

BENEFITS OF LEGUMES IN BEEF CATTLE SYSTEMS

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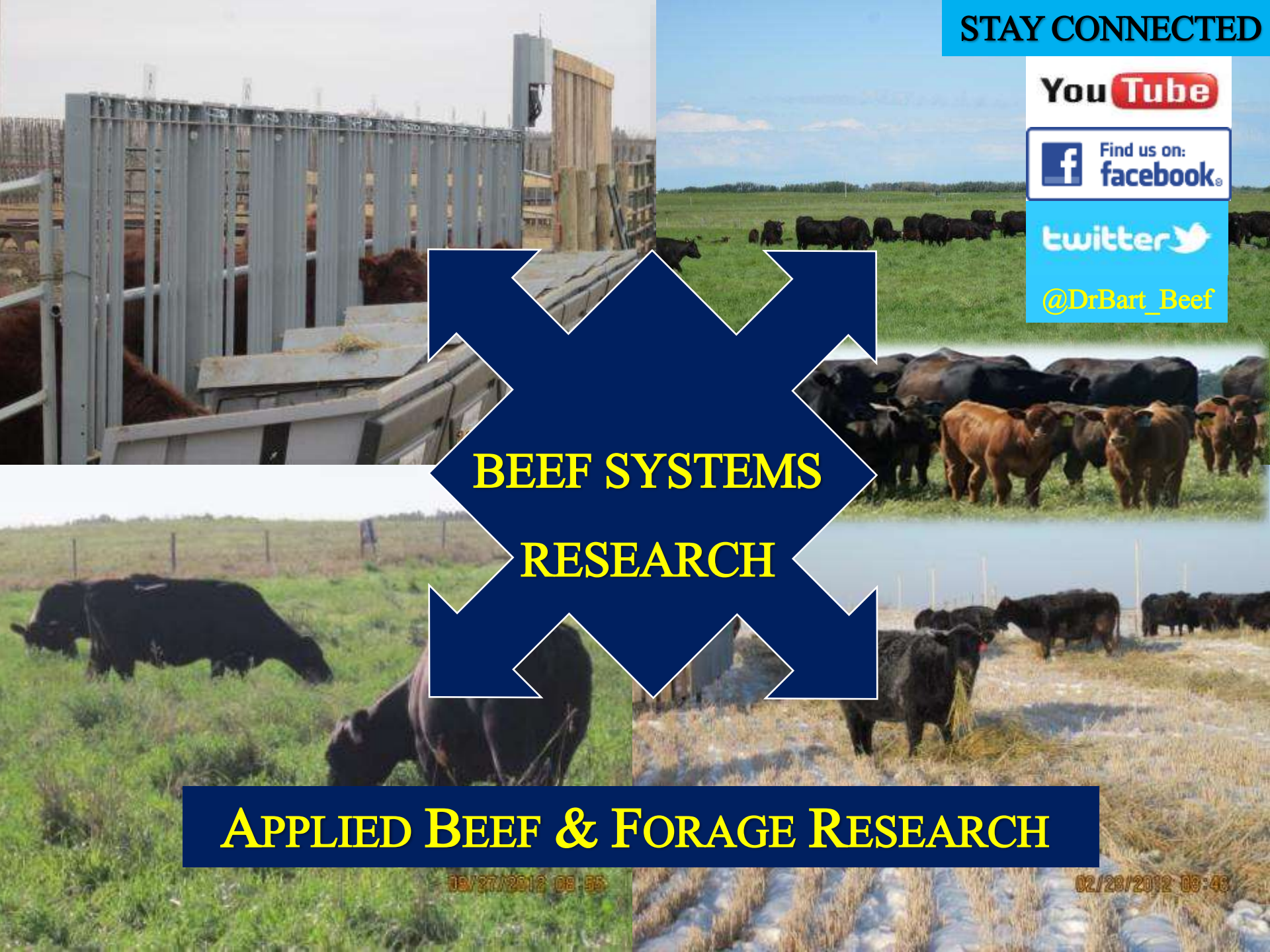
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**BEEF SYSTEMS
RESEARCH**



APPLIED BEEF & FORAGE RESEARCH



10/27/2012 08:55

02/20/2012 08:48

TERMUENDE RESEARCH RANCH LANIGAN SASKATCHEWAN

**20 years at WBDC Lanigan SK!
Moving to Livestock & Forage Centre of
Excellence at Clavet SK in 2019!**

2960 acres



330 Angus cows





Western Beef
DEVELOPMENT CENTRE



Clavet Saskatchewan



Livestock & Forage Centre of Excellence

Forage and Cow-Calf Unit

Clavet Saskatchewan

INCREASED USE OF LEGUMES



FIX ATMOSPHERIC N
PROVIDE HIGH QUALITY FORAGE
DIETARY SOURCE FOR MICROBIAL PROTEIN SYNTHESIS

Forages are “Foundation of Beef Industry”

NOVEL APPROACH - BENEFITS GRAZING TREE LEGUMES (LEUCAENA)

Leucaena (Leucaena leucocephala)

- used as animal feed and green manure
- condensed tannins (DIG 55-70 %; CP 25%)
- complementary with native grassland Australia
- seed in rows - graze with low quality C4 grasses (CP 5%; TDN 48%)
- able to double liveweight gains (1.0 kg/weaner/d)

Queensland Australia

N₂ IS NEARLY 80% OF ATMOSPHERE



Legumes - high quality forage - fix nitrogen

- Alfalfa (*Medicago sativa*; *M. falcata*)
- Vetches (*Astragalus spp.*)
- Sainfoin (*Onobrychis viciaefolia*)
- Trefoils (*Lotus spp.*)
- Clovers (*Melilotus spp.*) (*Trifolium spp.*)



ALFALFA NODULES



BIRDSFOOT NODULES

LEGUME MANAGEMENT

QUANTITY N FIXED
30 TO 95% OF TOTAL
PLANT REQUIREMENT

Alfalfa (*Medicago sativa*; *M. falcata*)

- Greater economic loss occurs due to fear of bloat, limiting use of high yielding legume pasture (Goplen et al. 1982)
- Pasture bloat is major concern
 - New species (AC Grazeland Br)
 - Bloat aids (Alfasure)
 - Integrate tannins (Jonker et al. 2011)



AC GRAZELAND BR LOW BLOAT ALFALFA



2010 © Peter M. Dziuk

CICER MILKVETCH (ASTRAGALUS CICER)

- Non-bloat legume
- Reticulate vein patterning of the leaves (Williams et al. 2011)
 - Reduces bloat potential of alfalfa
 - Decreases rate of digestion by microbes
- Persistent and survives winter conditions (Acharya et al. 2006)



SAINFOIN

(ONOBRYCHIS VICIIFOLIA)

- Non-bloat legume
- Condensed tannins (McMahon et al. 1999)
 - Reduces bloat potential of alfalfa
 - Increases passage rate through the rumen
- Older varieties have low persistence after grazing (Sottie et al. 2017)



SAINFOIN IN MIXED STANDS (ALFALFA)

Objective: To compare selections for better persistence in competition with alfalfa compared to *Nova*

- Sainfoin varieties
 - Nova + 5 experimental lines
 - **LRC05-3900; 3901; 3902; 4012; 3519**
- AC Grazeland alfalfa (check)

Sainfoin

A wide-angle photograph of a lush green field of sainfoin plants stretching to the horizon under a clear blue sky. The plants are dense and vibrant green, with some small yellow flowers visible in the foreground.

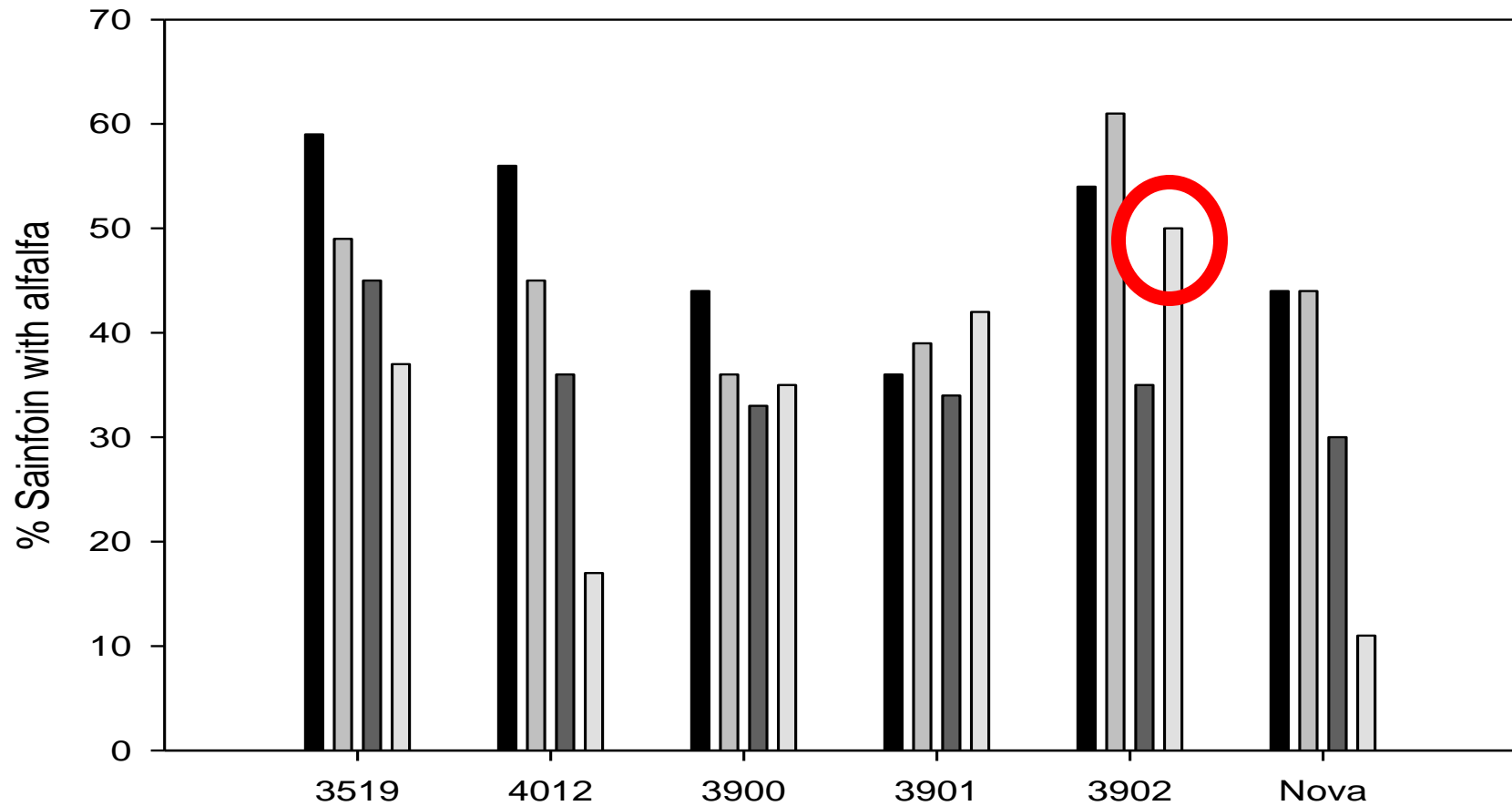
- **Withstands winterkill**
- **More drought/cold tolerant than alfalfa**
- **Contains condensed tannins (4 to 5%)**
 - condensed tannins bind proteins in rumen,
 - reduce foam that trap gases in the rumen and cause bloat



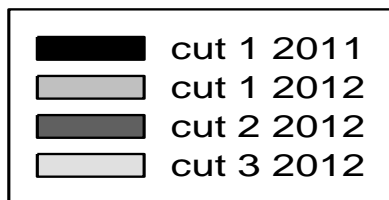
September 2011



Sainfoin persistence under simulated grazing



Experimentals and check



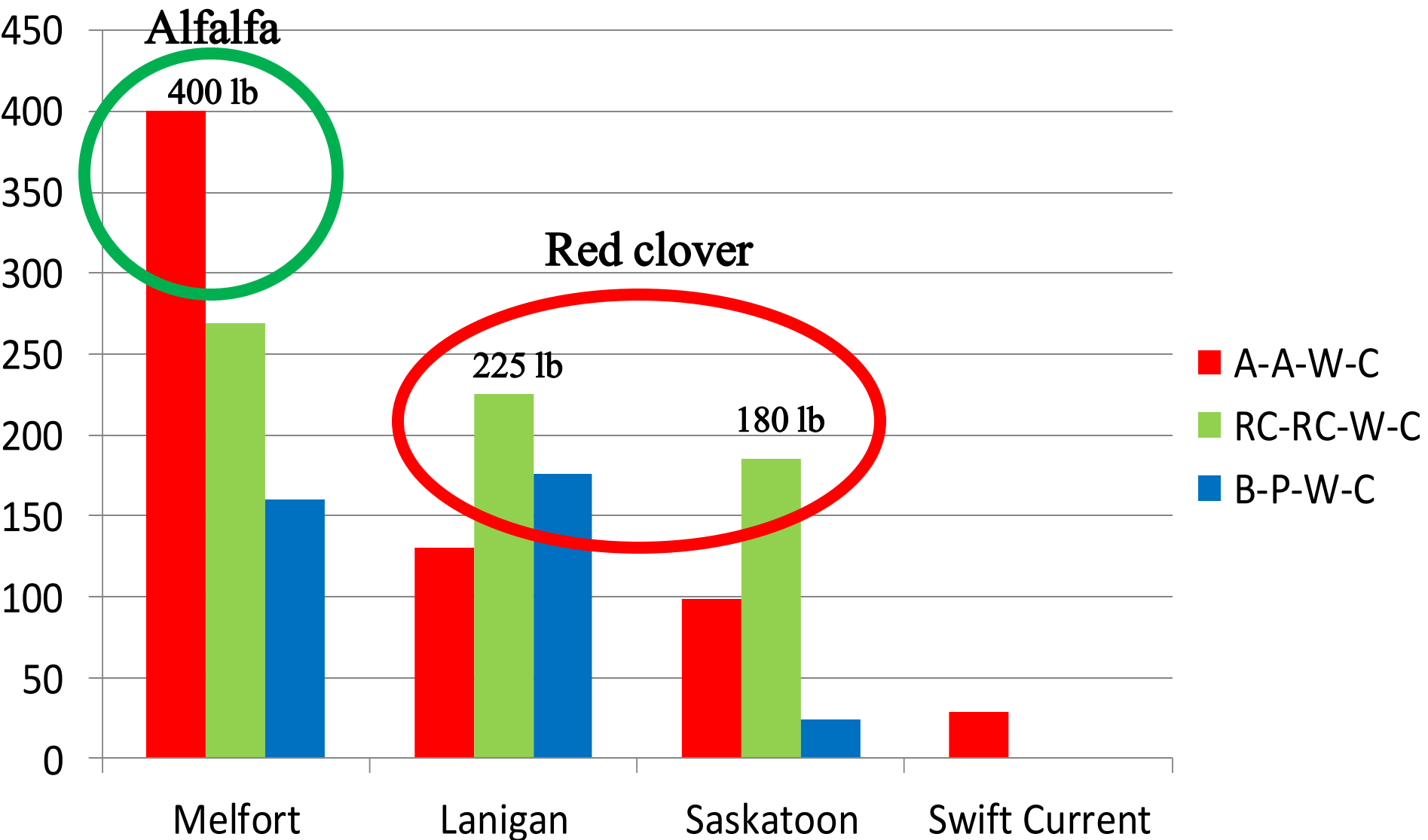
SHORT ROTATION FORAGE LEGUMES

What if?

- a legume hay crop was grown for only 2 years?
 - red clover is better or worse than alfalfa?
 - there are soil zone differences?
 - can calculate fertilizer savings?
-
- 4 yr study - 2010 to 2013
 - 4 sites - Swift Current (Brown Soil zone), Saskatoon (Dark Brown), Lanigan (Thin Black), Melfort (Black)
 - 4 rotations

	2010	2011	2012	2013
Rotation 1	Alfalfa	Alfalfa	Wheat	Canola
Rotation 2	Red Clover	Red Clover	Wheat	Canola
Rotation 3	Barley	Pea	Wheat	Canola
Rotation 4	Barley	Flax	Wheat*	Canola*
	'2065 Mf' alfalfa 'Belle Red' clover 'Copeland' barley	'Golden Yellow' pea 'Bethune' flax	'Unity' wheat * N rate subplots 0,40,80,120, 160 kg/ha	'L-130' canola * N rate subplots 0,40,80,120, 160 kg/ha

TOTAL N FERTILIZER EQUIV. LB N/AC FOR 2012 AND 2013



“AC YELLOWHEAD” ALFALFA



Rhizomatous type (*M. falcata*)

Very persistent in pastures - all soil zones

Seed available since 2014

LEGUMES FOR SUSTAINABLE SUMMER PASTURE

Binary mixtures in summer grazing

- AC Yellowhead alfalfa / hybrid bromegrass;
- AC Yellowhead alfalfa / Russian wild ryegrass
- AC Mountainview sainfoin / hybrid bromegrass
- AC Mountainview sainfoin / Russian wild ryegrass

- Evaluate forage yield , quality, legume persistence, cattle performance

2 sites - Lanigan; Swift Current

PEPRAH ET AL. 2018

SOD-SEEDED LEGUMES IN EXISTING PASTURE STANDS

Can we rejuvenate long established mixed stands?

3-year study - 2 sites:

- Lanigan SK (Thin Black soil zone)
- Lethbridge AB (Dark Brown soil zone)

Kelln et al. 2018

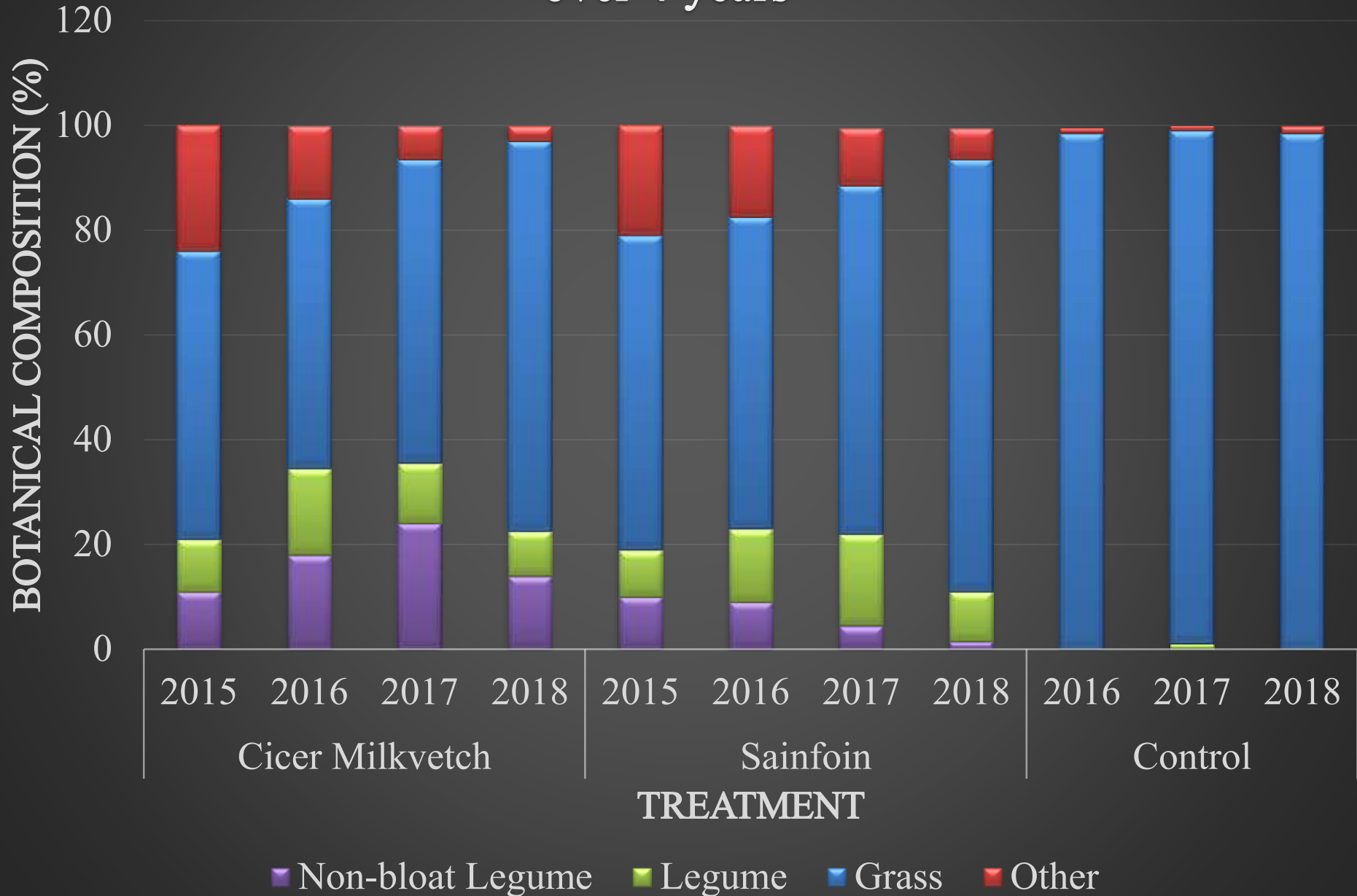


SOD-SEEDING 2015

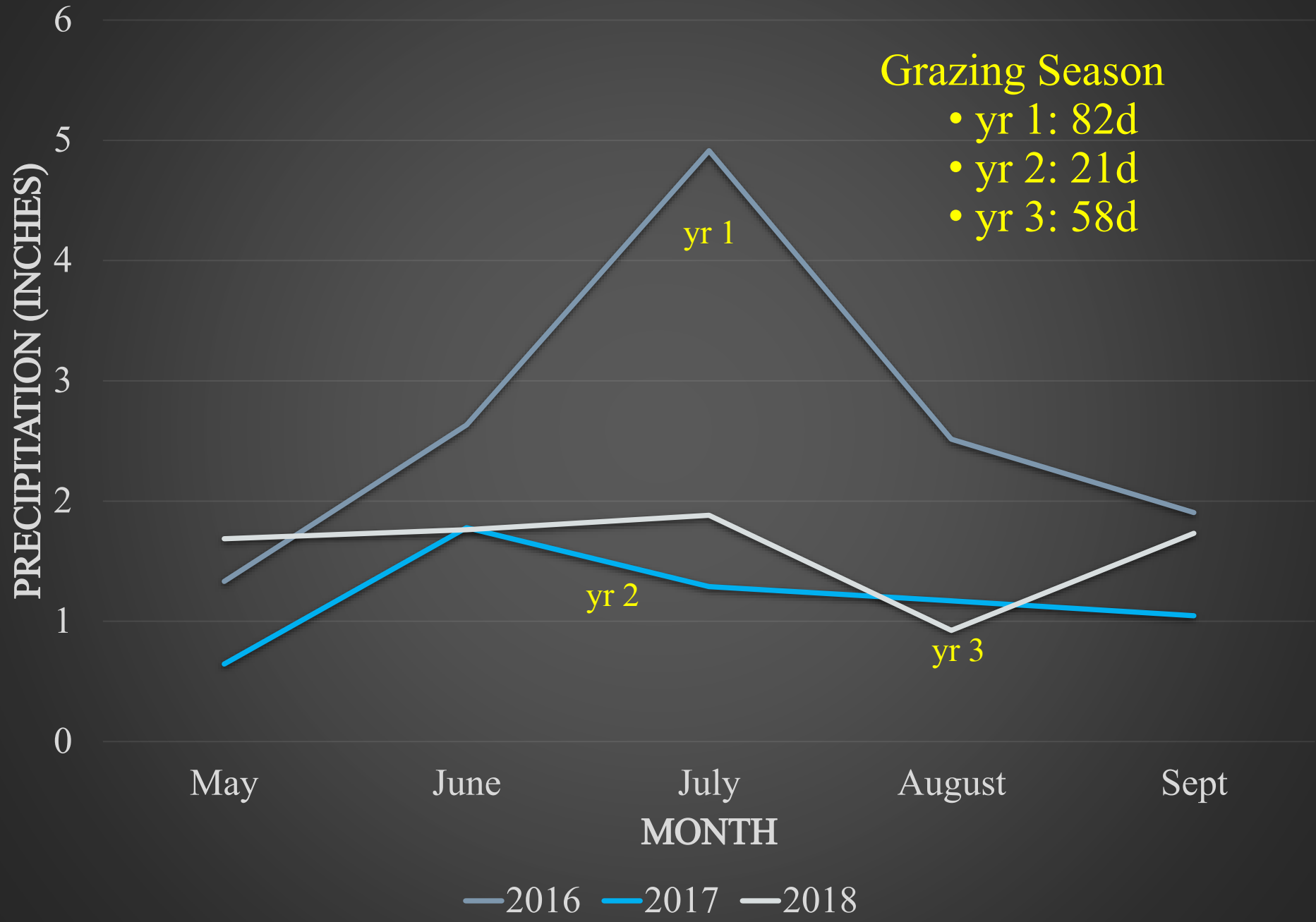


- Apply 0.5 L per acre glyphosate
- Sainfoin seeded at 23 lb per acre
- Cicer milkvetch seeded at 15 lb per acre
- Sod-seeded with an AgroPlow

Persistence of Sod-Seeded Legume in Pasture over 4 years



Lanigan Rainfall

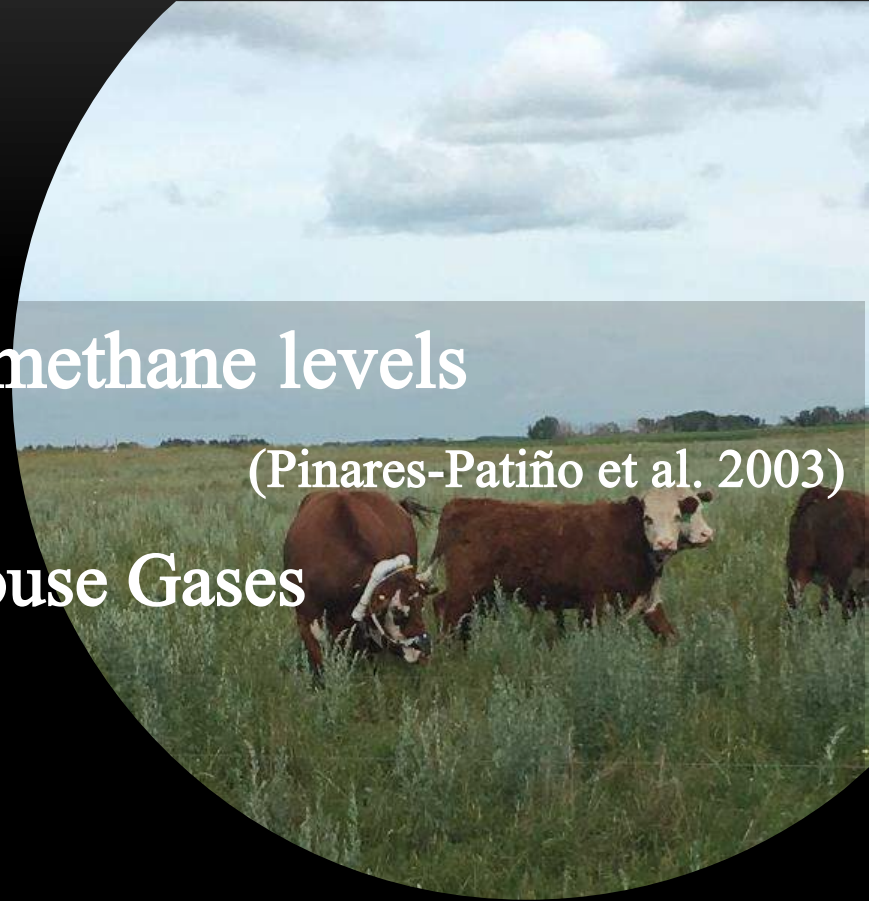


EFFECT OF LEGUME TYPE ON PERFORMANCE AND ENTERIC METHANE PRODUCTION



PASTURE QUALITY AND EMISSIONS

- Stage of maturity influences methane levels
(Pinares-Patiño et al. 2003)
- Ruminants produce 3 Green House Gases
 - Methane (CH_4)
 - Carbon Dioxide (CO_2)
 - Nitrous Oxide (N_2O)
- CH_4 production is related to diet quality (Chaves et al. 2006)



SOD-SEEDED LEGUMES

STEER PERFORMANCE & ENTERIC GASES

Table 5. Effect of pasture type on steer performance

	Start (kg)	End (kg)	ADG ¹ (kg/d)
Lanigan 2016 (70 d)			
SAIN ²	335.5	402.9	0.82
CMV	335.2	399.9	0.79
Control	336.6	379.1	0.52

(L/DAY)	<u>CH₄</u>
Cicer milkvetch mixed pasture	345
Sainfoin mixed pasture	408
Control mixed pasture	432

SUMMARY



- **Consider legumes in rotation – N fixing – fertilizer equivalent**
- **Integrate both annual and perennial forage legumes/pulse**
- **Dietary protein source – rumen microflora**
- **Benefits of high quality forage – reduce emissions**

2010 COST OF PRODUCTION

22 operations

AVERAGE

Herd Size	282
Days on Feed	160
\$/Cow	\$615



WINTER FEED SYSTEMS

DRYLOT

- Cows fed daily in drylot pens
- Nutrients accumulate in straw pack over winter
- Cost to move manure (nutrients) in spring



OPTIONS

- Break and Reseed
- Fertilization
- Mechanical Soil Disturbance
- Sod Seeding
- Over Seeding
- Grazing Management
- Winter Grazing to Improve Soil Fertility



Fall Rye - Quality

- CP 19.3 %; TDN 64.8 %
- NDF 44.6 %; ADF 26.6 %
- Ca 0.3 %



VIDEOS

Cutting stage for
swath grazed annuals



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@LFCE_usask

Winter grazing cows on
standing corn

Refining corn graze
recommendations



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LEGUME RESEARCH AT WBDC LANIGAN

HIGH QUALITY FORAGE

SHORT ROTATION BENEFITS

Previous cultivar work

Oxley cicer milkvetch

Nova sainfoin

AC Grazeland Br alfalfa

Spredor IV alfalfa

Other legume studies

1. Veldt, Oxley, Oxley II cicer milkvetch

- seedling vigour, establishment, stockpile

2. Sainfoin (LRC05-3900; 3901; 3902; 4012; 3519, Nova, ACG)

- persistence, alternate rows