

Can replacing native grasslands with agronomic species improve the above-ground productivity on the Mixed Prairie in Canada ?

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Introduction The relative benefits of introducing forage species to the Northern Great Plains has been examined in well publicized studies with contradictory conclusions . In most cases the research was conducted in trials that were confounded by time of establishment or where the treatments could not be randomized and consequently lacked independence . Therefore , we initiated a study to re-examine the relative productivity between commonly introduced species and native Mixed Prairie communities on the Northern Great Plains .

Materials and methods We examined the above-ground primary production (ANPP) and harvested biomass from *Agropyron cristatum* (L.) Gaertn . , *Psathyrostachys juncea* (Fisch.) Nevski and *Triticum aestivum* L . in comparison with the native community in a randomized complete block design with 4 blocks and 5 treatments over 12 or 13 years from establishment . The study was repeated on two sites having either a Brown or Dark Brown Chernozemic soil in southern Alberta , Canada . Average annual precipitation at the sites was 348 and 377 mm , respectively . The native community was represented by a control (native_{cont}) and a harvested treatment (native_{harv}) . We examined the ANPP and harvested biomass of the introduced species and the native_{harv} in three , 4/5-yr periods at each site .

Results and discussion With the exception of *P. juncea* on the Brown Chernozemic (BC) site , the seeded treatments were relatively more productive in the establishment period than in subsequent periods (Table 1) . Following establishment , *A. cristatum* produced similar yields as native_{harv} on the Dark Brown Chernozemic (DBC) site but about 1.8 times more on the BC site . *P. juncea* generally produced less ($P < 0.05$) or similar ($P > 0.05$) yields as native_{harv} while *T. aestivum* produced more ($P < 0.05$) . The study confirms the relative ANPP advantage of *A. cristatum* to native on the BC site but not on the DBC site . *T. aestivum* was the most productive on both sites and its ANPP advantage to the native appeared sustainable . Our study does not support unconditionally the previous claims of improved productivity from introduced grasses (Smoliak 1968 , Kilcher and Looman 1983) since their relative performance was affected by species , time since establishment and by site . Production comparisons of introduced species with native communities must consider their previous management . Furthermore , the relative productivity of native grasslands is strongly influenced by their defoliation regime . Therefore , production comparisons of introduced species with native communities must consider their previous management .

Table 1 Above-ground net primary production of native communities and monocultures of seeded introduced species during three periods since establishment at two sites on previously unbroken land . The effect of period , treatment , and its interaction on ANPP are significant ($P < 0.05$) for each site .

Period (years)	Native		Introduced		
	Native _{cont}	Native _{harv}	<i>A. crist.</i>	<i>P. junce.</i>	<i>T. aest.</i>
Dark Brown Chernozemic (1994 to 2006)					
ANPP (g m ⁻²)					
1 to 4	178b ¹	154ab	291c	123a	338d
5 to 8	178b	139b	138b	87a	164b
9 to 13	306c	259b	301bc	190a	538d
Mean	221	184	243 .1	133	346
Brown Chernozemic (1995 to 2006)					
ANPP (g m ⁻²)					
1 to 4	64a	75ab	265c	93b	476d
5 to 8	124a	91a	205b	134a	224b
9 to 12	178b	129a	178b	120a	207b
Mean	123	98	216	116	269

¹a-d Means followed by a common letter within row are not different ($P > 0.05$) .

Conclusions The belief that seeding native grassland with introduced species would increase forage production is not supported by this study . *A. cristatum* , probably the most productive of the perennial forage grasses that were introduced to the Mixed Prairie , yielded greater ANPP in the more xeric community represented by the BC site but demonstrated little advantage on the more mesic community of the DBC site .

References

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