweeks fescue 85 to 100% the first year after application (Fig. 1). Control was nearly 100% during the following 2 years. Potassium hexafluoroarsenate reduced frequency of sixweeks fescue about 60% in 1971 and 1973 and about 40% in 1972 (Table 3). It did not effectively control sixweeks fescue, particularly during drought. In this second study N fertilizer had no significant effect on frequency of sixweeks fescue.

The frequency of sixweeks fescue in any one year greatly depended on the amount and distribution of seasonal precipitation (Fig. 2). High precipitation during the second preceding summer prior to June measurement and second preceding winter reduced frequency of sixweeks fescue. High precipitation during the second preceding spring and the preceding fall increased frequency.

Discussion

The unacceptability of sixweeks fescue to cattle in all seasons often

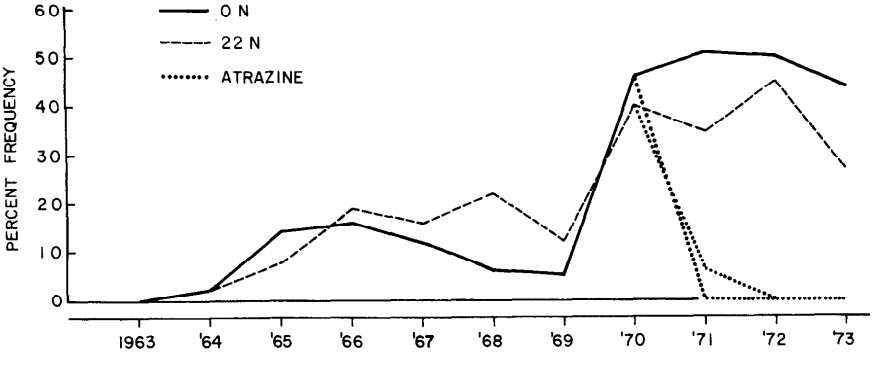

Fig. 1. *Percent frequency of sixweeks fescue, 1963–73, showing effects of N applied annually and atrazine applied at 2 kg/ha in the fall of 1970, 1971, and 1972.*

Table 2. Percent frequency of sixweeks fescue, 1970, 1971, and 1972. Herbicides were applied in May each year on the same plots.

Year of sampling	Herbicide[1] and rate (kg/ha)							Average
	Control	C 1.1	S 1.1	A 1.1	C 3.4	S 3.4	A 3.4	
1970	11.7 d[2]	3.0 ef	3.0 ef	5.7 def	3.7 ef	0.3 f	3.0 ef	4.3 b
1971	64.7 a	48.0 b	7.3 de	8.3 de	34.3 c	0.3 f	2.0 ef	23.6 a
1972	7.3 de	5.0 ef	0.0 f	0.0 f	3.7 ef	0.0 f	0.0 f	2.3 b
Average	27.9 a	18.7 b	3.4 de	4.7 d	13.9 c	0.2 e	1.7 de	

[1] C–cyanazine, S–simazine, and A–atrazine.
[2] Interaction means or means in row or column of averages followed by the same letter are not significantly different at the 5% level.

Table 3. Percent frequency of sixweeks fescue 1970, 1971, 1972, and 1973. Atrazine was applied in the fall of 1970, 1971, and 1972 on the same plots. Potassium hexafluoroarsenate was applied only in the fall of 1970.

Year of sampling	Rate of atrazine (kg/ha)	Rate of pot. hex. (kg/ha) 0	2	Average
1970	0	45 a[1]	38 a	41 a
	2	52 a	34 a	43 a
	Avg	48 a	36 a	
1971	0	64 a	24 b	44 a
	2	3 c	T c[2]	2 b
	Avg	34 a	12 b	
1972	0	56 a	34 b	45 a
	2	1 c	T c	T b
	Avg	28 a	17 a	
1973	0	50 a	20 b	35 a
	2	T c	T c	T b
	Avg	25 a	10 b	

[1] Interaction menas or means in row or column of averages in each year followed by the same letter are not significantly different at the 5% level.
[2] T—trace, less than 0.5% frequency.

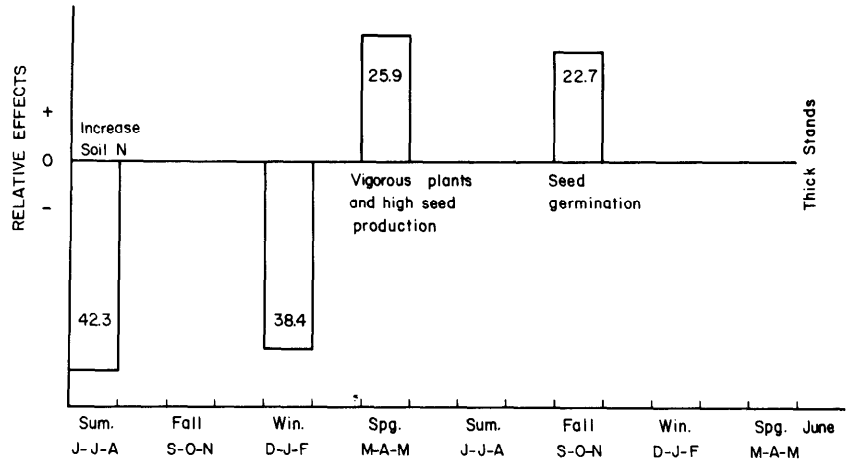

Fig. 2. *Relative effects of quarterly precipitation of two preceding years on percent frequency of sixweeks fescue, measured in June (regression coefficient multiplied by average quarterly precipitation total).*

creates a real problem for ranchers in the Central Great Plains. This annual grass is most abundant on upland range sites, and is present in some degree every year. This species not only contributes nothing to the forage supply, but, in years when abundant, seriously interferes with utilization of palatable forage. Hyder and Bement (1964) pointed out that this species is often abundant even in ungrazed exclosures. Seasonal weather conditions chiefly influence its abundance.

The relationship of seasonal precipitation and frequency of sixweeks fescue is complex. The most important part of the sequence begins with favorable moisture during spring of the preceding year, which produces good plant growth and high seed production. Favorable fall precipitation is then important for seed germination and establishment of a new stand. Low moisture during the second preceding summer is probably important for increasing nitrate N in the soil surface.

Annual applications of herbicides are not needed. Because sixweeks fescue germinates and emerges in the fall, control can be delayed until the need is evident. Both atrazine and simazine at 1.1 kg ai/ha effectively controlled sixweeks fescue. Since cool-season grasses are susceptible to these herbicides, the 1.1-kg rate should not be exceeded. Spring or fall applications were equally effective. Fall application may be preferred if ranges are fertilized in the fall for increased forage production. Cyanazine and potassium hexafluoroarsenate were ineffective herbicides for control of sixweeks fescue.

Cyanazine is highly soluble in water and usually has no residue beyond one growing season. Both atrazine and simazine are less soluble than cyanazine and may have increased in the soil over the three years.

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