How Do Native and Improved Grasses Affect Above-Ground Production and Soil Organic C?

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How do native and "improved" grasses affect above-ground production and soil organic C?

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Introduction Crested wheatgrass [*Agropyron cristatum* (L .) Gaertn .] and Russian wildrye [*Psathyrostachys juncea* (Fisch .) Nevski] are commonly used for reseeding in the more xeric Mixed Prairie because they are perceived to be more productive than native species . However , crested wheatgrass has been implicated in soil deterioration (Dormaar et al ., 1995) while native grasses are being examined with increasing interest in Canada for their potential use in reclamation and forage production (Kerr et al ., 1993) . The objectives of our study were to compare the above-ground net primary production (ANPP) and soil organic C among communities of selected native and introduced grasses and wheat , and to assess the benefits of simple mixtures .

Materials and methods A 10-year study was initiated on Dark Brown Chernozemic (Typic Haploboroll) soil near Lethbridge , Alberta . Eleven treatments consisting of monocultures of introduced [*Agropyron cristatum* (L .) Gaertn , *Psathyrostachys juncea* (Fisch .) Nevski] and selected native species [*Bouteloua gracilis* (H .B .K .) Lag . Ex Steud ., *Pascopyrum smithii* (Rydb .) A . Löve , *Stipa viridula* Trin .] mixtures of native species , and wheat (*Triticum aestivum* L .) were established in a randomized complete block design with four replications . ANPP was estimated over eight years ,and soils were sampled in the final year of the study . The vegetation was analyzed for N and the soils were analyzed for organic C . Light fraction was determined by grinding soil (2 mm sieve) and using NaI floatation .

Table 1 *Annual net primary production (ANPP) over 8 years (1997 to 2005) and soil organic C characteristics of native and introduced species to 60 cm depth 10 years after establishment .*

		ANPP		Nitrogen		Organic C		
Treatment	Origin	Total	Harvested	Conc .	Harvested	Stable fraction	Root (>2 mm dia)	Light fraction
		(kg ha^{-1})		(mg g^{-1})	(kg ha^{-1})		(Mg ha^{-1})	
P . *smithii* (1)	Native	322	178	20	5 .2	88	0 .44	7 .8
S . *viridula* (2)	Native	376	272	20	7 .1	84	0 .49	6 .9
B . *gracilis* (3)	Native	313	177	20	4 .6	87	0 .66	7 .8
1+2 (4)	Native	362	240	21	7 .5	84	0 .60	9 .0
1+3 (5)	Native	320	183	22	6 .3	85	0 .58	8 .0
2+3 (6)	Native	368	257	19	6 .8	81	0 .64	9 .0
1+2+3 (7)	Native	359	223	21	6 .9	88	0 .73	9 .8
P . *junceus* (8)	Introd .	342	238	18	5 .2	79	1 .51	10 .1
A . *cristatum* (9)	Introd .	363	257	15	6 .1	83	0 .97	9 .9
T . *aestivum* (10)	Introd .	287	244	21	6 .5	84	0 .04	3 .8
P :		0 .01	0 .06	0 .01	< 0 .01	0 .15	< 0 .01	< 0 .01
Contrasts								
1—3 vs 7		0 .57	0 .72	0 .61	0 .04	0 .58	0 .07	< 0 .01
1—3 vs 8 ,9		0 .62	0 .22	< 0 .01	0 .99	0 .02	< 0 .01	< 0 .01
1—9 vs 10		0 .28	0 .41	0 .27	0 .37	0 .96	< 0 .01	< 0 .01

Results and discussion Introduced grass species were not more productive than native species ($P > 0.05$) , and both had similar ($P > 0.05$) effects on soil organic C (Table 1) . However , the introduced perennial grasses yielded greater organic C in light fraction than monocultures of native species . *T . aestivum* had the least root or light fraction organic C , which contributed to marginally less soil organic C (Table 1) . The light fraction is a highly labile component of soil organic matter and is derived from the fine roots (< 2 mm) and partly decomposed large roots .

Conclusion There does not appear to be any distinction between native and introduced perennial species in their benefits to ANPP . However , soil organic C (less light fraction) seemed to be benefited by native species .

Reference

Dormaar , J .F . , Naeth , M .A . , Willms , W .D , . Chanasyk , D .S . ,(1995) . Effect of native prairie , crested wheatgrass (*Agropyron cristatum* [L .] Gaertn .) and Russian wildrye (*Elymus junceus* Fisch .) on soil chemical properties . J .*Range Manage* . 48 ,258-263 .