Best management practices for the re-introduction of sainfoin into existing alfalfa and grass pastures for western Canada

REJUVENATING SAINFOIN STANDS

PROJECT NO.: FRG.22.15
LEAD RESEARCHER: Dr. Alan Iwassa (Agriculture and Agri-Food Canada - Swift Current Research and Development Centre)
COLLABORATORS: Dr. Surya Acharya, Dr. Edmund Sottie, Dustin Ostrander (Agriculture and Agri-Food Canada), Terry Kowalchuk (Saskatchewan Ministry of Agriculture), Dean Dyck, Grant Lastiwka (Alberta Agriculture and Forestry)

Background: Despite the high nutritive value and yield of alfalfa, it cannot generally be used in pure stands due to risk of bloating. Legumes that contain tannins, like sainfoin and birdsfoot trefoil protect against bloating, but use of sainfoin has traditionally been limited due to the lower forage yields and slow establishment of older varieties. New varieties of sainfoin, such as Mountainview, seem to have largely overcome these challenges in most environments.

Previous research has shown that a mixture of 50% alfalfa and 50% sainfoin reduces bloat incidence by 90-98%. This protective effect against bloat persists as long as sainfoin makes up about 25-30% of the stand. However, after to four to five production years, the proportion of sainfoin in those mixed alfalfa stands decreased to less than 10%, no longer providing bloat protection.

Crested wheatgrass is estimated to occupy 1-1.3 million hectares of seeded pastures in western Canada. However, the optimal nutrient value of crested wheatgrass peaks in May and June, and then declines as the plant matures. Introducing a legume into crested wheatgrass stands would improve both forage yield and quality later into the grazing season.

Objectives:

- Determine the ability to rejuvenate existing alfalfa/sainfoin and crested wheatgrass or meadow bromegrass stands by re-introducing sainfoin through different management and seeding strategies.
- Determine sainfoin establishment success into existing alfalfa/sainfoin and crested wheatgrass or meadow bromegrass stands.
- Determine changes in pasture forage quality with the introduction of sainfoin when harvesting at grazing/haying and for use in stockpiling, and relate forage production and quality to animal performance and productivity.
- Conduct an economic cost/benefit analysis to determine best management practices to rejuvenate existing alfalfa/sainfoin and crested wheatgrass or meadow bromegrass stands.

What they did: In Lethbridge (under irrigation) and Swift Current (dryland), four methods of rejuvenating existing sainfoin stands were explored beginning in 2016. These were break and reseed, simulated grazing (mowing) and seed in the spring, spray glyphosate herbicide and seed in the spring, and spray glyphosate herbicide and seed in the fall. All plots were compared to the pre-existing crested wheatgrass (Swift Current), meadow bromegrass (Lethbridge) and alfalfa/sainfoin (both sites) stands. AAC Mountainveiw sainfoin was seeded at 15 lb/ac, alfalfa at 3.0 lb/ac, crested wheatgrass at 3 lb/ac and meadow bromegrass at 5 lb/ac. Forage was analyzed for botanical composition, yield (at flowering and seed pod stages) and quality, and soil analysis was

performed prior to seeding and during the first production year. A cost/benefit analysis was also conducted.

What they found: Sainfoin was successfully established at both sites into existing alfalfa, crested wheatgrass or meadow brome stands. At both sites abundant precipitation was received in May, as a result, spring herbicide suppression did not yield the desired results and plots were re-sprayed and existing standing plant residue removed prior to seeding. The Lethbridge site also experienced some weed competition pressure during establishment, and required another herbicide treatment during the establishment year to control weeds.

Swift Current: This site was challenged by drought conditions in both 2017 and 2018, resulting in overall lower yields that would normally be expected. In terms of establishment, the top two treatments for the reintroduction of sainfoin into alfalfa/sainfoin plots were break and reseed and herbicide application and direct seed in the fall, however; although numerically superior, the differences were not statistically significant. Reintroduction of sainfoin into existing crested wheatgrass plots observed break and reseed and mowing numerically superior, but not statistically significant.

Numeric yield at flowering of the sainfoin/alfalfa plots was highest for the spring spray and direct seed treatment (2,206 lb/ac), followed by break and reseed at 2,014 lb/ac, and break and reseed in the sainfoin/alfalfa plots was the only treatment to reach the target of 20% sainfoin. For the sainfoin/crested wheatgrass plots, there was a significant yield difference between years, but the trend was similar with break and reseed demonstrating the highest numerical yield (1,727 lb/ac in 2017 and 1,217 lb/ac in 2018). The yield and quality for the sainfoin/alfalfa plots at the Swift Current site was sufficient to maintain a dry cow in 2017 only.

Nitrogen and phosphorus levels in the soil increased for the sainfoin/alfalfa and sainfoin/crested wheatgrass from the baseline measurements, however there was a decrease in total carbon for all treatments.

None of the rejuvenation methods had a positive net present value for pasture in either the sainfoin/alfalfa or sainfoin/crested wheatgrass plots, however; spray and direct seed in the fall had the lowest negative values at -$65.20/ac and -$148.44/ac for sainfoin/alfalfa and sainfoin/crested wheatgrass respectively. The net present value for hay production for the sainfoin/alfalfa plots was highest at $34.08/ac for the spray and direct seed in the fall, followed by spray and direct seed in the spring at $5.45/ac. For the sainfoin/crested wheatgrass plots the least negative net present value for hay production was the same as for the sainfoin/alfalfa plots, with spray and direct seed in the fall at -$69.63/ac, followed by spray and direct seed in the spring at -$71.83/ac.

Lethbridge: Break and reseed also resulted in the best establishment under irrigation.

Two cuts were taken at flowering at Lethbridge. At the first cut, the sainfoin/meadow bromegrass plots, break and reseed yielded 3487 lb/ac, and the next numerically superior treatment, simulated grazing, yielded 1,832 lb/ac. In the sainfoin/alfalfa plots, yields for the break and reseed treatment were 4,969 lb/ac in 2017 and 5,495 lb/ac in 2018, the next best treatment was spray and direct seed in the spring at 4,327 lb/ac in 2017 and 4,628 lb/ac in 2018. For the second cut, sainfoin/meadow bromegrass yielded 3,136 lb/ac in the break and reseed treatment, followed by the spray and direct seed in the spring treatment at 2,021 lb/ac. The sainfoin/alfalfa plots at second cut yielded the highest for the spray and direct seed in the spring at 2,633 lb/ac kg/ha, followed by simulated grazing at 2,595 lb/ac. In the sainfoin/alfalfa plots, all rejuvenation methods in the first cut exceeded 25% sainfoin, with break and reseed exceeding 55%. This was not the case in the sainfoin/meadow bromegrass plots, where only break and reseed exceeded 20% sainfoin at 64% of the stand. Quality in all plots was more than sufficient to meet the maintenance needs of a dry cow.

Nitrogen levels were similar or a bit lower for the sainfoin/alfalfa plots in the first production year compared to the baseline measurements, and also lower for the sainfoin/meadow bromegrass stands. Like Swift Current, there was a decrease in total carbon in the first production year compared to baseline.

Net present value for pasture was totaled from the first and second cuts, with positive returns for all rejuvenation methods. Highest returns were realized in the sainfoin/alfalfa plots for the spray and direct seed in the fall at $918.95/ac, followed by the simulated grazing at $889.22/ac. These rejuvenation methods also resulted in the highest net present values for the sainfoin/meadow bromegrass stands with $819.49/ac for spray and direct seed in the fall and $769.40/ac for simulated grazing. In terms of hay production, again all rejuvenation methods resulted in

a positive net present value. In the sainfoin/alfalfa plots net present value was highest for spray and direct seeding methods, with $1601.74/ac for the fall and then 1572.00/ac for simulated grazing. The results were similar for the sainfoin/meadow bromegrass plots with spray and direct seed in the fall having a net present value of $1502.27/ac and spray and simulated grazing resulting in $1452.18/ac.

What it means: Generally, sainfoin seemed to establish better in crested wheatgrass stands than alfalfa under the dry conditions in Swift Current, but due to drought conditions, none of the rejuvenation methods except break and reseed resulted in a high enough proportion of sainfoin for bloat prevention. With the higher moisture conditions at the Lethbridge site, sainfoin established better in the alfalfa stands than in the meadow bromegrass stands, with all rejuvenation methods exceeding 20% sainfoin for bloat prevention in the sainfoin/alfalfa stands, compared to only break and reseed exceeding 20% in the alfalfa/meadow bromegrass stands.

The lack of carbon sequestration is not surprising given the relatively short time frame of the observations. There are significant year to year variations in carbon flux, which makes determining carbon sequestration a long term endeavor.

Even though break and reseed was the most effective method of reintroducing sainfoin into an existing forage stand at both locations, due to high costs it was not the most profitable option. Success of establishment will depend on proper preparation of the existing stand (i.e. reducing competition), and especially weather conditions during the establishment year.

This project was also supported by the Alberta Livestock and Meat Agency, subsequently Alberta Agriculture and Forestry, and the Southwest Saskatchewan Forage Association.

ALBERTA BEEF, FORAGE & GRAZING CENTRE

SINCE 1969 Alberta Beef Producers

www.albertabeef.org