AAFC-SPARC long term grazing and forage production on re-established native grasslands in Southern Saskatchewan

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2012 native Prairie Restoration/Reclamation Workshop
“Bridging the Gap”

Feb. 8-9th, 2012, TCU Place, Saskatoon, SK.
• Grasslands have traditionally been managed to provide sustainable forage and livestock production. However, there is the need to recognize that grasslands provide more than food and fibre, but also other beneficial ecological goods and services (health, social, cultural and economic).
Remnant Natural Grasslands Today

Natural Grassland for Western Canada (11.4 M ha) (Bailey et al. 2010)

- In the span of 50 to 90 years, crop agriculture cultivated about 50 million ha of our grasslands, thus changing over 80% of the ancient natural grassland ecosystems.
Semiarid Prairie Agricultural Research Centre (SPARC)

- SPARC was established in 1920 with strong forage research programs;
- Since 1930 research with native species in the area of range management and ecology has occurred;
- Grazing Management and Range Ecology research
SPARC is the only AAFC research centre located in the semiarid prairie’s and encompasses over 20% of the arable land in Canada.

Total = 5.6 M ha in the Brown Soil Zone

Alberta = 1.6 M ha (4.0 M ac)

Saskatchewan = 4.0 M ha (10 M ac)

Semiarid brown soil = 2.2 M ha (5.5 M ac)
Map of remaining native prairie [red] in Southern Saskatchewan
Grazing Research Studies: Native Species Re-establishment

- Re-establishment of two native mixtures on annual cropland: Mix1 = 7 species, Mix2 = 12 species. Rep = 2 or 4.

- Seeding of the pasture occurred in 2001 and the study is still ongoing (2011).

- Grazing and forage production, biodiversity and environmental benefits are being measured.
Grazing Research Studies: Greencover: Native vs. Tame


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NG+Alf in 2011
Work with MOTHER NATURE

- Development of environmental and economical sustainable grazing systems
  - less inputs (fertilizer etc.)
  - long lived and environmentally hardy
  - complement other forage systems

- Extending the grazing season and keep cattle longer on pastures.
Re-establishment of a Mix Native Grassland

Seeded in May 2001

Total Monthly Precipitation

- 2002 wet year
- 2001 drought
- 2004 hot summer

September 2001

[Image of a tractor and a field with young plants]
SIMPLE seed mix (7 species)
- Western WG
- Northern WG
- Green NG
- Awned WG
- June G
- Slender WG
- Purple Prairie Clover

COMPLEX seed mix (12 species)
- Western & Northern WG
- Slender Wheatgrass
- Green Needlegrass
- Awned Wheatgrass
- Purple Prairie Clover
- Canada Wild Rye
- June Grass
- Little Bluestem (C4)
- Needle and Thread Grass
- Blue Grama (C4)
- Prairie Sandreed (C4)
Available pasture forage production (end of June) for SIMPLE vs. COMPLEX mixes (no N inputs & CG)

Based on AAFC-SPARC data
Peak pasture forage production (end of July) for SIMPLE vs. COMPLEX mixes (no N inputs & CG)

Based on AAFC-SPARC data
Available pasture forage production (end of June) for SIMPLE vs. COMPLEX mixes (no N inputs & CG)

Growing Season Precipitation
Apr to Oct

Production years

Kg per ha (AYD) DM

Simple
Complex
Accessing deeper resources
Shallow roots

- Take advantage of short rain events
- Cool season grasses (cwg) are early season grasses
- Warm season grasses develop later providing nutritional value later
Deep Roots

- Little Bluestem
- Russian wildrye
- Shrubs (winterfat, antelope bitterbrush, saltbush, leadplant)
- Legumes – alfalfa (AC Yellowhead), purple and white prairie clovers
Take Home Message

• Although at first the aggressive cool season grasses (WWG, NWG, SWG etc.) associated with the SIMPLE native mix established quickly and gave increased forage production the COMPLEX native mix eventually provided similar forage production.

• More diverse stands are able to adapt to changing conditions. They tend to have larger root mass, and this ensure more energy stores and nutrients to buffer environmental variations which can result in higher biomass production (Tilman et al. 2006).
Take Home Message

• Native species are generally long-lived and contribute to make a more sustainable ecosystem.
DEFERRED ROTATIONAL GRAZING vs. CONTINUOUS GRAZING

- Continuation from the Re-establishment of different native mixtures (seeded in 2001);
- Deferred rotational grazing vs. continuous grazing;
- A seven year study (2005-2011);
- SOC, forage and cattle production, grazing behavior and specie composition changes.

Start of fall grazing
DEFERRED ROTATIONAL GRAZING vs. CONTINUOUS GRAZING

Grazing in the spring (June)

Grazing in the summer (July-Aug.)

Grazing in the fall (Sept. – Oct.)
Available pasture forage production (end of June) for SIMPLE vs. COMPLEX mixes (no N inputs & NDRG)

Based on AAFC-SPARC data
Peak pasture forage production (end of July) for SIMPLE vs. COMPLEX mixes (no N inputs & NDRG)

Based on AAFC-SPARC data

Seedmix P<0.05
Year P<0.0001
Interaction NS
Take Home Message

• When the native pastures were grazed under a NDRG system we did observe more forage biomass production from the COMPLEX vs. SIMPLE at Peak Pasture Production (end of July).

• The NDRG system allows seed ripening of native species and increases forage production which is especially true for the COMPLEX native seed mixture.
DEFERRED ROTATIONAL GRAZING vs. CONTINUOUS GRAZING

DEFERRED ROTATIONAL GRAZING vs. CONTINUOUS GRAZING

Average total live production (kg/ha) (2005-2010)
For grazing systems: Continuous (June to Aug.) vs. Deferred rotational grazing system (June to Oct.)
Average Organic matter digestibility (2005 to 2010) for SIMPLE vs. COMPLEX

Because of the different native species in the COMPLEX mixture (C3, C4, and forb) the Organic matter digestibility (OMD) does not decline as rapidly as the SIMPLE mixture.
Forage Diet Selectivity

- Animals select a diet 1.5 to 2.0% higher than what the plants sward.

- Warm season grasses

- Purple prairie clover
DEFERRED ROTATIONAL GRAZING vs. CONTINUOUS GRAZING

- Since the start of the NDRG study in 2005 we have observed an increase in the proportion of PPC in the pastures. In 2011 the average DM proportion of PPC in a quadrat measurement is between 12-40%.

- Continuous grazed pastures since 2005 had an average DM proportion of only at 4-7%.
Purple Prairie Clover (*Dalea purpurea* Vent.)

- Grazing of PPC containing native pastures at AAFC-SPARC has occurred from the end of June to the beginning of October.

- Average forage quality of PPC for digestibility and crude protein from vegetative to seed pod stage were 65 to 50% and 20 to 12%, respectively.
Purple Prairie Clover (*Dalea purpurea* Vent.)

- PPC is a warm-season forb and main growth is during July and September (in the mid summer slump period).

- PPC can improve the nutritional profile and help extend the grazing season.
PPC grazing throughout the season

June – July: Spring
July – August: Summer
August – Sept/Oct: Fall
Purple Prairie Clover (*Dalea purpurea* Vent.)

What is the effect through the digestive tract?
Take Home message: PPC has lots of potential!

- Warm season, drought tolerant and nitrogen fixing.
- Good forage quality, grazing preference and ability to extend the grazing season.
- Contains condense tannins, thus improves protein utilization and feed efficiency. Important for fall grazing?
- The condense tannins also can reduce E. Coli 0157:H7 and is anti-parasitic.
- Increase biodiversity and help bee pollinators prosper.
Greencover: Native vs. Tame

- Seeding of native and tame forage species using a Bourgault double disc air seeder in May 2006.

- Row spacing was about 9 inches and seeding depth less than 0.25 inches.

- Prior to seeding the land was cultivated and harrowed packed.

- Study duration from 2006 to 2011 and SOC and grazing and forage performances will be measured.
Greencover: Native vs. Tame

- Native grasses: WWG, NWG, GNG, LBS, BG, AWG, & CWR.
- Native grasses + Purple prairie clover.
- Native grasses + tame legume (alfalfa).
- Meadow brome + alfalfa.
- Trying to evaluate if a native legume is better than alfalfa (forage production etc.)
Greencover: Native vs. Tame

Total available forage yield (kg per ha DM) harvested in July on MB+Alf, NG, NG+Alf and NG+PPC pastures in 2007 to 2011 (under CG)

Growing Season Precipitation Apr to Oct

Harvest years

Semi-arid?
Take Home Message

- Major limitations in the use of more native species are seed prices and availability.

- Native grasses and forbs pasture systems are sustainable and long lived. Difficult to envision a selection of tame grasses that could provide the tolerance and ability to adjust to changing environmental conditions from one extreme to another.
Take Home Message

• Native species greatly improves soil structure and fertility.

• Native species root system occupies a huge underground area and contributes significantly to carbon sequestration potential.
Take Home Message

• AAFC-SPARC have successfully established native species, and the native pasture mixes have provided comparable forage production and quality to tame species.

• Native species can complement tame forages in beef production, extend the grazing season and are adapted to low input grazing systems. Type of grazing system can influence pasture production and specie composition.
Thank you - Questions?

Native establishment seeded in 2001 (32 ha or 80 ac)

Native establishment seeded in 2006 (10 ha or 25 ac)