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Beef Science Cluster

Drought Tolerant Forage Mixtures

Project Title:	Project Code:	FRG.01.09
Development of Drought-Tolerant Forage for the Dry Mixed-Grass Prairie	Completed:	*March 2013*

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Background:

Because native species may increase carbon sequestration, improve wildlife habitat, lower agronomic inputs, and extend the grazing season, there is a growing interest in the use of native perennial species for seeded rangeland and reclamation following disturbance.

Diverse forage swards composed of native species have the potential to be as productive as tame monocultures in a greater range of environmental conditions. Unfortunately the information for the right combination of species is very limited.

Ideal combinations of species or functional groups (plants species providing a specific function such as nitrogen fixation) will support complementary interactions among species which can increase productivity over that of single species pastures. An ideal forage sward should be nutritious and provide forage for the entire spring and summer.

The focus of this research was to field test mixtures of species that could be seeded in former cropland and could provide a sustainable, drought tolerant, non-invasive, productive rangeland for pasture use in the Mixed Grassland of the Canadian Prairies.

Objectives:

1. Assess the productivity (forage yield) of the forage swards to determine if species show complementarity, and
2. Assess the crude protein content of the forage swards

What they did:

The researchers assessed the suitability of seeded forage swards in the early establishment phase of the communities, composed of mixtures of native warm and cool-season grasses, and legumes, for use as seeded rangeland. The functional groups represented by these species were:

- warm season species that develop later in the season providing late season quality forage;
- cool season species for early season forage and spring moisture capture; and
- nitrogen fixing legume species.

Seven species with agronomic potential and a broad native geographic distribution were selected for testing including *Pascopyrum smithii* (Western Wheatgrass; cool season), *Pseudoregeneria spicatum* (Bluebunch Wheatgrass; cool season), *Schizachyrium scoparius* (little blue stem; warm season), *Bouteloua curtipendula* (side oat grama; warm season), *Bromus anomalus* (nodding brome; cool season), *Dalea purpurea* (purple prairie clover; nitrogen fixer), and *Dalea candida* (white prairie clover; nitrogen fixer).

Forage swards were seeded that included all 7 one-species mixtures, 21 two-species mixtures, and a seven- species mixture in two sites: Saskatoon and Swift Current, Saskatchewan. Each forage sward's plant density, forage yield, and crude protein were measured and compared.

What they learned:

Forage yield differed between the forage swards, and increased with plant density. In both sites, at both harvest times, monocultures and combinations of the legumes and warm-season grasses ranked low, while forage swards containing Western Wheatgrass ranked high. The seven species mixture ranked among the top 3 most productive groups in all cases. Crude protein differed significantly between swards. Percent crude protein for each treatment was highly variable across time of harvest and site, though the legume monocultures and mixtures were consistently highly ranked.

The most productive species was Western wheatgrass, which overall performed better than all other monocultures. However, even when Western wheatgrass is seeded at half of the seeding rate, the mixed forage sward was still as productive as Western Wheatgrass in monoculture. Therefore, including warm season grasses and legumes in addition to Western Wheatgrass, did not reduce the productivity of the forage sward.

The legumes and warm season grasses were the least productive swards, which may be due to the exceptionally high precipitation during 2010 and 2011 and the cooler temperatures during the seeding year. Perennial species tend to invest in roots before shoots, especially in arid environments and therefore full establishment and maximum forage yield may require more than two years to be realized.

Warm season grasses were included in part for their drought resistance which was not evident in such wet years. Benefits to including them may be more obvious in drier years, where Western Wheatgrass may prove to be less successful. Additionally, rangeland plant diversity can improve the nutritional quality and palatability of forage by providing a mixed diet, thereby increasing weight gain in cattle.

What it means:

Fast growing and highly competitive species dominate biomass production in the early establishment phase of the community, however the inclusion of less productive species in the forage sward carries little penalty for pasture productivity or nutritional value.

Less productive species should be included in pasture mixes when they bring beneficial traits (i.e. increasing nitrogen availability, drought resistance) to the restored forage sward. Including these traits carries little penalty under good growing conditions, and provides 'insurance' for less optimal years.

This work provides insight in forage sward development at the early establishment stage; additional work is required to determine species impacts for well-established forage swards.

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