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The XIX International Grassland Congress took place in São Pedro, São Paulo, Brazil from February 11 through February 21, 2001.

Proceedings published by Fundacao de Estudos Agrarios Luiz de Queiroz

BERSEEM CLOVER IN BINARY MIXTURES WITH OATS, TRITICALE OR BARLEY FOR SILAGE AND LATE SEASON GRAZING

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Abstract

An experiment was conducted at northerly latitudes with berseem clover (*Trifolium alexandrinum* L) in binary mixtures with oats (*Avena sativa* L.), barley (*Hordeum vulgare* L.) and triticale (*X Triticosecale* Wittmack). The effects of cereal species, variety and density were assessed for a two cut harvest. Total dry matter yields were 11.7 to 14.5 t ha^{-1}, with 7.8 to 10.2 t ha^{-1} as silage, and 2.0 to 6.0 t ha^{-1} as berseem regrowth. Berseem regrowth added an average of 4.0 t ha^{-1} in forage yield. Total yields did not differ with cereal type, but triticale mixtures had higher silage yields and lower regrowth yields than the other cereals. The silage yield of the ¼ triticale mixture had the best combination of high yield (10.2 t ha^{-1}) and high berseem component (23%). Early maturity of the barley allowed for a longer period of regrowth. The full rate of cereals was too competitive and greatly suppressed berseem initial growth and regrowth. Reducing the cereal density to ¼ of the full rate, increased the percentage of berseem in yields, and increased the total yields of barley, AC Mustang oat and triticale mixtures. Intercropping of berseem clover with silage cereals shows promise as a means to extend the grazing season and increase total forage yields.

Keywords: cereal-legume, intercrop, silage, berseem clover, oats, triticale, barley.

Introduction

Cereal silage has formed the backbone of the feedlot, backgrounding and dairy industries within the Canadian Prairie Provinces for the last decade. In Alberta, silage production mainly involves one cut of oats or barley, with lesser use of pea-cereal mixtures and triticale. Although the growing season is short, the period of several weeks after silage harvest could be utilized for additional forage production for fall grazing. The potential to extend forage production has been demonstrated with mixtures of spring and winter cereals (Jedel and Salmon, 1995). Berseem clover shows promise as forage for Alberta. Although annual legumes are not strong competitors, tests at Edmonton found that berseem was more competitive than six other clover species, due to its upright growth habit, long stems, high biomass accumulation, and late flowering (Ross, 1999). Growing berseem with silage cereals may increase total production during the growing season, while improving nutrient value and reducing fertilizer inputs. Berseem establishment and regrowth in intercrops may vary with cereal species/variety and cereal seeding rate. An experiment was conducted with oat-berseem, triticale-berseem and barley-berseem mixtures, using full and reduced cereal rates, to assess the forage potential of a silage and regrowth system.

Material and Methods

The experiment was conducted in 1998 in Edmonton (53° 25’ N, 113° 33’ W) on an Orthic Black Chernozem soil. The experimental design was a split-plot, randomized complete block, with three replicates. Cereal type constituted the main plots, and cereal density the sub-plots. ‘AC Lacombe’ barley (B), ‘AC Mustang’ oats (OA), ‘Waldern’ oats (OW), and ‘Pronghorn’ triticale (T) were seeded at three densities: 240 (full rate), 120 and 60 plants m^{-2}. Cereals and ‘Bigbee’ berseem clover were seeded on May 14 using a 6-row Fabro disc drill, with 17 cm row spacing. Sub-plot size was approx. 2 m x 6 m, and each contained 12 rows of cereals.

The berseem was inoculated with the appropriate *Rhizobium* species and cross-seeded at 15 kg ha^{-1} over all plots.

Cereals and berseem emerged concurrently. Two quadrats, each 0.6 m^{-2}, were permanently marked in each subplot. Cereal plant numbers were set within quadrats. Plots were hand weeded. A silage stage harvest was taken at late milk to early soft dough stage of the cereals: July 21 - B; July 28 - OA; July 30 - OW; and Aug. 4 - T. Quadrat growth was cut by hand at 5-7.5 cm above soil level. Berseem and cereals were separated, dried for 72 hours at 52 °C, and weighed. The regrowth harvest was taken on Sept. 28, at 137 days after planting. Dry matter yields were analyzed using analysis of variance procedures.

Results and Discussion

Above-average spring and summer temperatures in 1998 resulted in early heading of the cereals and early silage harvests. In north-central Alberta, silage is usually harvested in August. The early silage cut and mild Sept./Oct. weather resulted in relatively long periods of regrowth. Berseem regrowth was measured at 8-10 weeks after the silage harvest, but the berseem stayed green into November.

The effects of cereal density were highly significant ($p < 0.001$), and interactions between cereal type and density were significant ($p < 0.05$) for Harvest 1, Harvest 2 and Total yields (Table 1). The effects of cereal type were significant ($p < 0.05$) for Harvest 1 and Harvest 2 yields, but not for Total yield.

Harvest 1 dry matter yields ranged from 7.8 t ha^{-1} for B60 to >10 t ha^{-1} for T mixtures (Table 1). The full rate (240) of cereals was very competitive against berseem, and resulted in berseem components of only 1-6%. The ranking of silage yield, across treatments, was T > OW =

OA = B. The yield advantage of triticale treatments may be partly attributed to longer periods of growth, as triticale plots were harvested two weeks later than barley plots. Unlike the other cereal types, yields of triticale treatments did not decline with decreasing cereal density. Within all 60 and 120 treatments, high availability of soil nutrients and water probably supported some yield compensation from tillering, but T60 was unique in the amount of yield (23%) contributed by berseem. Oat and barley 60 treatments contained only 10-16% berseem. It appeared that the 60 rate of triticale allowed for greater penetration of light through the canopy than occurred with barley or oats. Barley treatments had the lowest amounts of berseem growth, indicating that barley was the most competitive of the cereals. Although the triticale treatments produced the highest silage yields, results may vary with environmental conditions and cereal variety. Jedel and Helm (1993) found that oat-legume mixtures had somewhat higher silage yields than barley or triticale mixtures with peas or fababeans.

Harvest 2 consisted only of berseem, because regrowth of cereals was negligible. Harvest 2 yield ranged from 2.0 t ha^{-1} for T240 to 6.0 t ha^{-1} for B60 (Table 1). The mean berseem regrowth was 4 t ha^{-1}, and represented 44% of the Harvest 1 yield. The ranking of regrowth yield, across treatments, was B = OA = OW > T. The length of time of regrowth varied among cereal treatments and likely affected yield results. Yield trends among the 60 treatments, corresponded to days of regrowth: B > OA > OW > T. Berseem regrowth increased with decreasing cereal density. Yields for the 240 treatments ranged from 2.0 to 3.8 t ha^{-1}, while those for the 60 treatments ranged from 4.3 to 6.0 t ha^{-1}. Compared to the 240 treatments, the yields for the 60 treatments were 3.3 t ha^{-1} (122%) higher for B, 2.0 t ha^{-1} (57%) higher for OA, 1.1 t ha^{-1} (29%) higher for OW, and 2.3 t ha^{-1} (115%) higher for T. Initial suppression of berseem by high cereal densities, resulted in poorer regrowth.

Total (two cut) yields ranged from 11.7 t ha^{-1} for B240 to 14.5 t ha^{-1} for T60 (Table 1, Figure 1). Total yields were similar for the four cereal types, but yields differed by cereal density. With the exception of OW treatments, yields for the 60 treatments were higher than those for the 240 treatments. Yields of the 60 treatments of T, B and OA were 2.3, 2.2 and 1.4 t ha^{-1} higher than the respective 240 treatments. The berseem component of total yield increased (across all cereal varieties) as cereal density declined. The berseem component of total yield was 19-32% for 240 treatments, and 46-49% for 60 treatments.

Intercropping of berseem clover with silage cereals shows potential to provide late season grazing. Reducing cereal density to ¼ of the full rate resulted in better regrowth and higher total yields. Further research is needed to test berseem-cereal mixtures over a number of years, with additional cereal varieties and additional cereal densities.

References

Jedel, P.E. and Helm J.H. (1993) Forage potential of pulse-cereal mixtures in central Alberta. Canadian Journal of Plant Science, **73:** 437-444.

Jedel, P.E. and Salmon D.F. (1995) Forage potential of spring and winter cereal mixtures in a short-season growing area. Agronomy Journal, **87:** 731-736.

Ross, S.M. (1999) Clovers in cropping systems. M.S. thesis. Univ. of Alberta, Edmonton, Canada.

Table 1 - Dry matter (DM) yields (t ha^{-1}), % berseem clover, and days of growth for two harvests from 12 cereal-berseem mixtures at Edmonton in 1998.

		Harvest 1			Harvest 2		Total	
Cereal	Cereal density	DAP	Mixture DM	% Bers.	DR	Bers. DM	DM	% Bers.
	plants m^{-2}	d	t ha^{-1}	%	d	t ha^{-1}	t ha^{-1}	%
Barley	60	68	7.8	10	69	6.0	13.9	49
	120	68	8.9	3	69	4.5	13.4	35
	240	68	8.9	1	69	2.7	11.7	24
Oats (OA)	60	75	8.8	14	62	5.5	14.3	47
	120	75	8.5	9	62	4.5	13.0	40
	240	75	9.4	4	62	3.5	12.9	30
Oats (OW)	60	77	8.5	16	60	4.9	13.4	46
	120	77	8.8	9	60	4.4	13.2	38
	240	77	9.8	6	60	3.8	13.7	32
Triticale	60	82	10.2	23	55	4.3	14.5	46
	120	82	10.0	9	55	3.3	13.3	31
	240	82	10.2	4	55	2.0	12.2	19
Mean			9.2	8		4.0	13.2	36
Source of variation								
Cereal (C)			*			*	ns	
Density (D)			***			***	***	
C x D			*			**	*	

*, **, *** Significant at the 0.05, 0.01, and 0.001 probability levels, respectively. ns = not significant, Bers.= berseem clover, DAP = days after planting, DR = days of regrowth.

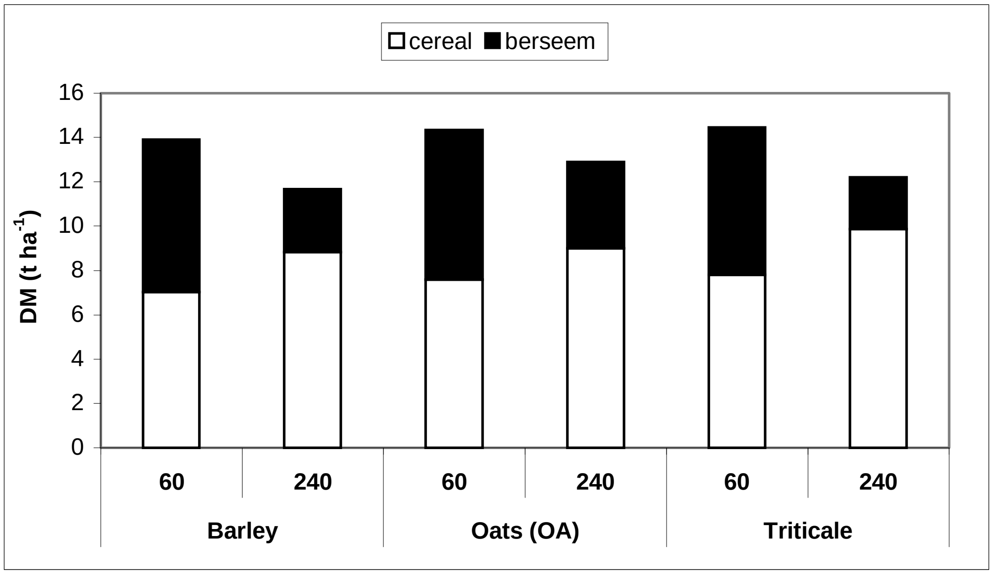

Figure 1 - Total dry matter yields (t ha^{-1}) of berseem clover (■) and cereals (□) for two harvests from six cereal-berseem mixtures, with cereal densities of 60 and 240 plants m^{-2}, at Edmonton in 1998.