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

Shabtai Bittman, John waddington and Duane McCartney
Agriculture Canada Research Station
Melfort, Saskatchewan

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 wheatgrss, 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

Common name	Botanical name	Cultivars		Seeding rate kg/ha
		Expt. 1	Expt. 2	
Creeping red fescue	*Festuca rubra* L.	Boreal	Boreal	10
Meadow fescue	*Festuca pratensis* Huds.	Trader	Trader	11
Hard fescue	*Festuca ovina* var. *duriuscula* (L.) Koch	Durar		20
Tall fescue	*Festuca arundinacea* Schreb.	Kenhy	Kenhy	11
Crested wheatgrass	*Agropyron cristatum* (L.) Beauv. spp. *pectinatum* (Bieb.) Tzvel.	Parkway	Parkway	7
Intermediate wheatgrass	*Elytrigia intermedia* (Host) Nevski	Chief	Chief	15
Pubescent wheatgrass	*Elytrigia intermedia* subsp. *trichophora* A. & D. Love	Greenleaf	Greenleaf	13
Tall wheatgrass	*Elytrigia pontica* (Podp.) Holub	Orbit		10
Slender wheatgrass	*Elymus trachycaulus* (Link) (Gould ex Shinners)	Revenue		10
Smooth bromegrass	*Bromus inermis* Leyss.	Carlton	Magna	8
Meadow bromegrass	*Bromus biebersteinii* Roem & Schult.	Regar	Regar	13
Timothy	*Phleum pratense* L.	Bottnia 2		
Turf timothy	*Phleum nodosum* L.	Evergreen		
Russian wildrye	*Psathyrostachys juncea* (Fisch.) Nevski	Mayak	Swift	7
Altai wildrye	*Leymus angustus* (Trin.) Pilger	Prairieland	Prairieland	17
Meadow foxtail	*Alopecurus pratensis* L.	NRG strain		20
Orchardgrass	*Dactylis glomerata* L.	Kay	Kay	17
Green stipa (needlegrass)	*Stipa viridula* Trin.	Lodorm	Lodorm	25
Kentucky bluegrass	*Poa pratensis* L.	Dormi	Troy	10
Reed canarygrass	*Phalaris arundinacea* L.	Frontier		8

Table 2. Total yield of grass species under simulated grazing

	Exp. I (1980-1986)		Exp. II (1981-1986)	
	D.M. yield kg/ha	% of mean	D.M. yield kg/ha	% of mean
Crested wheatgrass	5304	101 (100)*	1896	100 (103)*
Intermediate wheatgrass	5994	114 (107)	1882	100 (95)
Smooth bromegrass	5070	96 (95)	1881	99 (98)
Meadow bromegrass	5342	101 (101)	2063	108 (108)
Russian wildrye	4932	94 (100)		
Green stipa (needlegrass)	4987	95 (96)	1807	95 (95)

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

Table 3. Total yield of grass species under hay management

	Exp. I (1980-1986)		Exp. II (1981-1986)	
	D.M. yield kg/ha	% of mean	D.M. yield kg/ha	% of mean
Crested wheatgrass	7957	114 (115)*	2685	111 (113)*
Intermediate wheatgrass	7166	103 (102)	2192	90 (85)
Smooth bromegrass	7619	110 (110)	2457	101 (102)
Meadow bromegrass	6251	90 (87)	2581	106 (107)
Russian wildrye	6658	96 (97)		
Green stipa (needlegrass)	6069	87 (92)	2220	92 (93)

*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

	Exp. I (1980-1986)		Exp. II (1982-1986)	
	D.M. yield kg/ha	% of mean	D.M. yield kg/ha	% of mean
Crested wheatgrass	2236	138 (137)*	819	142 (144)*
Intermediate wheatgrass	1233	76 (69)	460	79 (79)
Smooth bromegrass	1238	76 (74)	608	106 (104)
Meadow bromegrass	1472	91 (86)	602	105 (104)
Russian wildrye	2160	133 (141)	485	84 (85)
Green stipa (needlegrass)	1412	87 (93)	484	85 (85)

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

Fig. I

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

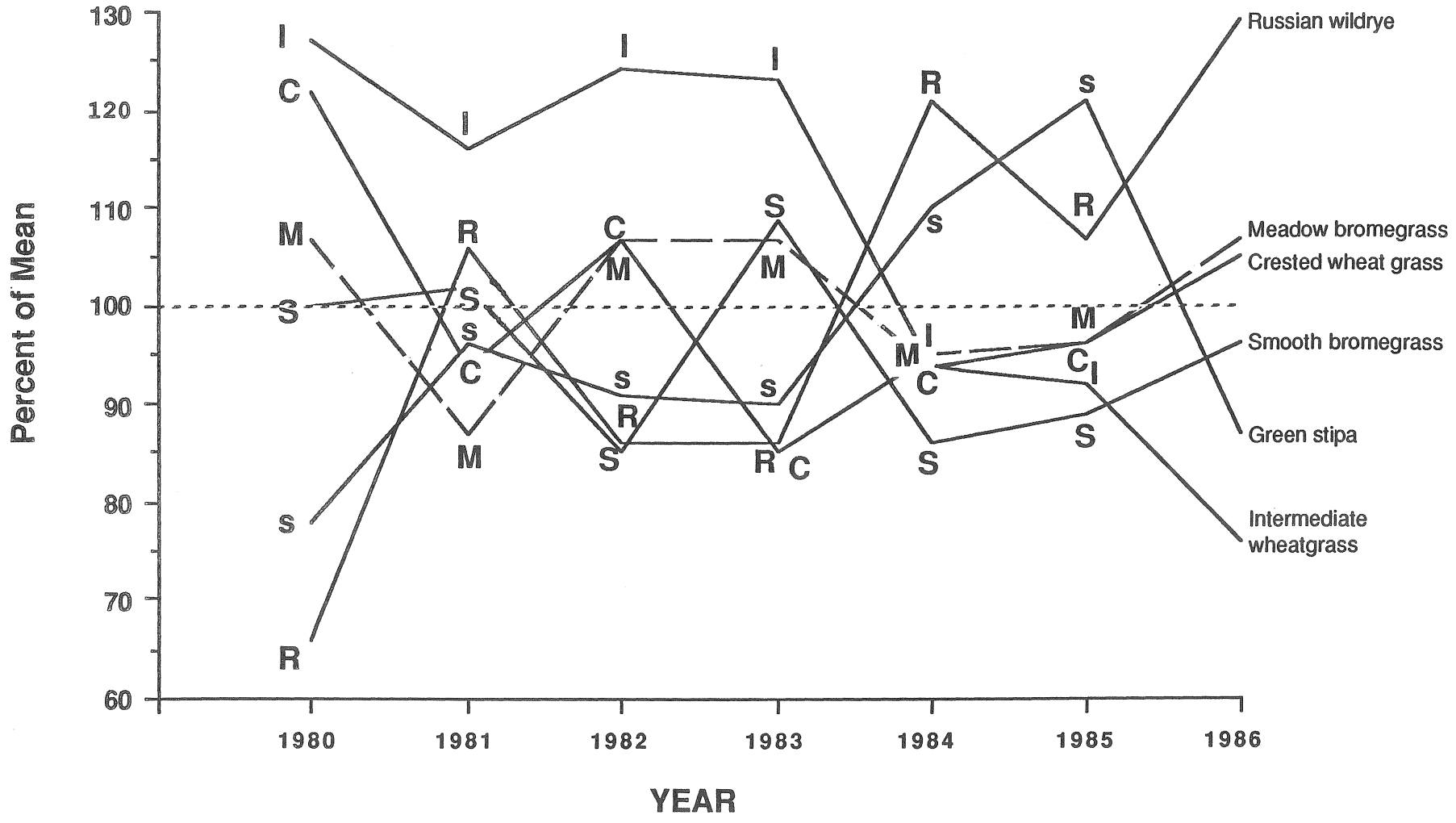
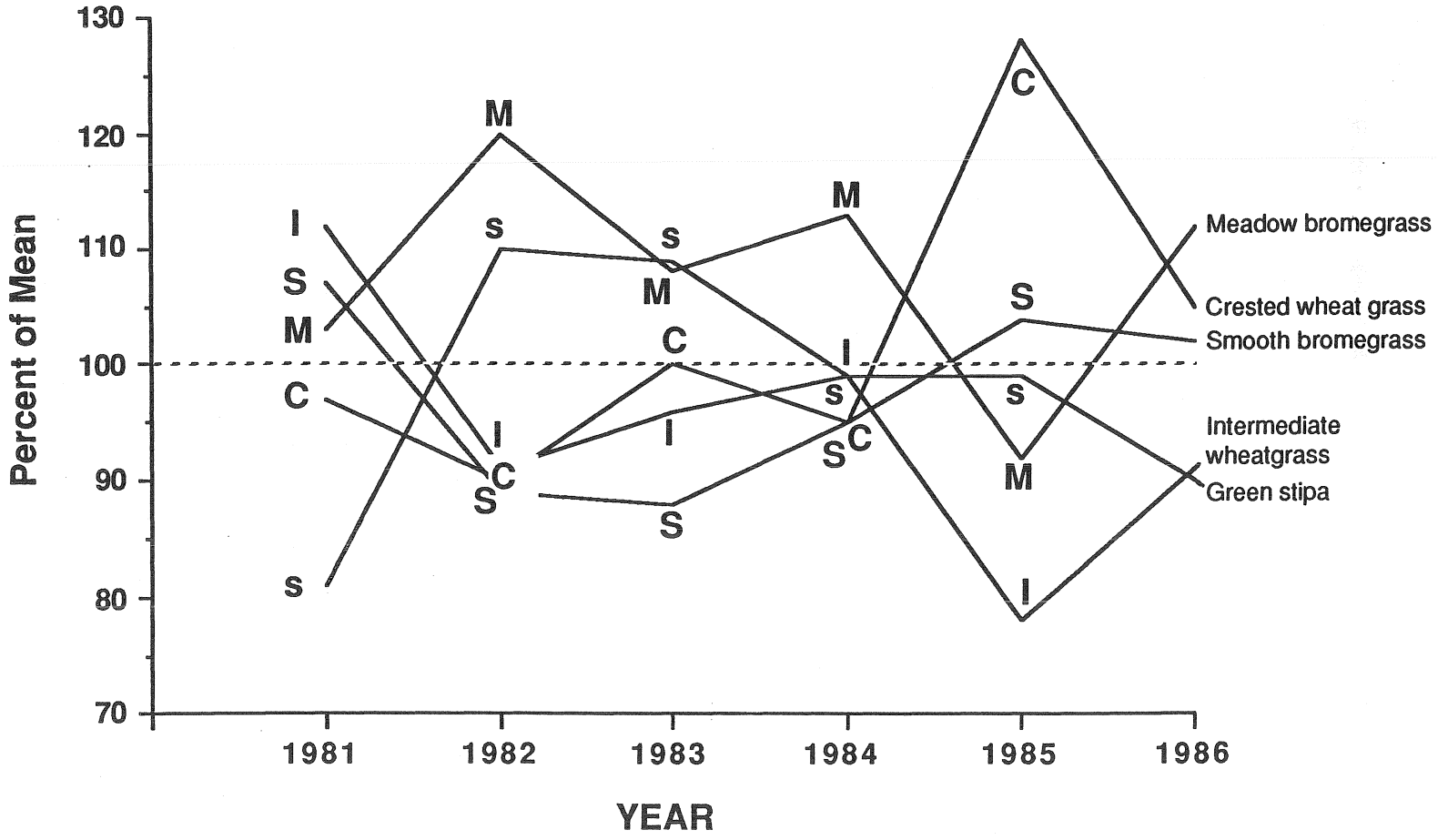


Fig. 2

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



Under simulated grazing, total regrowth (cuts 2, 3 and 4) was greatest for meadow bromegrass on gray-wooded soil and greatest for intermediate wheatgrass followed by meadow bromegrass on black soil (Table 5). Meadow bromegrass 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 bromegrass 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

	Exp. I (1980-1986)		Exp. II (1982-1986)	
	D.M. yield kg/ha	% of mean	D.M. yield kg/ha	% of mean
Crested wheatgrass	3067	92 (82)*	683	75 (77)*
Intermediate wheatgrass	4306	129 (126)	925	102 (102)
Smooth bromegrass	3367	101 (102)	816	90 (92)
Meadow bromegrass	3462	104 (111)	1074	118 (116)
Russian wildrye	2771	83 (80)		
Green stipa (needlegrass)	2993	90 (100)	1054	116 (114)

*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 bromegrass has better regrowth than the other grasses, particularly good late-season growth, and slightly higher total yield. In addition, meadow bromegrass 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

	Exp. I (1981-86)		Exp. II (1982-1986)	
	D.M. yield kg/ha	% of mean	D.M. yield kg/ha	% of mean
Crested wheatgrass	414	79 (66)*	235	91 (71)*
Intermediate wheatgrass	674	128 (129)	233	90 (87)
Smooth bromegrass	465	88 (83)	207	80 (70)
Meadow bromegrass	843	160 (147)	329	127 (151)
Russian wildrye	324	62 (76)		
Green stipa (needlegrass)	436	83 (100)	291	112 (120)

*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

	CWg[+]	IWg	SBr	MBr	RWR	GS
Yield (% of Mean)[‡]						
Black soil	100	107	95	101	100	96
Gray soil	103	95	98	108		95
Regrowth Yield (% of Mean)						
Black soil	82	126	102	111	80	100
Gray soil	77	102	92	116		114
Fall Regrowth (% of Mean)						
Black soil	66	129	83	147	76	100
Gray soil	71	87	70	151		120
Early Spring Production (% of Mean)						
Black soil	137	69	74	86	141	93
Gray soil	144	79	104	104	85	85
Ease of establishment	Good	Good	Good	Fair	Very Poor	Poor
Longevity	Good	Fair	Good	Good	Good	Good
Palatability	Fair-Poor	-	Fair	Good	-	-
Compatability with Alfalfa	-	-	Fair	Good	-	-
Cold hardiness (LT_{50}) (°C)	-30	-25	-28	-23	-28	-

[+]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.

Bittman, S. 1985. Physiological and agronomic responses to drought of three forage grasses, crested wheatgrass, smooth bromegrass, and Altai wildrye. Ph.D. Thesis, University of Saskatchewan, Saskatoon, Sask.

Clark, K.W. and D.H. Heinrichs. 1957. Grass-legume mixture trials. Can. Dept. of Agric. Publ. (Un-numbered). Agriculture Canada Research Station, Swift Current, Mimeographed Publ.

Cooper, C.S., L.E. Welty, S.B. Laudbert, and L.E. Wiesner. 1978. Evaluation of Regar meadow bromegrass in Montana. Montana Agric. Exp. Station, Bull. 702.

Howarth, R.E. 1986. Economic value of forage crops in Saskatchewan. Report to Forage Advisory Sub-Committee of Sask. Advisory Council of Soils and Agronmoy. J. Knipfel, Swift Current Research Station, Chairman.

Knowles, R.P. 1985. Pasture clipping test, Saskatoon. Uniform variety tests of forage crops contributed by research workers in Western Canada. Agriculture Canada, Research Branch, p. 37-39.

Knowles, R.P. and W.J. White. 1949. The performance of southern strains of bromegrass in Western Canada. Sci. Agr. 29: 437-450.

Lawrence, T. and Ratzlaff. 1985. Evaluation of fourteen grass populations as forage crops for southwestern Saskatchewan. Can. J. Plant Sci. 65: 951-957.

Lawrence, T. and J.E. Troelson. 1966. An evaluation of 15 grass species as forage crops for southwestern Saskatchewan. Can. J. Plant Sci. 44: 301-310.

Limin, A.E. and D.B. Fowler. 1986. An evaluation of winter hardiness in Saskatchewan forage grasses. Soils and Crops Workshop, Research in Agriculture, Saskatchewan Advisory Council on Crops and Agronomy. pp. 262-267.

Lodge, R.E., S. Smoliak and A. Johnston. 1972. Managing crested wheatgrass pastures. Agriculture Canada, Publ. 1473.

Smoliak, S. and M. Bjorge. 1981. Hay and pasture crops in Alberta Forage Manual. Print Media Branch, Alberta Agriculture, Edmonton, Alta.