RESEARCH

Improving grazing capacity through introduction of bloat free legumes in existing pasture stands

GRAZING SAINFOIN AND CICER MILKVETCH IN EXISTING ALFALFA AND GRASS STANDS

PROJECT NO.: FRG.06.14
LEAD RESEARCHER: Dr. Bart Lardner (University of Saskatchewan)
COLLABORATORS: Dr. Surya Acharya, Dr. Tim McAllister (Agriculture and Agri-Food Canada Lethbridge), Kathy Larson (University of Saskatchewan), Breeanna Kelln (PhD Candidate)

Background: Including legumes in a pasture improves biodiversity, forage quality, forage yield, and soil nutrient status without having to apply extra nitrogen fertilizer. While alfalfa has long been the legume species of choice, concerns about bloat have often limited its inclusion into forage stands. Sainfoin is bloat safe due to the presence of condensed tannins that bind to proteins, providing protection from digestion in the rumen. Similarly, cicer milkvetch is bloat safe due to its leaf structure which slows digestion in the rumen. Non-bloating legumes such as sainfoin and cicer milkvetch have been growing in popularity but have traditionally suffered from poor establishment and longevity in mixed stands.

Previous small plot research indicated that newer varieties of sainfoin planted in alternate rows with alfalfa were able to maintain 30-40% biomass under simulated grazing (clipping). This is above the suggested 25-30% inclusion rate to mitigate bloat issues in mixed alfalfa stands. In addition, legumes with creeping root systems, such as cicer milkvetch, have also been shown to be effective in reducing the damage done by burrowing rodents such as pocket gophers.

Objectives:

- Determine establishment success of sainfoin and cicer milkvetch populations sod-seeded into existing mixed forage stands (alfalfa and tame grass)
- Evaluate forage quality, forage yield, soil nutrients, and rumen fermentation characteristics between sod-seeded and non sod-seeded pastures
- Determine grazing animal performance and enteric methane emissions from animals grazing sod-seeded mixed legume pastures
- Conduct an economic analysis of using new legume varieties for sod-seeding as a method of pasture rejuvenation.

What they did: The trial took place over three years at two sites, Lanigan, SK and Lethbridge, AB.

At Lanigan: AC Mountainview sainfoin, L4342 sainfoin, Veldt cicer milkvetch and Oxley II cicer milkvetch seeds were scarified and sod-seeded into an existing mixed meadow bromegrass-alfalfa stand after two applications of glyphosate to control existing forage species competition. Three non sod-seeded pastures of the mixed grass-legume stand were included as a control. Yearling steers (60 in year 1 and 45 in years 2-3) were randomly allocated to the different forage types. In addition, 15 cannulated cows were utilized at Lanigan to determine the effect of pasture type on rumen fermentation characteristics and methane production.

At Lethbridge: The existing alfalfa monoculture stand was mowed and sprayed with glyphosate prior to sod-seeding in alternate rows. Varieties used at Lethbridge were Nova sainfoin, L3432 sainfoin, Veldt cicer milkvetch and Oxley II cicer milkvetch, with two non sod-seeding control pastures. Yearling steers (32 in years 1-3) were randomly allocated to the different forage types. Irrigation was used at the Lethbridge site in years 2 and 3.

At both sites, grazing commenced at approximately the 4-5 leaf stage and ended when forage was grazed down to a uniform height of about eight centimeters. Forage yield, quality, botanical composition, estimated herbage utilization and dry matter intake (Lanigan only), steer performance, soil fertility and organic matter, and net present value of dry matter yield was used to determine the economic returns over time.

What they learned: Drought conditions affected both study sites in multiple years, which certainly impacts results. The specific sainfoin or cicer milkvetch variety did not affect yield, quality, intake or animal performance at either location.

The pastures sod-seeded with sainfoin decreased over the three-year study from 10% to 2% of stand composition, while cicer milkvetch increased from 11% to 14% at Lanigan. At Lethbridge, the pastures sod-seeded with sainfoin decreased over the three-year study from 47% to 16% of stand composition, and cicer milkvetch also decreased from 45% to 8%.

Dry matter yield increased by about 14% when incorporating sainfoin or cicer milkvetch into the existing stands. The inclusion of legumes also increased protein content by just over 2%, and decreased neutral detergent fibre by about 7%, though total digestible nutrients did not differ. The steers at the Lanigan location gained 0.44 lbs/day more than the steers on the control pastures, but at Lethbridge, gains were similar. Inorganic nitrogen levels were 55% greater in sod-seeded sainfoin and cicer milkvetch pastures compared to the control pastures, but after three years of grazing, inorganic nitrogen levels were similar between control and sod-seeded pastures.

Differences in rumen fermentation characteristics were discovered between types of forages. Acetate to propionate ratio was lower for cicer milkvetch than for sainfoin and control and total propionate concentration was also increased for cicer milkvetch. Methane production decreased from 33.25 L/kg dry matter intake (sainfoin) and 36.59 L/kg dry matter intake (control) to 28.16 L/kg dry matter intake for cicer milkvetch.

The cost of sod-seeding was recovered after three years at Lanigan when the return was estimated as dry matter yield valued at the three-year average price for standing hay ($0.046/kg).

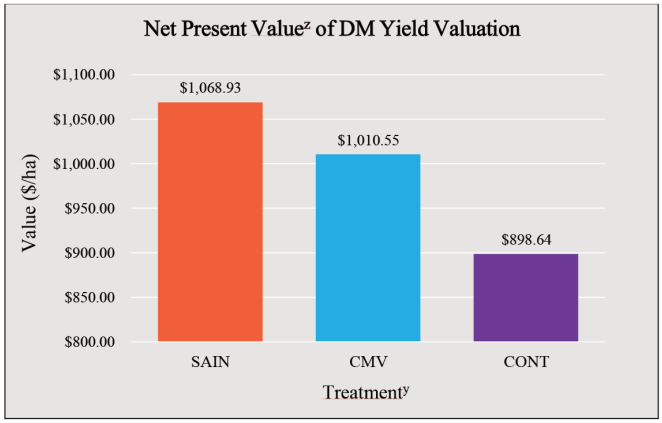

Fig. 5. Net present value[z] of DM yield valuation.
[z]net present value = estimated value over 10 years based on standing dry hay price
[y]CMV = cicer milkvetch; SAIN = sainfoin; CONT = control

What it means: Sod-seeding legumes into existing stands had variable effects in this study, likely due to the adverse weather conditions experienced at both sites. The inclusion of sod-seeded sainfoin and cicer milkvetch improved forage yield and quality (improved protein and reduced fibre), which translated into improved animal performance at one location. While neither sainfoin nor cicer milkvetch were able to consistently persist in the stands in a high enough proportion to confidently reduce bloat risk, the increase in cicer milkvetch proportion under grazing pressure at Lanigan would seem to indicate that the new varieties are quite grazing tolerant. The effect of type of forage on ruminal fermentation efficiency and potential for reduced methane production should be investigated further. In addition, the economic returns on the sod-seeded pastures at Lanigan demonstrated a clear advantage over the control, recouping costs in three years.

This project was also supported by the Saskatchewan Agriculture Development Fund.

SINCE 1969
Alberta Beef Producers

www.albertabeef.org