Mixed Species Seeding: A Means to Increase Production in Temperate Pastures

Michael P. Schellenberg
Agriculture and Agri-Food Canada, Canada

Bili Biligetu
Agriculture and Agri-Food Canada, Canada

Valentin Picasso
Universidad de la República, Uruguay

The 22nd International Grassland Congress (Revitalising Grasslands to Sustain Our Communities) took place in Sydney, Australia from September 15 through September 19, 2013.

Proceedings Editors: David L. Michalk, Geoffrey D. Millar, Warwick B. Badgery, and Kim M. Broadfoot

Publisher: New South Wales Department of Primary Industry, Kite St., Orange New South Wales, Australia

Mixed species seeding: A means to increase production in temperate pastures

Michael P Schellenberg [A], *B. Biligetu* [A] *and Valentin Picasso* [B]

[A] Semiarid Prairie Agricultural Research Center, Box 1030, Swift Current, Saskatchewan, Canada, S9H 3X2
[B] Facultad de Agronomía, Universidad de la República Av. E. Garzón 780, Montevideo, 11700, Uruguay
Contact email: Mike.Schellenberg@agr.gc.ca

Keywords: Diverse seeding, forage, biodiversity, functional group, perennials.

Introduction

Seeding mixed species for forage production has been suggested as a means of increasing productivity and stabilizing yields under a changing climate. Forages have traditionally been sown as monocultures or binary mixtures only, with the emphasis being on species and not necessarily their function or compatibility. While natural plant communities typically may be dominated by a single species, they are comprised of several species and functional groups.

This paper provides the results of sowing multiple species at semiarid sites within the North American Great Plains and identifies a similar result from a more humid region reported within the literature.

Materials and Methods

At the semi-arid site located at the Semiarid Prairie Agricultural Research Centre of Agriculture and Agri-Food Canada (Swift Current, Saskatchewan, Canada), 4 perennial species, representing 2 functional groups were sown. These were comprised of the legumes, alfalfa (*Medicago sativa* L.) and purple prairie clover (*Dalea purpurea* Vent.), and the C_3 grasses, western wheatgrass (*Pascopyrum smithii* (Rydb.) Barkworth & D.R. Dewey) and green needle grass (*Nasella viridula* (Trin.) Barkworth). Plots (2 m by 10 m) were sown at a rate of 100 live seeds/m, with a 30 cm row separation, and the trial design was a fully factorial randomized complete block with 4 replicates. All species combinations were represented. Analysis of variance was conducted using a mixed model approach.

Results

At the semi-arid site, inclusion of two legumes resulted in increases of both forage DM yield and crude protein (Table 1). Combinations of grass and legume functional groups out-yielded monocultures of either legumes or grasses. Alfalfa was the highest yielding forage in all combinations for both sites (data not shown). The combination of species within the functional groups can be important in providing the increase in productivity (Schellenberg and Banerjee 2002), and maintaining nutritional value throughout the grazing season (Schellenberg *et al.* 2012).

Table 1. Forage dry matter (DM) yield (kg/ha) and nutritive value (g/kg DM) for different functional groups at Swift Current, SK, Canada.

Functional group	DM yield	ADF[z]	NDF	CP
2 legumes	5891 a [y]	438 a	525d e	108 ab
2 legumes + 2 grasses	5602 a	431 ab	569 cd	99 bc
2 legumes + 1grass	5401 a	422 ab	561 cd	98 b
1 legume + 1 grass	4439 b	398 bc	595 bc	87 cd
1 legume + 2 grasses	3930 b	394 bc	595 bc	83 d
1 legume	3648 b	382 c	475 e	116 a
2 grasses	2412 c	370 c	635 ab	66 e
1 grass	2148 c	384 c	669 a	56 e
P	<0.0001	0.0094	<0.0001	<0.0001
SEM[x]	533	26	33	13

[z]ADF, acid detergent fiber; NDF, Neutral detergent fiber; CP, Crude protein; [y]Means within a column with the same lower case letter are not significantly different (P>0.05); [x]Standard error of the means.

Discussion

The noted benefits for polycultures and higher yielding from well adapted species found within a semiarid environment are not confined to this type of environment. At Ames, Iowa, a humid environment in which 8 perennial species from 4 functional groups were sown: Legumes consisted of alfalfa, white clover (*Trifolium* repens L.) and Illinois bundle flower (*Desmanthus illinoensis* (Michx.) MacM. Ex B.L. Robins. and Fern). C3 grasses comprised orchardgrass (*Dactylis glomerata* L.) and intermediate grass (*Thinopyrum intermedium* (Host) Barkworth and D.R. Dewey). C4 grasses consisted of switchgrass (*Panicum virgatum* L.) and eastern gamagrass (*Tripsacum dactyloides* (L)L. The Compositae forb, Maximilian sunflower (*Helanthus maximiliani* Schrad.), was also included (Picasso et al. 2008). Polycultures out yielded on average by 73%, but well-adapted species produced high amounts of biomass (Picasso *et al.* 2008). Complementarity increased as species richness increased and was consistent over years (Picasso *et al.* 2011).

Conclusion

Increasing diversity in species and functional groups increased productivity under both semi-arid and humid environments. The key for increased productivity in mixed species seeding is complementarity between the sown components.

References

Picasso VD, Brummer EC, Liebmann M, Dixon PM, Wilsey BJ (2008) Crop species diversity affects productivity and weed suppression in perennial polycultures under two management strategies. *Crop Science* **48,** 331- 342.

Picasso VD, Brummer EC, Liebmann M, Dixon PM, Wilsey BJ (2011) Diverse perennial crop mixtures sustain higher productivity over time based on ecological complementarity. *Renewable Agriculture and Food Systems* **26**, 317-327.

Schellenberg MP, Banerjee MR (2002) The potential of legume-shrub mixtures for optimum forage production: A greenhouse study. *Canadian Journal of Plant Science* **82**, 357-363.

Schellenberg MP, Biligetu B, Iwaasa AD (2012) Species dynamic, forage yield, and nutritive value of seeded native plant mixtures following grazing. *Canadian Journal of Plant Science* **92,** 699-706.