CROP RESIDUE MANAGEMENT AND FERTILIZATION FOR MEADOW BROMEGRASS (BROMUS RIPARIUS REHM.) SEED PRODUCTION

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ABSTRACT
Studies were conducted to determine whether adequate fertilization with nitrogen and timely crop residue removal would improve seed yield and prolong the productive life of meadow bromegrass. The meadow bromegrass (MB) response to these treatments was compared to that of smooth bromegrass (*Bromus inermis* Leyss.) (SB) and a MB x SB hybrid (S9197). Three levels of nitrogen (0, 50, 100 kg ha-1) and four residue removal treatments (none, after harvest, October and after harvest + October) were tested at Saskatoon, Saskatchewan, under rainfed conditions and at Outlook, Saskatchewan under irrigation. Tiller number and leaf stage in the fall and spring, days to heading, number of panicles, and seed yield were determined. In general, residue removal after harvest resulted in the optimum combination of tiller density and maturity, greatest number of heads and the highest seed yield. Nitrogen fertilization improved seed yield at Saskatoon, but not at Outlook. The meadow bromegrass cultivars produced more tillers than either smooth bromegrass or the hybrid, but they were less mature in fall. Meadow bromegrass was generally more responsive to residue removal than either smooth bromegrass or the hybrid. At Saskatoon, Paddock meadow bromegrass produced as much seed as smooth bromegrass (more than Regar or S-9197) when residue was removed either after harvest or both after harvest + October.

KEYWORDS
Time of removal, N rate, tiller development

INTRODUCTION
Meadow bromegrass is a temperate bunch grass. Its rapid regrowth potential makes it particularly suitable for grazing and, as a result, it has become widely accepted as a pasture species, particularly in the moister areas across the Prairies. Due to its popularity as a forage species, demand for meadow bromegrass seed is generally high. Seed production however, is less reliable than smooth bromegrass, and a significant decline in seed yield is often observed after the first two seed crops (Knowles *et al*. 1993, Upton, 1983) . Since much of the cost of production is associated with stand establishment, prolonging the productive life of a stand could significantly improve the economics of bromegrass seed production. N fertilization and crop residue management can improve grass seed yield (Canode, 1978; Klebesadel, 1970; Knowles, 1966; Knowles, 1952; Nordestgaard 1980 and Upton, 1983). It has been suggested that tiller development in the fall and good light penetration during initiation and elongation are critical for optimal seed production (Meijer and Vreeke 1988, Schoberlein 1987) . However, this response is not clearly understood, particularly in meadow bromegrass. The objectives of this study were to a) determine the effects of three levels of nitrogen fertilizer and four residue removal treatments on the seed yield of two cultivars of meadow bromegrass and b) to compare this response to that of smooth bromegrass cv Carlton and a MB X SB hybrid, S-9197.

METHODS
Field trials were conducted at Saskatoon (rainfed) and Outlook (irrigated) in Saskatchewan from 1994 to the present. The following treatments were applied in a split-split plot design: main plots of three rates of nitrogen (0, 50, and 100 kg ha^{-1}) applied in the fall, sub plots of four residue removal treatments (none, after harvest, October and after harvest +October), and sub-sub plots of bromegrass species (meadow bromegrass cvs. Paddock and Regar, smooth bromegrass cv Carlton, and meadow X smooth bromegrass hybrid S-9197). Tiller number and stage of development in fall and spring (approximately October 15 and May 15) and seed yield components were determined in permanently marked .25 x.25 m quadrats. Seed yield was determined on the whole plot. As well, leaf area index was measured and number of days to flowering was recorded.

RESULTS AND DISCUSSION
Residue management and genetic background had the greatest impact on tiller density, stage of development, head density and seed yield. Nitrogen did not generally affect this response and there were very few interactions between these factors.

The meadow bromegrass cultivars generally produced more tillers (Regar= 2798 m^{-2}, Paddock= 2392 m^{-2}) than either the hybrid, S-9197 (1768 m^{-2}) or Carlton smooth bromegrass (1159 m^{-2}). The meadow bromegrass tillers, however, were generally less mature, with a mean leaf number of 2.42, 2.46, 2.73, 2.82 for Regar, Paddock, S-9197 and Carlton, respectively. Schoblerlein (1987) reported a highly significant correlation between stage of development in fall and the number of flowering tillers the following spring, with a higher degree of flowering in more advanced fall tillers.

At Saskatoon, when residue was removed after harvest or both after harvest and in October, Paddock produced as much seed as Carlton and more than S-9197, even though the fall tillers were less mature (Figures 1 and 2). Regar yield was similar to S-9197. At Outlook, Regar was the poorest seed producer regardless of residue management system, Paddock and S-9197 were intermediate and similar, while Carlton produced the most seed.

Fertilizer treatment did not generally affect tiller density or leaf stage in the fall. Thompson and Clarke (1993) found that N application increased basal diameter of tillers in the fall, which was correlated to the number of flowering shoots that developed. Basal diameter was not measured in this study, instead leaf stage, which generally is closely correlated to basal diameter (Chastain T., pers. comm.) was recorded. At Saskatoon increasing nitrogen fertilization resulted in increased seed yield, particularly when residue was removed. At Oultook, however, there was no increase in seed yield in response to nitrogen fertilization. The reason for this is unclear at this time, however there was more winter injury at Outlook than at Saskatoon, and the additional nitrogen may have exacerbated this.

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Figure 1
Bromegrass seed yield (kg/ha) at Saskatoon, 1996.

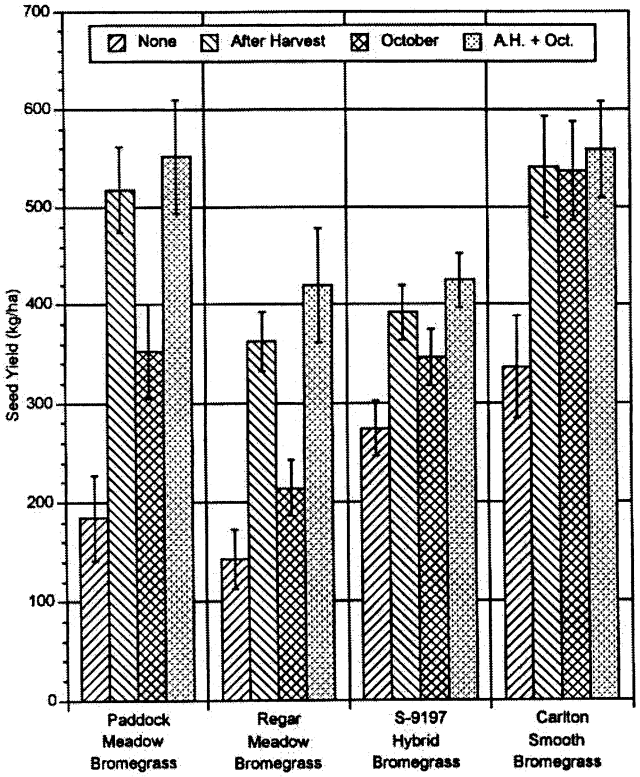

Figure 2
Bromegrass seed yield (kg/ha) at Outlook, 1996.