EFFECTS OF POST-HARVEST RESIDUE MANAGEMENT ON SEED PRODUCTION OF ROEMER'S FESCUE (*FESTUCA ROEMERI*)

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Introduction

Roemer's fescue (*Festuca roemeri* [Pavlick] Alexeev) is a native bunchgrass that is recommended for revegetation of upland prairies and oak savannas in the Pacific Northwest. Although it is a useful restoration species, there is little information available on seed production practices. Members of the fine fescue complex (Chewings, creeping red, and slender red fescues) and closely related sheep fescue complex (hard, sheep, Idaho and Roemer's fescues) are commonly grown for turf seed in the Willamette Valley of Oregon. According to research conducted at Oregon State University, seed yield and quality were maintained in Chewings fescue (*Festuca rubra* L. ssp. *commutata* Gaudin) seed crops without burning when most of the post-harvest straw and stubble were removed by baling and then vacuuming or raking up remaining residue (Chastain et al., 1999; Young et al., 1998). In the same study, however, there were no nonthermal management practices that produced acceptable seed yields in creeping red fescue (*Festuca rubra* L. ssp. *rubra*) fields. More recent work has shown mixed results dependent on age of stand and a newer red fescue classification: Chewings (*Festuca rubra* L. ssp. *fallax* (Thuill.) Nyman) vs. slender creeping red (*Festuca rubra* L. var. *littoralis* Vasey) vs. strong creeping red (*Festuca rubra* L. ssp. *rubra*) (Chastain et al., 2011). The objective of this study was to determine the effects of different post-harvest residue management practices (low, medium and high mowing heights with residue removal versus open field burning) on the following year's seed production of Roemer's fescue.

Materials and Methods

Plant material used: The experiment was conducted on a field of Northwest Maritime Germplasm Roemer's fescue (accession 9079484, PVGOR 101) at the Corvallis Plant Materials Center (PMC) Schmidt Farm that was sown in October 2006 (medium mow reps 2 and 3) and October 2007 (all other treatments). The field was fertilized annually in March with 50 lb N/acre (150 lb/acre 33-0-0-12), and treated annually in October with Outlook® (dimethylamid-p) herbicide and Banvel® (dicamba) in the spring as needed.

Experimental design: The experimental design was completely randomized with three replicates per treatment. Plots were 4 x 100 ft consisting of four-row beds on 12-inch spacing. Four treatments were examined: control (no mowing or residue removal), low mow (1.5- to 2.5-inch mowing height with residue and stubble mostly removed), high mow (5- to 6-inch mowing height with residue and stubble partly removed), and burn (3- to 4.5-inch mowing height but residue and stubble left and then burned). The burn treatment was analogous to "residue and stubble open-burned with full straw load" used in similar research. There was also a fifth observational treatment of medium mow (3- to 4.5-inch mowing height with residue and stubble partly removed), but it was not included in statistical analyses as that part of the field was planted a year earlier than the rest (2006). Age of stand can affect seed yields and the medium mow plots were not randomized.

Treatment implementation: Seed was harvested from all plots with a seed stripper on July 10, 2010. Post-harvest residue was mowed and removed from low, medium and high mow treatments with a flail forage harvester on August 25, 2010. Burn plots were also mowed on this date, but residue was left on the surface to simulate a windrow or swath; these plots were burned on September 8, 2010. One of the control plots was incorrectly mowed and subsequently burned, resulting in four burn plots and two controls. Therefore, one of the control plots was sampled twice.

Data collection and analysis: All plots were scored for insect damage, injury, vigor/recovery, and culm (fertile tiller) abundance on a scale from 1 to 9 (9 as highest or most) on April 27, 2011. Plots were windrowed on July 12, 2011 and combined on July 28, 2011. Seed yield data were collected from 30-ft strips (120 ft^2) of uniform plant density in each plot. Effects of treatments on seed yield, insect damage, injury, vigor, and culm abundance were tested using ANOVA and Tukey HSD means comparisons in Statistix 8.1.

Results and Discussion

Results of seed yields and plot scoring for all four treatments, plus the observational fifth treatment, are given in Table 1. All mowed and burned treatments had higher seed yields than the un-mowed control (*F*=13.9, *P*=0.0015). Although the treatments did not differ

Table 1. Results of 2011 study on post-harvest residue management of Roemer's fescue at the Corvallis PMC.

Treatment	Seed yield	Insect damage	Injury	Vigor/ Recovery	Culm abundance
	(lb/a)	----- (scored on 1-9 scale, with 9 high/most) -----			
control	42.9 b[*]	2.7 ab	1.0 a	7.3 a	1.3 c
low mow	152.6 a	5.0 a	1.7 a	8.0 a	8.7 a
high mow	102.0 a	3.7 ab	1.0 a	7.7 a	5.3 b
burn	133.1 a	2.3 b	2.0 a	7.0 a	7.0 ab
med. mow	78.7	3.7	1.0	7.3	5.7

[*]Means in columns followed by the same letter are not significantly different in Tukey HSD tests (*P* = 0.05).

significantly among mowing height and burning, the low mow and burned plots tended to have the highest seed yields. Residue treatments also affected culm (fertile tiller) abundance scores (*F*=29.6, *P*=0.0001); the low mow had the most culms, followed by the burn and high mow, with the control having the least. In fact, there was a direct positive correlation between culm abundance score and seed yield (*P*=0.0001; Figure 1), so the higher yields in the low mow and burned plots in large part appear to be due to the greater abundance of culms on those plants. Other variables affecting seed yield such as percent seed set, seed weight, the number of spikelets per panicle, and the number of florets per spikelet could also have played a role, but were not measured.

Residue treatments also affected insect damage scores (*F*=4.31, *P*=0.04); low mow plots had the most insect damage while burned plots had the least (Table 1). Most of the observed damage was suspected to be from feeding grass sawfly larvae, as the stems appeared to have been clipped off near the base (often at an angle), although armyworm damage is also similar (Hollingsworth, 2011). Damage may have been greater in the low mow plots simply because they had a greater abundance of young foliage and more culms to attract insects to those rows. Therefore, yields may have been disproportionately reduced by insects under this treatment. In contrast, burn plots had the least amount of damage but a high abundance of culms (and recovery of foliage was not significantly less). Despite the small size of the plots and close proximity of treatments, burning may have reduced insect numbers or the desirability of such plots as habitat. The direct effect of insect damage on yield was not quantitatively assessed.

Residue management treatments did not significantly affect crop injury or vigor/recovery scores (*P* > 0.05, Table 1), so presumably observed differences in seed yield were not due to any direct damage to the plants from the residue management treatments.

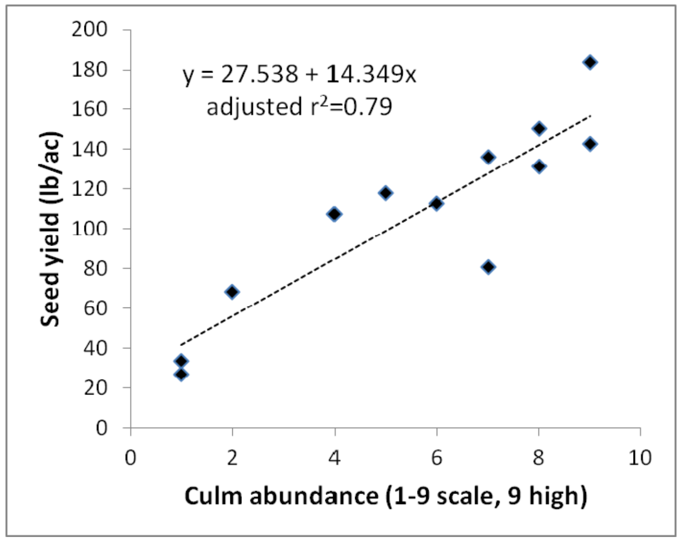

Figure 1. Relationship between Roemer's fescue seed yield and culm abundance scores in 2011 post-harvest residue management study at the Corvallis PMC.

Although it is only one year of data, results were similar to those of Chewings fescue, where mechanical removal of residue and stubble achieved seed yields similar to open field burning (Chastain et al., 1999; Young et al., 1998). Yields in this experiment are substantially lower than other fine fescues grown for seed in western Oregon, but Northwest Maritime Germplasm was not bred or hybridized, and yields of Roemer’s fescue typically decline on their own by age three. A repeat study is needed on a younger field and other germplasm.

Conclusions

If it is not possible to do open field burns on Roemer’s fescue seed production fields, comparable seed yields can still be obtained by mowing stubble low (1.5 to 2.5 inches tall) and removing all residue using a forage harvester or other method.

References

Chastain, T.G., W.C. Young III, G.L. Kiemnec, C.J. Garbacik, G.A. Gingrich, and G.H. Cook. 1999. Post-harvest residue management for fine fescue seed crops in Oregon. pp. 55-56 (session 25). In J.G. Buchanan-Smith et al. (ed.) Proc. XVIII International Grassland Congress, Winnipeg and Saskatoon, Canada. 8-17 June 1997. Association Management Centre, Calgary, Canada.

Chastain, T.G., C.J. Garbacik, T.B. Silberstein, and William C. Young III. 2011. Seed production characteristics of three fine fescue species in residue management systems. Agron. J. 103:1495-1502.

Hollingsworth, C.S. (ed.) 2011. Pacific Northwest insect management handbook. Available at http://uspest.org/pnw/insects (accessed 30 Mar 2012). Oregon State Univ., Univ. of Idaho, and Washington State Univ. Ext. Services.

Young III, W.C., G.A. Gingrich, T.B. Silberstein, and B.M. Quebbeman. 1998. Post-harvest residue management of creeping red and Chewings fescue seed crops. Agron. J. 90:69-73.