

Forage Production and Crude Protein of Seven Native Species in a 4-Year Stand in Mixed-Grass Prairie, Saskatchewan

Mostafa Serajchi¹, Eric G. Lamb¹ and Michael P. Schellenberg²

¹ University of Saskatchewan, Saskatoon, Saskatchewan ² Agriculture and Agri-Food

Canada, Swift Current, Saskatchewan

Abstract

There is an increasing interest in using the native perennial forage species for rangelands. In this research forage swards of seven native perennial plants and their crude proteins were evaluated in a 4-year stand study. In the monoculture plots, Western Wheatgrass (WWG) was produced the highest dry matter. More than 85% of mixture plots in which WWG was a component, were occupied by WWG. The percentage of crude protein was higher in July, however, in both harvesting times White Prairie Clover (WPC) and Purple Prairie Clover (PPC) had the highest percentage of crude protein. Mixture plots of Little Blue Stem (LBS) + Blue Bunch Wheatgrass (BWG) performed well at the end of growing season.

Key Words: Forage production, C3 and C4 Grasses, legume-grass mixture.

Introduction

Native species can increase carbon sequestration, prepare stable habitats for animals, expand the grazing period and product with fewer rely on external inputs. Focusing on native plants vs. non-native plants can be a sustainable, environmental friendly and ecological approach for cattle industries. Mix-cropping of native plants has a potential to reduce the productivity fluctuations in different year-to-year environmental conditions. C3 grasses are the dominant species in semi-arid Saskatchewan that can cope the climate in this area. On the other hand, C4 grasses are more productive in hot and dry years. Legumes in the mixture can fix nitrogen and reduce fertilizer application in the rangelands; therefore, combinations of different functional plants may show sustainable productivity over the years. The objective of this study was to determine the forage productivity and crude protein content of monoculture and mix-culture of seven native plants in a 4-year stand in semi-arid Saskatchewan.

Materials and Methods

Field experiment was conducted in Swift Current, Saskatchewan, which is categorized as a dry-mixed grassland ecoregion. Seven native forage species were seeded in monoculture, two-species mixture and 7-species mixture in spring 2010, including: nodding brome (*Bromus anomalus*), blue bunch wheatgrass (*Pseudoregneria spicata*), western wheatgrass (*Pascopyrum smithii*), side oats grama (*Bouteloua curtipendula*), little blue stem (*Schizachyrium scoparium*), purple prairie clover (*Dalea purpurea*), and white prairie clover (*Dalea candida*). A Complete randomised block design was seeded with four replications in 4x8 m plots with 12 rows. Grasses and legumes were seeded at a rate of 100 and 200 seeds m⁻¹, respectively. In two-species plots

1/2, and in 7-species plot, 1/7 of mentioned numbers were seeded. Dry matter was measured in early-July and late-August with two 0.25 m² quadrats. Crude protein was calculated by multiplying total Kjeldahl N x 6.25.

Results

Forage Yield:

At both harvesting times, all monocultures ranked low except WWG and LBS at late-August harvesting time (Fig 1). Forage production in the all-species plot ranked mid-range, while in 2011 forage sward of this plot ranked among the most productive plots (data not shown). In late-August LBS+BBW plot reached the highest productive plot, while in early-July it ranked mid-range. In mid-season harvest, all plots contained WWG, except SOG+WWG and 7-species plots, ranked the most productive plots. In late-season SOG+WWG joined the most productive plots too; however, 7-species plot remained mid-range. There was no significantly difference between WWG in monoculture and other most productive two-species plots at both harvesting times.

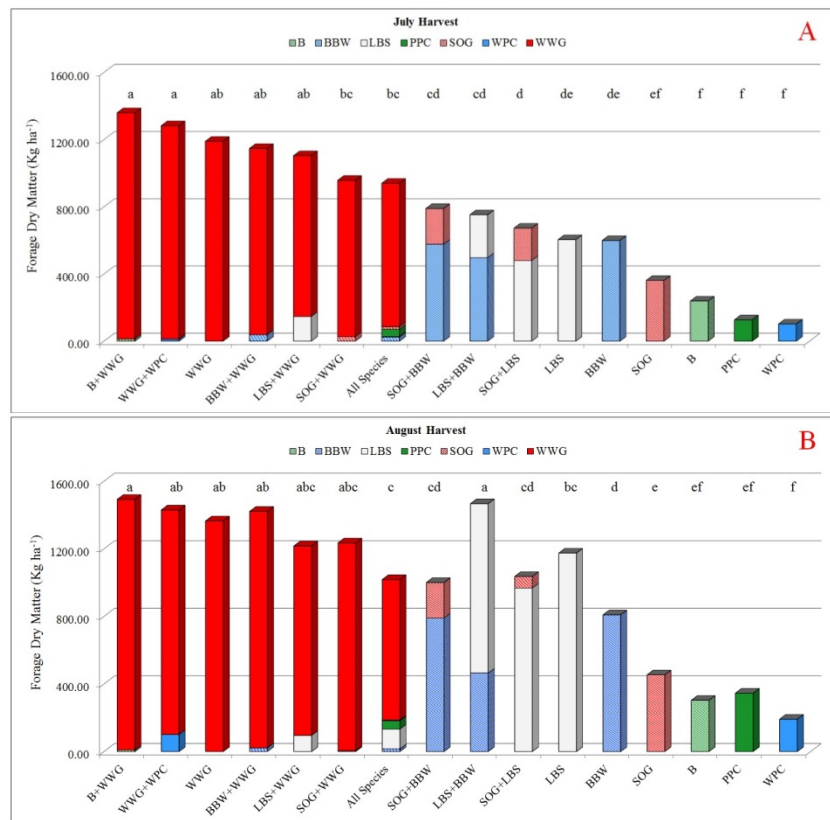


Figure 1. Forage production (Kg ha⁻¹ of dry matter) of seven native species in monoculture and mixture at the early-July (A) and late-August (B) in 2014. Means with the same letter are not significantly different ($p > 0.05$).

Crude Protein:

Crude protein differed significantly between different species (Fig 2). Percent crude protein decreased sharply in many treatments in August. As expected, PPC and WPC were consistently highly ranked in both harvesting time. Monoculture of WWG ranked third in crude protein in

July harvest. The highest ranking two-species plots were B+WWG in July harvest and WPC+WWG in August harvest.

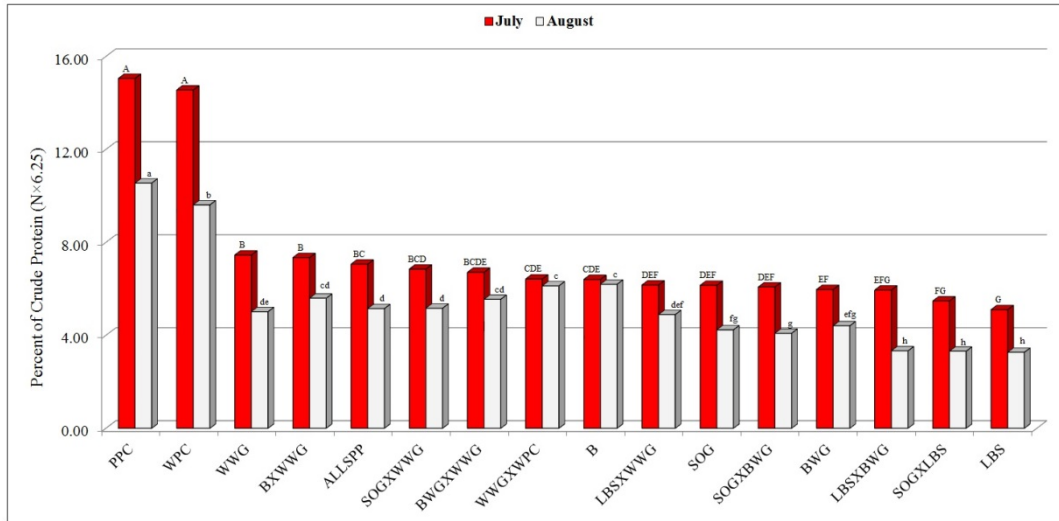


Figure 2. Percent of crude protein of each forage sward in July and August harvest. Means with the same capital letter for July and lower case letter for August are not significantly different ($p > 0.05$).

Discussion and Conclusions

Although there are a dramatic decreases in forage production from 2011 compared to 2014 in all plots (data not shown), however, WWG both in monoculture and two-species plots performed better than others. In plots containing WWG, the gap between rows were fully filled in by new rhizomes and stems of WWG and might be a reason for higher production in these plots. In the same way, because of producing dense stands with sod-forming rhizomes of WWG, more than 85% up to 99% of two-species plots and 7-species plot were occupied by WWG in the 4-year old stand plots. WWG is palatable, nutritious, digestible and has low neutral detergent fiber which makes it suitable for the cattle industry. LBS as a C4 grass performed well in late season, especially in the LBS+BBW plot. More diverse mixtures, including C3 and C4 crops, can be a reliable source of production especially in hot and dry years. In conclusion, using commercially available native forage crops can be a step toward sustainable forage production. WWG has the potential to be one of the best options for the forage industry, however, on the other hand, adding other species to the mixture, can increase the margin of security for producers. Moreover, presence of legumes in the mixtures can increase soil nitrogen without external chemical applications.

Acknowledgements

We appreciate the technical help provided by J. Mischkolz, I.Piché, M.Kehler, S.Bender, S.Friedrich, M.Zeid and K. Deuck. We also wish to acknowledge funding from the Beef Cattle Research Council and NSERC that makes this work possible.

References

- Biliget, B., Jefferson, P. G., Muri, R., Schellenberg, M. P. 2014. Late summer forage yield, nutritive value, compatibility of warm-and cool-season grasses seeded with legumes in western Canada. *Canadian Journal of Plant Science* 94:1139-1148.
- Mischkolz, J. M., Schellenberg, M. P., and Lamb, E. G. 2013. Early productivity and crude protein content of establishing forage swards composed of combinations of native grass and legume species in mixed-grassland ecoregions. *Can. J. Plant Sci.* 93: 445-454.
- Picasso, V. D., Brummer, E. C., Liebman, M., Dixon, P. M. and Wilsey, B. J. 2008. Crop species diversity affects productivity and weed suppression in perennial polycultures under two management strategies. *Crop Sci.* 48: 331-342.