Previous grass-lucerne mixtures affect barley yield and quality in a semiarid location of the Canadian prairie region

P.G. Jefferson, F. Selles, R.P. Zentner and R. Lemke
Agriculture and Agri-Food Canada, Semiarid Prairie Agricultural Research Centre, P.O. Box 1030, Swift Current, Saskatchewan, S9H 3X2, Canada, Email: JeffersonP@agr.gc.ca

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Introduction In the semiarid region of the Canadian prairies perennial forages are not rotated with annual crops because previous experiments reported negative impacts (Kilcher and Anderson 1963; Campbell *et al.* 1990). However, previous research used persistent species while short-lived species could have less adverse effect. Our objective was to compare three grass species in three lucerne mixtures terminated with tillage or herbicide for effects on barley grain, N concentration, and N uptake.

Materials and methods Intermediate wheatgrass (*Elytrigia intermedia*) cv. Chief (IWG), Dahurian wildrye (*Elymus dahuricus*) cv. Arthur (DWR), and slender wheatgrass (*Elymus trachycaulus*) cv. Revenue (SWG) were seeded in monoculture, or mixture with lucerne (*Medicago sativa*) cv. Beaver, a persistent winterhardy cultivar or Nitro, an annual non-winterhardy cultivar in 1998 and 1999. Half of each trial was tilled or sprayed with glyphosate herbicide to terminate the forage stands in 2002 and 2003. Barley (*Hordeum vulgare*) cv. Harrington was seeded without N fertiliser. Grain and straw yield, and grain and straw N concentration were determined and N uptake was calculated. N_2O emission was monitored on selected treatments.

Results Nitrogen availability to barley, as shown by N uptake, was improved by including lucerne in the previous short-lived grass (DWR and SWG) stand (Table 1). In 2002, a year with above-average precipitation, the inclusion of lucerne increased barley grain yields but did not affect grain N concentration. Conversely, in 2003, a dry year, inclusion of lucerne did not affect grain yield but increased grain N concentration. Tillage increased grain yield compared to no-tillage in 2002 but not in 2003 (data not shown). Emissions of N_2O during the barley phase was not affected by previous forage mixture (data not shown).

Table 1 Effect of grass species and lucerne mixture on lucerne composition of forage in the year before barley, barley grain yield, barley grain N concentration and N uptake for two years

	Lucerne (g/g)		Barley (kg/ha)		Grain N (g/kg)		N uptake (kg/ha)	
Grass species	2001	2002	2002	2003	2002	2003	2002	2003
DWR	0.23	0.33	1265	1224	14.8	23.0	31	48
IWG	0.10	0.12	681	1045	14.6	19.4	23	35
SWG	0.23	0.27	1352	1231	14.8	22.8	35	48
SE	0.02	0.01	89	70	0.3	1.6	2	2
Lucerne cultivar								
Beaver	0.57	0.72	1450	1099	14.9	24.9	37	50
Nitro	0.01	0.01	986	1222	14.6	20.7	27	43
None	0.01	0.01	862	1180	14.7	19.6	24	37
SE	0.02	0.01	78	63	0.2	1.6	1	2

Conclusions Barley after short-lived perennial grasses such as DWR and SWG yielded more in 2002 and had higher grain protein in 2003 than barley after IWG. The inclusion of lucerne improved N availability to the barley in both years. These forages have potential for inclusion in annual crop rotations in semiarid regions of the Canadian prairies.

References

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