EFFECTS OF NITROGEN FERTILIZER TIMING AND RATES ON SEED PRODUCTION OF ROEMER'S FESCUE (*FESTUCA ROEMERI*)

D.C. Darris and A. Young-Mathews

Introduction

Roemer's fescue (*Festuca roemeri* [Pavlick] Alexeev) is a native bunchgrass that belongs to the sheep fescue-Idaho fescue-hard fescue complex (Stace et al., 1992). Roemer's fescue is recommended for revegetation of upland prairies and oak savannas west of the Cascade Mountains from British Columbia to northwestern California (Darris et al., 2007). Although it is a useful restoration species, there is little information available on seed production practices.

Members of the red fescue complex (Chewings, creeping red, and slender red fescues) and closely related sheep fescue complex (hard, sheep, and Idaho fescues) are commonly grown for turf seed in the Willamette Valley of Oregon, and there is over 40 years of data available from research conducted by Oregon State University. According to this research, optimal fine fescue seed yields were obtained with spring (mid-February to late March) application of 30 to 70 lb N/acre (Gingrich et al., 2003). Fall (October) application of 15 to 30 lb N/acre to stimulate fall growth is optional, but the guide states that "nitrogen in the soil should be adequate for fall growth" (Gingrich et al., 2003). The purpose of this study was to determine the optimal timing and rates of nitrogen fertilization for seed production of Roemer's fescue.

Materials and Methods

An existing field of Roemer's fescue (Hyslop Research Farm, near Corvallis, OR) was used for this study. The field was 140 x 62.5 ft, with rows running north-south at 12-inch row spacing. The field was sown in October of 2007 for a carbon banded seeding trial with diuron herbicide applied immediately after sowing. Any residual carryover of diuron is expected to have dissipated by the start of this experiment in October 2009. The seed used to sow the field was harvested in 2004 from a mix of 47 accessions in a common garden study at the Corvallis Plant Materials Center; these accessions were originally collected throughout western Washington, western Oregon and northwestern California in 2001-2002. The field was fertilized once in March 2008 (the year prior to the study) at a rate of 50 lb N/acre. A standard regime of weed and disease control was used during this experiment. Outlook® herbicide (dimethenamid-p) was applied in the fall for volunteer and annual grass control and Banvel® (dicamba) was applied in the spring for broadleaf weed control. Residue was removed with a flail type forage harvester after each seed harvest. Rust was controlled with Quilt® fungicide (azoxystrobin and propiconazole) as needed. No irrigation water or other practices were applied.

Fertilizer was applied to plots according to 14 treatments (Table 1) as a granular mixture of urea and ammonium sulfate (33-0-0-12), marketed as "urea-sul," using an 8-ft wide Gandy type drop spreader. All rates are actual N/acre. Each plot was 8 ft wide and 16 ft long. In 2010, seed was harvested on July 8 from the middle of the plots with a 6-ft wide flail-vac seed stripper. Harvest occurred parallel to the seeded rows along the long axis of each plot. Plots with excessive lodging were hand-harvested in 1-m^2 subplots. In 2011, all seed was hand-harvested from 1-m^2 subplots on July 15 (mechanical harvest was not possible due to excessive lodging). Seed was cleaned and conditioned before recording plot yields. Lodging was scored prior to harvest on July 8, 2010 and July 15, 2011 on a scale from 1 to 10, with 1 being no lodging (plants completely upright) and 10 being the most lodging (plants flat). The experimental design was a randomized complete block with four replications. Data analysis consisted of ANOVA and Tukey HSD means comparisons performed in Statistix 8.1. An outlier (treatment 9, rep 2) was omitted from the 2010 data set in order to meet the assumptions of normality of variances for the ANOVA.

Results and Discussion

Mean seed yield of Roemer's fescue according to the 14 nitrogen fertilization treatments is given in Figure 1. Seed yield was significantly affected by treatments in both 2010 ($P < 0.001$) and 2011 ($P = 0.036$). In 2010, application of 50 lb N/a in February (Trt. 3) and split application of 25 lb N/a in October plus 75 lb N/a in February (Trt. 10) had higher seed yields than the control (Trt. 1) and many other treatments. Plots that received early spring fertilizer were noticeably greener and healthier looking. Nitrogen fertilization treatments also had a significant effect on lodging scores in 2010 ($P < 0.001$); plots that received the highest early spring (February and March) N rates (Trts. 6, 7, 10, 11, and 12) had higher lodging scores than the control (Trt. 1) and plots that only received fall (Trt. 2) or late spring (April) fertilization (Trts. 5, 8, 13, and 14) (data not shown). This may have been because fall fertilization rates were too low or fall-applied N was no longer available to the plant by the time fertile tiller formation began, and April application may have come too late after tillers had already formed, so tiller height and lodging were not affected.

Table 1. Nitrogen fertilization rates and timing for Roemer's fescue study at Hyslop Farm, Corvallis, 2010 and 2011.

Treatment	Year 1	Year 2
1	Control (no fertilizer)	Control (no fertilizer)
2	25 lb/a 28-Oct-09	25 lb/a 2-Nov-10
3	50 lb/a 24-Feb-10	50 lb/a 7-Mar-11
4	50 lb/a 22-Mar-10	50 lb/a 4-Apr-11
5	50 lb/a 28-Apr-10	50 lb/a 2-May-11
6	75 lb/a 24-Feb-10	75 lb/a 7-Mar-11
7	75 lb/a 22-Mar-10	75 lb/a 4-Apr-11
8	75 lb/a 28-Apr-10	75 lb/a 2-May-11
9	25 lb/a 28-Oct-09 + 50 lb/a 24-Feb-10	25 lb/a 2-Nov-10 + 50 lb/a 7-Mar-11
10	25 lb/a 28-Oct-09 + 75 lb/a 24-Feb-10	25 lb/a 2-Nov-10 + 75 lb/a 7-Mar-11
11	25 lb/a 28-Oct-09 + 50 lb/a 22-Mar-10	25 lb/a 2-Nov-10 + 50 lb/a 4-Apr-11
12	25 lb/a 28-Oct-09 + 75 lb/a 22-Mar-10	25 lb/a 2-Nov-10 + 75 lb/a 4-Apr-11
13	25 lb/a 28-Oct-09 + 50 lb/a 28-Apr-10	25 lb/a 2-Nov-10 + 50 lb/a 2-May-11
14	25 lb/a 28-Oct-09 + 75 lb/a 28-Apr-10	25 lb/a 2-Nov-10 + 75 lb/a 2-May-11

.

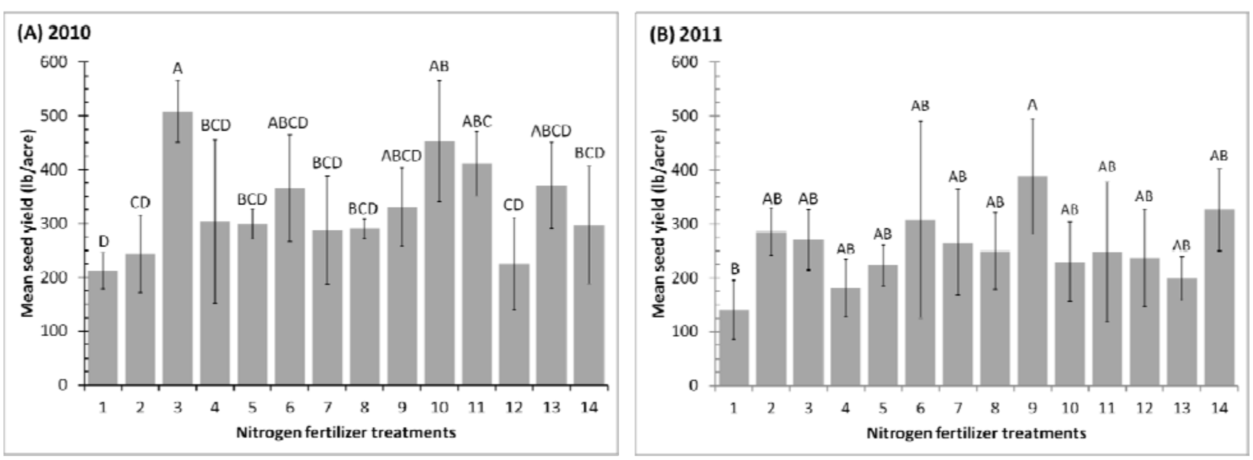

Figure 1. Seed production of Roemer's fescue at Hyslop Farm, Corvallis in 2010 (A) and 2011 (B) according to 14 nitrogen fertilization treatments. Mean ± 1 SD; within each year, means marked with the same letter indicate no significant difference at $\alpha = 0.05$ level in Tukey HSD tests.

By 2011, the stands had begun to decline and overall mean seed yield was significantly lower than in 2010 (253±98 vs. 329±114 lb/ac, respectively; $P < 0.001$). There was also substantial plant and seed loss to predation by voles and mice. The only significant treatment effect in 2011 was that split application of 25 lb N/a in November plus 50 lb N/a in early March (Trt. 9) had higher seed yields than the control (Trt. 1). In 2011, fertilization treatments again significantly affected lodging scores ($P < 0.001$), with patterns similar to those seen in 2010 (data not shown). Interestingly, an ANOVA of the effects of total pounds nitrogen applied on lodging scores showed that application rates of 75 and 100 lb N/a had more lodging than 0 to 50 lb N/ac (mean lodging scores for applications rates of 100, 75, 50, 25 and 0 lb N/a were 4.6, 4.0, 2.2, 1.0 and 1.0, respectively; $P <$

0.001). Thus higher N application rates, especially in the early spring, appear to lead to increased lodging which makes direct harvest (i.e., straight combining or seed stripping) difficult and may reduce seed yields.

Conclusions

Our results suggest that optimum seed yields of Roemer's fescue can be obtained by applying 50 to 75 lb N/a in late February to early March, either alone or as a split application with 25 lb N/a in the fall (late October to early November). However, total application rates of 75 to 100 lb N/a are likely to increase lodging and make direct combining and seed stripping more difficult.

References

Darris, D., S. Johnson, and A. Bartow. 2007. Plant fact sheet for Roemer's fescue (*Festuca roemeri*). USDA-NRCS Plant Materials Center, Corvallis, OR.

Gingrich, G.A., J.M. Hart, D.A. Horneck, W.C. Young, and T.B. Silberstein. 2003. Fertilizer guide: fine fescue seed (western Oregon—west of Cascades). FG 6-E. Oregon State University Extension Service, Corvallis.

Stace, C.A., A.K.K.A Al-Bermani, and M.J. Wilkinson. 1992. The distinction between the *Festuca ovina* L. and *Festuca rubra* L. aggregates in the British Isles. Watsonia 19:107-112.