MEADOW BROMEGRASS: A NEW PASTURE GRASS FOR THE BLACK AND GRAY SOIL ZONE (PARKBELT) OF SASKATCHEWAN

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ABSTRACT

This paper describes the results of 7 years of research comparing adapted species for their potential usefulness in pastures on black and gray soils. Our research has shown that meadow bromegrass has several attributes which are desirable for pasture including high yield, good regrowth, stable production, ease of establishment, and leafiness. Some questions remaining about meadow bromegrass will be described.

INTRODUCTION

Extensive evaluation of forage grasses in the brown and dark brown soil zones (Swift Current and Saskatoon Research Stations) has lead to the introduction to the Canadian Prairies of several exotic species such as crested wheatgrass, Russian wildrye, and smooth bromegrass (Clark and Heinrichs 1957, Lawrence and Troelson 1964, Knowles and White 1969). Plant growth on the prairies occurs mainly in spring and summer pasture consists of mature, drought-stressed, and quiescent vegetation gradually losing its nutritional value. Hence useful forage species grow abundantly in spring and maintain their quality through the summer.

The forest transition zone or Parkbelt (black and gray soil zone) has shorter and cooler summers, and less evapotranspiration all year, than the prairies. Pastures in the Parkbelt differ from their southern counterparts by being several-times more productive and producing more regrowth after grazing. Despite these differences and the large cattle populations in the Parkbelt (50% of the provincial total) (Howarth 1986), there have been few published reports on species evaluations in the Parkbelt.

The purpose of this study was to evaluate several forage species with contrasting growth habits and adaptation for use in pastures in the Parkbelt.
MATERIALS AND METHODS

Experiment I was seeded in 1979 on a deep black soil (Melfort silty clay) and fertilized annually with 90 kg/ha N and 22 kg/ha P. Treatments were replicated four times and arranged in a split plot design with harvesting regimes as main-plots and species (listed in Table 1) as subplots. The plots were cut either as hay (June 27 and Sept. 17) or to simulate grazing (June 2, July 1, Aug. 6 and Sept. 18). Plots were not cut on Sept. 18 in 1980, 85 and 86 because of insufficient growth. All plots were 1.8 x 6.6 m and of this, 1.2 x 6 m was harvested.

Experiment II was seeded in 1980 on a gray-wooded soil (Waitville loam). Treatments were replicated four times in a split-split-plot design with two fertilizer rates (unfertilized, 90 kg/ha N plus 22 kg/ha P) as main-plots, species (Table 1) as subplots and harvesting system (hay and simulated grazing) as sub-sub-plots. Plots were cut as hay on July 2 and Sept. 22, and as simulated pasture on June 6, July 4, Aug. 8, and Sept. 22; no growth was available for harvesting on simulated grazing plots on Sept. 22 in 1981, 84 and 86. All plots were 2.1 x 6.6 m and of this area 1.5 x 6 m was harvested.

RESULTS AND DISCUSSION

Several species had substantial loss of stand over the course of the experiments due to winterkill and other factors (orchardgrass, meadow fescue, tall fescue, reed canarygrass, tall wheatgrass, slender wheatgrass). Other species had consistently low yields under all management systems (timothy, turf timothy, creeping red fescue, hard fescue, Kentucky bluegrass, meadow foxtail). Altai wildrye was particularly prone to invasion by weeds. Discussion in this report is confined to those species which showed the best overall performance.

On black soil total seasonal yield was greatest for intermediate wheatgrass followed by crested wheatgrass and meadow bromegrass under simulated grazing (Table 2) whereas crested wheatgrass and smooth bromegrass yielded most under hay management (Table 3). On gray-wooded soil meadow bromegrass yielded most under simulated grazing (Table 2) while crested wheatgrass yielded most under hay management (Table 3). In previous studies, under hay management, crested wheatgrass yielded more than smooth bromegrass on black soil at Melfort (Bittman 1985), and standard type crested wheatgrass
Table 1. Grass species, varieties, and seeding rates used in Experiments I and II

<table>
<thead>
<tr>
<th>Common name</th>
<th>Botanical name</th>
<th>Cultivars</th>
<th>Seeding rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Expt. 1</td>
<td>Expt. 2</td>
</tr>
<tr>
<td>Creeping red fescue</td>
<td><em>Festuca rubra</em> L.</td>
<td>Boreal</td>
<td>Boreal</td>
</tr>
<tr>
<td>Meadow fescue</td>
<td><em>Festuca pratensis</em> Huds.</td>
<td>Trader</td>
<td>Trader</td>
</tr>
<tr>
<td>Hard fescue</td>
<td><em>Festuca ovina</em> var. <em>duriuscula</em> (L.) <em>Koch</em></td>
<td>Durar</td>
<td>Kenhy</td>
</tr>
<tr>
<td>Tall fescue</td>
<td><em>Festuca arundinacea</em> <em>Schreb.</em></td>
<td>Kenhy</td>
<td>Kenhy</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td><em>Agropyron cristatum</em> (L.) <em>Beauv.</em> spp. <em>pectinatum</em> (Bieb.) <em>Tzvel.</em></td>
<td>Parkway</td>
<td>Parkway</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td><em>Elytrigia intermedia</em> (Host) <em>Nevski</em></td>
<td>Chief</td>
<td>Chief</td>
</tr>
<tr>
<td>Pubescent wheatgrass</td>
<td><em>Elytrigia intermedia</em> subsp. <em>trichophora</em> A. &amp; D. <em>Love</em></td>
<td>Greenleaf</td>
<td>Greenleaf</td>
</tr>
<tr>
<td>Tall wheatgrass</td>
<td><em>Elytrigia pontica</em> (Podp.) <em>Holub</em></td>
<td>Orbit</td>
<td>Revenue</td>
</tr>
<tr>
<td>Slender wheatgrass</td>
<td><em>Elymus trachycaulus</em> (Link)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>(Gould ex Shinners)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td><em>Bromus inermis</em> <em>Leyss.</em></td>
<td>Carlton</td>
<td>Magna</td>
</tr>
<tr>
<td>Meadow bromegrass</td>
<td><em>Bromus biebersteinii</em> <em>Roem &amp; Schult.</em></td>
<td>Regar</td>
<td>Regar</td>
</tr>
<tr>
<td>Timothy</td>
<td><em>Phleum pratense</em> L.</td>
<td>Bottnia 2</td>
<td></td>
</tr>
<tr>
<td>Surf timothy</td>
<td><em>Phleum nodosum</em> L.</td>
<td>Evergreen</td>
<td></td>
</tr>
<tr>
<td>Russian wildrye</td>
<td><em>Psathyrostachys juncea</em> (Fisch.) <em>Nevski</em></td>
<td>Mayak</td>
<td>Swift</td>
</tr>
<tr>
<td>Altai wildrye</td>
<td><em>Leymus angustus</em> (Trin.) <em>Pilger</em></td>
<td>PrairieLand</td>
<td>PrairieLand</td>
</tr>
<tr>
<td>Meadow foxtail</td>
<td><em>Alopecurus pratensis</em> L.</td>
<td>NRG strain</td>
<td></td>
</tr>
<tr>
<td>Orchardgrass</td>
<td><em>Dactylis glomerata</em> L.</td>
<td>Kay</td>
<td>Kay</td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td><em>Stipa viridula</em> (Trin.)</td>
<td>Lodom</td>
<td>Lodom</td>
</tr>
<tr>
<td>Kentucky bluegrass</td>
<td><em>Poa pratensis</em> L.</td>
<td>Dormi</td>
<td>Troy</td>
</tr>
<tr>
<td>Reed canarygrass</td>
<td><em>Phalaris arundinacea</em> L.</td>
<td>Frontier</td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Total yield of grass species under simulated grazing

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>D.M. yield (kg/ha)</td>
<td>% of mean</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>5304</td>
<td>101 (100)*</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td>5994</td>
<td>114 (107)</td>
</tr>
<tr>
<td>Smooth brome grass</td>
<td>5070</td>
<td>96 (95)</td>
</tr>
<tr>
<td>Meadow brome grass</td>
<td>5342</td>
<td>101 (101)</td>
</tr>
<tr>
<td>Russian wildrye</td>
<td>4932</td>
<td>94 (100)</td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td>4987</td>
<td>95 (96)</td>
</tr>
</tbody>
</table>

*Percentages in brackets are calculated to give equal weight to all years.

Table 3. Total yield of grass species under hay management

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>D.M. yield (kg/ha)</td>
<td>% of mean</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>7957</td>
<td>114 (115)*</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td>7166</td>
<td>103 (102)</td>
</tr>
<tr>
<td>Smooth brome grass</td>
<td>7619</td>
<td>110 (110)</td>
</tr>
<tr>
<td>Meadow brome grass</td>
<td>6251</td>
<td>90 (87)</td>
</tr>
<tr>
<td>Russian wildrye</td>
<td>6658</td>
<td>96 (97)</td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td>6069</td>
<td>87 (92)</td>
</tr>
</tbody>
</table>

*Percentages in brackets are calculated to give equal weight to all years.
yielded more than any other species including smooth and meadow bromegrass and Russian wildrye on brown soil at Swift Current (Lawrence and Ratzlaff 1985). Under simulated grazing 'Regar' meadow bromegrass yielded more than 'Carlton' smooth bromegrass on black soil at Lacombe, Alta. (Baron 1985) but had similar or lower yield than 'Carlton' on dark brown soil at Saskatoon (Knowles 1985).

In the first year after the year of seeding, Russian wildrye and green stipa had significantly lower yields than the other species in both experiments (Figs. 1 and 2). This indicates that both species establish slowly due to poor seedling vigour as previously reported (Lawrence and Troelson 1964, Smoliak et al. 1970). Species with poor seedling vigour require better control of weeds, should not be sown with companion crops, and take up to two years to provide a usable stand. The cultivar Swift used in Experiment II was developed for improved seedling vigour, but still proved less vigorous than most of the other species. Work is in progress at Swift Current Research Station and in the U.S. to improve the vigour of Russian wildrye further; apparently no such work is being carried out on green stipa.

Early spring growth under simulated grazing was greatest for crested wheatgrass on gray-wooded soil and greatest for both crested wheatgrass and Russian wildrye on black soil (Table 4). Rapid growth in early spring by crested wheatgrass was previously reported on black soil by Bittman (1985) while both crested wheatgrass and Russian wildrye were reported to grow rapidly in spring on brown soil (Lodge et al. 1972).

Table 4. Early-June yield of grass species grown under simulated grazing

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>D.M.</td>
<td>% of mean</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>2236</td>
<td>138 (137)*</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td>1233</td>
<td>76 (69)</td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td>1238</td>
<td>76 (74)</td>
</tr>
<tr>
<td>Meadow bromegrass</td>
<td>1472</td>
<td>91 (86)</td>
</tr>
<tr>
<td>Russian wildrye</td>
<td>2160</td>
<td>133 (141)</td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td>1412</td>
<td>87 (93)</td>
</tr>
</tbody>
</table>

*Percentages in brackets are calculated to give equal weight to all years.
Fig. 1

Total Yield of Grass Species Grown on Black Soil Under Simulated Grazing

Russian wildrye
Meadow bromegrass
Crested wheat grass
Smooth bromegrass
Green stipa
Intermediate wheatgrass

Percent of Mean

YEAR

Fig. 2

Total Yield of Grass Species Grown on Gray-wooded Soil Under Simulated Grazing

Percent of Mean

130
120
110
100
90
80
70

YEAR


- Meadow bromegrass
- Crested wheat grass
- Smooth bromegrass
- Intermediate wheatgrass
- Green stipa
Under simulated grazing, total regrowth (cuts 2, 3 and 4) was greatest for meadow brome grass on gray-wooded soil and greatest for intermediate wheatgrass followed by meadow brome grass on black soil (Table 5). Meadow brome grass had the greatest late season growth (final regrowth) among the species on both soil types and although the yields were small, differences among the species were substantial. The regrowth potential of meadow brome grass in Montana was previously described (Cooper et al. 1978).

Table 5. Yield of regrowth (cuts 2, 3 and 4) of grass species under simulated grazing

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>D.M. yield</td>
<td>% of mean</td>
</tr>
<tr>
<td></td>
<td>kg/ha</td>
<td></td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>3067</td>
<td>92 (82)*</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td>4306</td>
<td>129 (126)</td>
</tr>
<tr>
<td>Smooth brome grass</td>
<td>3367</td>
<td>101 (102)</td>
</tr>
<tr>
<td>Meadow brome grass</td>
<td>3462</td>
<td>104 (111)</td>
</tr>
<tr>
<td>Russian wildrye</td>
<td>2771</td>
<td>83 (80)</td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td>2993</td>
<td>90 (100)</td>
</tr>
</tbody>
</table>

*Percentages in brackets are calculated to give equal weight to all years.

Most of the grasses showed similar long term productivity, however, Russian wildrye became relatively more productive on black soil over the duration of the experiment while intermediate wheatgrass became less productive on both soil types (Figs. 1 and 2). Yield decline in intermediate wheatgrass has also been reported in Alberta (Smoliak and Bjorge 1981) and may be due to lack of cold and drought resistance.

Table 7 summarizes attributes of the grasses described above in relation to suitability for pasture. Under simulated grazing meadow brome grass has better regrowth than the other grasses, particularly good late-season growth, and slightly higher total yield. In addition, meadow brome grass is less...
competitive with alfalfa (Knowles 1985) and probably leafier than smooth bromegrass because of a smaller number of floral tillers (unpublished data). Meadow bromegrass is apparently as persistent as any of the other species tested, although previous work has shown that meadow bromegrass is less cold hardy in the year of establishment (Limin and Fowler 1986). While we have observed some injury (no winterkill) after the first winter, we have not observed winter-injury in older stands.

Table 6. Late-season growth by grass species under simulated grazing

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td></td>
<td>D.M. yield</td>
<td>% of mean</td>
<td>D.M. yield</td>
</tr>
<tr>
<td>Crested wheatgrass</td>
<td>414</td>
<td>79 (66)*</td>
<td>235</td>
</tr>
<tr>
<td>Intermediate wheatgrass</td>
<td>674</td>
<td>128 (129)</td>
<td>233</td>
</tr>
<tr>
<td>Smooth bromegrass</td>
<td>465</td>
<td>88 (83)</td>
<td>207</td>
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<tr>
<td>Meadow bromegrass</td>
<td>843</td>
<td>160 (147)</td>
<td>329</td>
</tr>
<tr>
<td>Russian wildrye</td>
<td>324</td>
<td>62 (76)</td>
<td></td>
</tr>
<tr>
<td>Green stipa (needlegrass)</td>
<td>436</td>
<td>83 (100)</td>
<td>291</td>
</tr>
</tbody>
</table>

*Percentage in brackets are calculated to give equal weight to all years.

Some questions remain about meadow bromegrass. We have no data on palatability, intake, and digestibility. We are concerned that it may have somewhat less seedling vigour than smooth bromegrass, and we don't know how well it will compete with weeds. However, based on our results we strongly urge the gradual introduction of meadow bromegrass to pastures in the Parkbelt of Saskatchewan and the other prairie provinces. Meadow bromegrass will be included in the list of recommended species for pastures in the black and gray soil zones in the 1987 Saskatchewan Guide to Farm Practice.
Table 7. Comparison of six grass species for use in pastures in the Parkbelt

<table>
<thead>
<tr>
<th></th>
<th>CWg⁺</th>
<th>IWg</th>
<th>SBr</th>
<th>MBr</th>
<th>RWR</th>
<th>GS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Yield (% of Mean)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black soil</td>
<td>100</td>
<td>107</td>
<td>95</td>
<td>101</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Gray soil</td>
<td>103</td>
<td>95</td>
<td>98</td>
<td>108</td>
<td>96</td>
<td>95</td>
</tr>
<tr>
<td><strong>Regrowth Yield (% of Mean)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black soil</td>
<td>82</td>
<td>126</td>
<td>102</td>
<td>111</td>
<td>80</td>
<td>100</td>
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<tr>
<td>Gray soil</td>
<td>77</td>
<td>102</td>
<td>92</td>
<td>116</td>
<td>114</td>
<td></td>
</tr>
<tr>
<td><strong>Fall Regrowth (% of Mean)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Black soil</td>
<td>66</td>
<td>129</td>
<td>83</td>
<td>147</td>
<td>76</td>
<td>100</td>
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<tr>
<td>Gray soil</td>
<td>71</td>
<td>87</td>
<td>70</td>
<td>151</td>
<td>120</td>
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<tr>
<td><strong>Early Spring Production (% of Mean)</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Black soil</td>
<td>137</td>
<td>69</td>
<td>74</td>
<td>86</td>
<td>141</td>
<td>93</td>
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<tr>
<td>Gray soil</td>
<td>144</td>
<td>79</td>
<td>104</td>
<td>104</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td><strong>Ease of establishment</strong></td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Fair</td>
<td>Very Poor</td>
<td>Poor</td>
</tr>
<tr>
<td><strong>Longevity</strong></td>
<td>Good</td>
<td>Fair</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
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<tr>
<td><strong>Palatability</strong></td>
<td>Fair-Poor</td>
<td>-</td>
<td>Fair</td>
<td>Good</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Compatibility with Alfalfa</strong></td>
<td>-</td>
<td>-</td>
<td>Fair</td>
<td>Good</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Cold hardiness (LT₅₀) (°C)</strong></td>
<td>-30</td>
<td>-25</td>
<td>-28</td>
<td>-23</td>
<td>-28</td>
<td>-</td>
</tr>
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</table>

*Crested wheatgrass (CWg), intermediate wheatgrass (IWg), smooth bromegrass (SBr), meadow bromegrass (MBr), Russian wildrye (RWR), green stipa (GS).

†Percentages are calculated to give equal weight to all years.
LITERATURE CITED

Baron, V. 1985. Test of bromegrass strains, Lacombe uniform variety tests of forage crops contributed by research workers in Western Canada. Agriculture Canada, Research Branch. p. 44.


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