Drought Effects on Southeast Oregon Native Meadows

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SUMMARY

Meadow foxtail (*Alopecurus pratensis* L.) is a highly productive grass introduced from temperate regions of Europe and Asia that has increased in density and gained dominance in many native meadows in southeast Oregon and elsewhere. Native meadows in this region are critical as a forage and hay base for commercial beef production, and their importance will increase as livestock operators search for alternatives to public land grazing. This study was established to investigate the response of meadow foxtail and associated native species to drought. In the third year of a drought, plots were established on meadow dominated, prior to the drought, by meadow foxtail. The first year (1992) was dry with snowpack at 25 percent of average, whereas in 1993, snowpack was 50 percent above average. Foxtail yield in ungrazed plots was 230 and 5,518 lb/ac in 1992 and 1993, respectively. Meadow foxtail provided 68 and 76 percent of total herbaceous production in 1992 and 1993, respectively. Botanical composition was dominated by foxtail both years at 71 and 53 percent, respectively, in 1992 and 1993. Basal cover of meadow foxtail more than doubled after the drought. We conclude from these data that meadow foxtail is persistent under severe drought conditions, and that stand deterioration is not likely.

INTRODUCTION

Native flood meadows of eastern Oregon are classified as seasonally wet because of early spring snowmelt. Historically, the forage was composed of native grasses including Nevada bluegrass (*Poa nevadensis* Vasey ex Scribn.) and beardless wildrye (*Elymus triticoides* Buckl.), rushes (*Juncus* spp.), sedges (*Carex* and *Eleocharis* spp.), and a variety of forbs.

During the past 20 years an introduced species, meadow foxtail (*Alopecurus pratensis* L.), has increased area of coverage in native meadow systems, producing almost monospecific stands in some localities. Yield and forage quality are high, and with nitrogen fertilization foxtail yields can equal or exceed those of timothy (*Phleum pratense* L.), orchardgrass (*Dactylis glomerata* L.), or smooth bromegrass (*Bromus inermis* Leyss.).

Development of new management strategies for these meadows requires quantitative information regarding response to drought. This study was established in the third year of an intense drought with the objective of determining the effect of drought on native meadow botanical composition, basal cover, and forage yield.

MATERIALS AND METHODS

The study was conducted at the Eastern Oregon Agricultural Research Center (EOARC), about 5 miles south of Burns, Oregon. Meadow foxtail dominated the stand prior

to the drought. Mean annual precipitation (30 year mean) is about 11.8 inches, primarily as winter snow. Our study site was a 57-acre native flood meadow in which eight 82-x 164-foot experimental plots were established in four blocks along an elevational gradient to account for elevation effects on flooding depth and duration. In each block one plot was fenced with electric fence to prevent grazing, creating two treatments in four blocks.

In May 1992, a permanent 160-foot line transect was established diagonally across each plot. Steel pins were placed at ground level to permit relocation in 1993. Forage yield was estimated each year by placing 10 frames at 15-foot intervals and clipping forage to ground level. Forage was separated into meadow foxtail, sedge/rush, other grasses, and forbs, then dried and weighed. Clipping was done in mid-July, corresponding to traditional haying dates.

Botanical composition and basal cover were estimated by modified step-point, with 200 points recorded in each plot. Data were separated into five categories: meadow foxtail, sedges, rushes, other grasses, and forbs. Sampling was performed over 3 days beginning July 9, just prior to clipping. Meadow foxtail forage from the clipping study was ground through a 1 millimeter screen and stored in plastic bags. Organic matter, ash, digestibility, and protein content were determined for each sample.

Drought restricted grazing in 1992, however eight steers were released on the pasture May 1 and were allowed to graze for 1 week. Forage yield in 1993 was excellent and 84 yearling heifers were released to graze on May 3. Cattle remained on pasture until the study was terminated July 19, 1993. Cattle had equal access to each of the four blocks, and in both years visual observations indicated that they spent similar amounts of time grazing in each block.

RESULTS

Precipitation

In this part of the Northern Great Basin precipitation usually peaks in January, with another small peak in May and June (Figure 1). September-August precipitation was 8.7 and 13.7 inches in 1991-92 and 1992-93, respectively. December and January were, respectively, 16 and 10 percent of average in the 1991-92 crop year, resulting in below-normal snowpack. No surface water was available in 1992 to provide irrigation to experimental plots, while in 1993 surface water was present from April through June. The only significant precipitation events during the 1991-92 season occurred in June, 1992, when 77 millimeter rain fell.

Yield

Total yield in ungrazed plots was significantly higher in 1993 than 1992 for all categories of plants (Table 1). During the drought of 1992, locust infestation was heavy. We noted that grasshoppers consumed primarily meadow foxtail leaf and sheath, based on visual observation. Grasshopper damage was extensive during the drought, and significantly affected yield estimates of meadow foxtail in 1992.

June, 1992, rainfall was three times normal and occurred during the normal peak growth period. We found that while meadow foxtail can produce growth after spring rain, yield will be significantly reduced without surface irrigation. Even with the high June precipitation amounts, ungrazed yields were only about 5 percent of average for this site in 1992.

The 1993 growing season allowed us to measure plant growth and development under ideal conditions; crop-year precipitation was 15 percent above average, and snowmelt provided irrigation for about 6 weeks beginning in early May. Even after 3 years without irrigation, yields in 1993 approached pre-drought 1989 values, at about 7,294 and 8,277 lb/acre, respectively.

In ungrazed plots, meadow foxtail contributed 68 percent of total yield in July, 1992, significantly less than in 1993 (Table 2). Meadow foxtail clearly remained the dominant forage species in these meadows following a 3-year drought, with percentage yield comparable to 1989.

Composition and basal cover

Botanical composition of ungrazed meadow in 1992 further illustrates the dominance which meadow foxtail has gained in these meadows (Table 3). Together, foxtail and sedges accounted for 85 percent of the composition. The following year, 1993, foxtail percentage declined significantly in response to significant increases in rush and other grass categories. Grazed plots exhibited a similar trend, however the greater regrowth potential of meadow foxtail allowed it to maintain its place in the stand. Earlier work on the same pasture found that steer diets in June were dominated by sedges and rushes. We speculate that in this study relatively greater pressure was probably placed on sedge and rush components during grazing in June. That would accentuate the differences noted, because sedge/rush species common to these meadows have limited regrowth potential.

Basal cover increased in the wet year, however the only plant category to show a significant change was meadow foxtail (Table 4). Basal cover of ungrazed meadow foxtail increased 3 percent between 1992 and 1993, while all other categories remained at or below 1 percent. Meadow foxtail on grazed plots tended to increase while other categories were minor components both years.

Meadow foxtail quality

Meadow foxtail IVOMD for hand-clipped samples was greatest in July, 1992 (Figure 2). Plants did not grow to maturity that year, but became quiescent during the late vegetative to early flowering stage of growth. Grazed and ungrazed plots did not differ for CP or IVOMD in 1992, however grazing increased forage quality in July, 1993. Regrowth after grazing raised IVOMD and CP by about 9 and 7 percent, respectively.

Crude protein was very high in 1992, at about 27 percent in both treatments, evidently enhanced by the early cessation of growth that year. Ungrazed plants grew to maturity in 1993, and protein levels in July had fallen to only 5 percent. This drop in quality is probably a result of advanced maturity and dilution of high-nitrogen cell constituents by low-nitrogen cell wall components. Increased cell wall content likely contributed to the measured drop in IVOMD.

CONCLUSION

Meadow foxtail is a species well adapted to wet, saturated conditions. It is not native to the high-elevation meadows of the northern Great Basin, however it has shown significant local increases in meadows such as those in the Harney Basin. After a 3-year drought during which no surface irrigation occurred, it maintained its presence in the stand and when released

from the drought produced yields comparable to pre-drought levels. It clearly did not decrease significantly due to drought effects. Botanical composition and cover data show that it was able to survive the drought, and provide no indication of significant death loss during the drought. We reject the hypothesis that drought will kill meadow foxtail and decrease its dominance in the stand. These data point to the fact that meadow foxtail is well-adapted to environmental conditions in the northern Great Basin and that it is likely that it will continue to expand its coverage and dominance in those meadows to which it is adapted. In light of this, additional research is warranted to determine the best management strategies for meadows which become dominated by this species.

Table 1. Forage DM yield (kg/ha) of meadow foxtail, sedges/rushes, other grasses, and forbs in grazed and ungrazed plots at EOARC during 1992 and 1993.

	Ungrazed		Grazed	
Species	1992	1993	1992	1993
Meadow foxtail	257 *	6184	274	1014
Sedges/Rushes	29 *	967	5	89
Other grasses	36 *	614	12	9
Forbs	69 *	430	35	57

* Species means between years are significantly different (P<.05).

Table 2. Forage DM yield (% of total) for meadow foxtail, sedges/rushes, other grasses, and forbs in grazed and ungrazed plots at EOARC during 1992 and 1993.

	Ungrazed		Grazed	
Plant Category	1992	1993	1992	1993
Meadow foxtail	68 *	76	85	83
Sedges/rushes	8 *	12	2	9
Other grasses	9	6	4	2
Forbs	16 *	5	9	7

* Species means between years are significantly different (P<.05).

Table 3. Composition of forage (%) on an eastern Oregon flood meadow during a drought (1992) and a wet (1993) year.

	Ungrazed		Grazed	
Species	1992	1993	1992	1993
Meadow foxtail	71 *	53	91	82
Sedges/Rushes	14	10	4	2
Other grasses	6 *	20	2 *	12
Forbs	4 *	13	2	3
Total yield	5	5	2	1

* Species means between years are significantly different (P<.05).

Table 4. Basal cover (%) for major plant categories on grazed or ungrazed eastern Oregon native meadows at EOARC during drought (1992) and wet (1993) years.

	Ungrazed		Grazed	
Plant Category	1992	1993	1992	1993
Meadow foxtail	2 *	5	2	4
Sedges	<1	1	0	0
Rushes	<1	1	0	1
Other grasses	<1	1	0	<1
Forbs	<1	1	1	<1

* Species means between years are significantly different (P<.05).

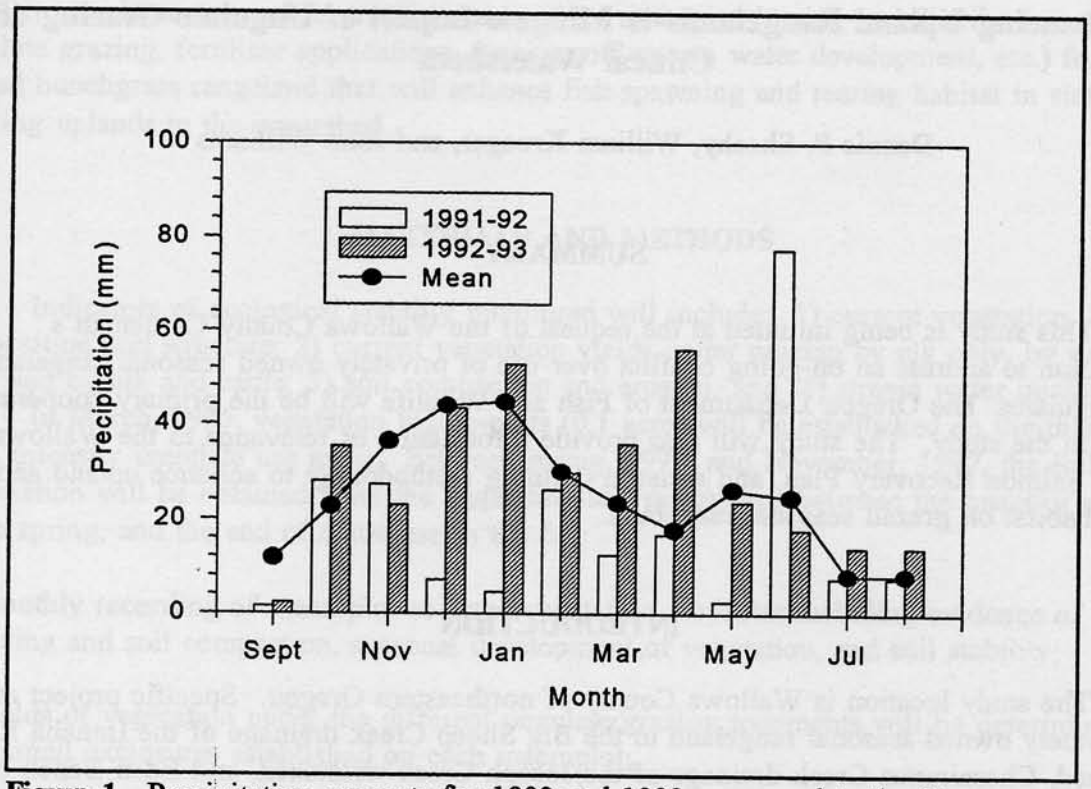

Figure 1. Precipitation amounts for 1992 and 1993 compared to the 30-year average at Burns, Oregon.

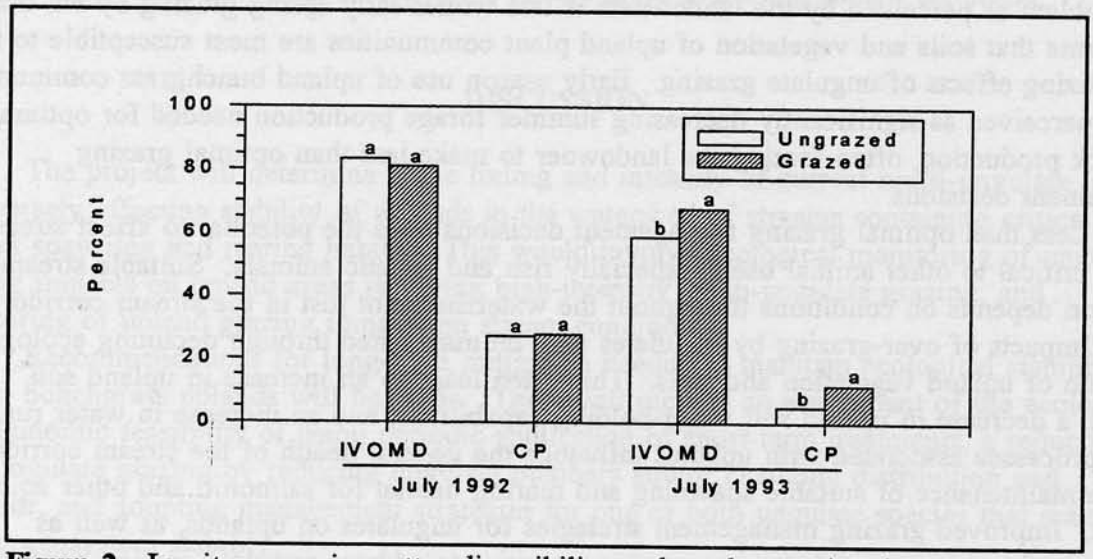

Figure 2. In vitro organic matter digestibility and crude protein of meadow foxtail clipped in July 1992 and 1993 at the Eastern Oregon Agricultural Research Center.