

# Sainfoin In Alberta.

## Bulletin 1: Seeding and Establishment

### Sainfoin in Alberta

New sainfoin populations have shown promise for persistence under grazing in alfalfa-sainfoin mixtures, with comparable yields to alfalfa/grass mixes and are bloat mitigating.

The threat of bloat in grazing livestock has stymied efforts by the livestock industry to use higher producing forage crops like alfalfa which could reduce the acres required to support livestock production and provide competitive gain opportunities for feeder cattle. The new emerging sainfoin cultivars will offer the livestock industry the opportunity to take advantage of the productivity, flexibility and profitability of legume based pastures.

These are the reasons for this series of bulletins. Each bulletin is designed to summarize what is known and new about the agronomy of sainfoin: about managing it profitably and maximizing its performance: what to expect in terms of persistence, yield: and in a word, sustainability.

This project will provide livestock producers with innovative options to reduce risk, improve productivity and develop grazing systems that deliver sustainable profitability.

#### Adaptation in Alberta: Field Conditions

In its native state, sainfoin is adapted to an ecological niche that includes:

- Open grasslands and meadows and altitude gradients below 1500m at latitudes north of 40°;
- Well-drained, dry sites not subject to flooding that receive 300-500 mm annual precipitation;
- Moderately fertile, weakly saline (below 8 dS/m) calcareous soils, with neutral to alkaline pH.

Sainfoin is adapted to at least two of the seven Natural Regions of Alberta, the Grassland and Parkland Natural Regions. Specifically, sainfoin has been grown successfully on Chernozemic and Solonchic soils within SCA 1 through 10, and 18 (Alberta's Soil Correlation Areas). General soil chemistry in these SCA's is neutral to alkaline with low salinity levels.

- Soil chemistry may limit specific soils for sainfoin. Among the many small soil series within each SCA are a few that have become acidic or have moderate to strong (8-15 dS/m) levels of salinity (e.g. the Duchess and Rainer series in SCA1; the Elnora and Killam series in SCA 7).
- Germinating sainfoin and alfalfa seeds are tolerant of strong salinity but their tolerance changes during establishment. Moderate levels of salinity reduce shoot and root lengths of sainfoin.

Sainfoin does not tolerate flooding or sub-irrigation in the root zone.

- Water channels and percolation rates change rapidly in the topography of the southern grasslands and parklands. Bottomlands are often saturated during the growing season because of June rains.
- Water percolation rates are hampered by the impermeable clay in Solonchic soils found in the central and eastern grasslands. Rainfall can leave these soils puddled and saturated.

Unlike alfalfa, sainfoin has not been shown to ameliorate problem soils. Field conditions to avoid:

- Obvious signs of salinity on the soil surface, such as the white crust often referred to as “alkali”;
- Areas where water may regularly saturate the surface or upper soil horizon for a week or less;
- Drained sloughs, or natural ground water recharge/discharge areas where water has ponded.

## Seeding and Establishment

Informally, sainfoin breeders recognize two types of sainfoin, 'single-cut' and 'double –cut' referring to their ability to regrow after cutting. Available cultivars produced in the USA include: 'Eski' (1964), a single-cut variety; 'Remont'(1971) and 'Renumex'(1979), double-cut varieties for northern and southern regions respectively; and 'Shoshone' (2005) a synthetic composed of single and double-cut varieties. Canadian geneticists have produced two single-cut varieties: 'Melrose' (1972) and 'Nova' (1980) and 'Mountainview' (2013), a double-cut for northern conditions. All cultivars have been recommended for hay and pasture use, for irrigation and dryland, and as parts in mixtures with grasses and other legumes. 'Mountainview' was selected for its regrowth performance in mixed stands with alfalfa.

## Field Preparation, Seed Placement and Post-Emergent Management

Whether used for pasture or hay, or as is more typical in Alberta, both uses, the ideal field should be weed-free with a firm seedbed.

- Seedbeds need to be uniform and well-packed before and after seeding.
- Heavy trash cover from previous crops should be avoided because the soft seedbed is more difficult to pack, dries out quickly, may increase the depth of the seedbed, and the trash often harbors a surprise crop of highly competitive weeds.
- Seeding sainfoin into existing stands of grass has not been successful in recent trials in the western US. However, anecdotal evidence in southwestern Alberta shows sainfoin may establish and persist in areas where sainfoin hay has been fed or plants have been allowed to go to seed.

- Seed should be placed within 1 to 2 centimeters of the soil surface.
- Dryland sainfoin should be seeded before the end of June in most parts of Alberta. Late autumn seedings have also been successful
- Avoid the use of annual cover crops except in areas where erosion could damage the seedbed
- Irrigated sainfoin may be damaged by over-watering

Prior crops could be legumes, including sainfoin, cereals or grass. The auto-toxicity observed in alfalfa, a condition in which dead alfalfa plant material inhibits the seedlings and regrowth of alfalfa, has not been reported for sainfoin or sainfoin residue.

## Weed Control

Residual herbicide activity from chemical fallow and the previous crops should be considered insofar as sainfoin has not been included in trials using modern formulations.

- Alfalfa and sainfoin were found to be equally tolerant of herbicides in a number of older Canadian trials to control grassy and herbaceous weeds.
- Rumours of glyphosate tolerance in sainfoin have been tested and found false in preliminary trials in Montana. Tests of other herbicides are currently underway in Montana.
- Control of weeds in post-emergent stands of sainfoin is critical because a young sainfoin plants is less competitive than many other plants.
- The best tool available is a mower, and the best time to cut is before the sainfoin is 15 cm high.
- There are six herbicides registered for sainfoin including Type 1,3 and 6; Assure II, Treflan EC, Basagran, Liquid Achieve SC, Poast Ultra and Amitrol 240. Follow the label instructions.

## Field Fertility

The field should be fertilized to correct deficiencies.

- Alkaline soils tie up available phosphorus.
- Sainfoin has been unresponsive to phosphorus application in some trials. Micorrhiza complexes are formed between sainfoin roots and a fungus, improving phosphorus uptake by the plant.
- Sainfoin may benefit from low-level nitrogen applications or seeding with other legumes in nitrogen deficient soils.
- Inoculate the seed. Sainfoin requires a host specific Rhizobia for nitrogen fixation. However, commercial strains of nitrogen-fixing bacteria specific to sainfoin are often unavailable. Use a clover or alfalfa inoculant as a substitute.

## Seeding Rates

Sainfoin is one of the largest forage seeds; one kilogram of 'Eski' seed contains roughly 71,400 seeds (32,400 seeds/lb). Size matters and seed size vary with seed source and cultivar.

- Sainfoin mean seed size is 52,500 seeds/kg (23,700 seeds/lb). Alfalfa has 500,000 seeds/kg.
- Plants from large seed emerge faster, have better nodulation, greater plant height and yield.
- With the high cost of seed, it is worth checking seed size in each seed lot

Sainfoin seed is sold with the hull intact because there is only one seed in each sainfoin seedpod.

- Dehulled seed imbibes water faster than hulled seed but the outcome is the same in the end
- The hull contributes about 30% to the weight of the seed.

## Seeding Rate Recommendations for Pure Stands

- All recommendations are based on pure live seed (PLS) and are the minimum necessary for a pure stand. Bulk seed rates should be slightly higher to account for non-seed debris in the bag (1-2%) and dead seed (15% in certified seed lots).
- Most modern drills do not have 15 cm (6 inches) row spacings. The lowest is 18 cm (7 inches) and many are set for 23 to 36 cm (9 to 14 inch) row spacings. As a general rule, irrespective of the row width, sainfoin seeding rates within rows should be in the range of 36-42 PLS seeds/meter of row (9 to 13 seeds/foot of row).
- Row width should not exceed 30 cm (12 inches) in order to maintain adequate sainfoin density in mixed pasture stands.

For areas receiving more than 400 mm precipitation, for dryland hay, pasture or irrigation, growers should target a seeding density of 36 PLS seeds/meter of row.

- Seeding rates (kg/ha) for a seeding density of 36 PLS seeds/meter of row vary with row spacing (Table 1.).
- The same density in a broadcast seeding is obtained at a seed density from 175 to 215 seeds/m<sup>2</sup> (16-20 seeds/ft<sup>2</sup>).

**Table 1:** Sainfoin seedings rates (kg/ha of PLS) for increasing row spacings where annual precipitation exceeds 400 mm

PLS seeds /m of row	Seeder Row Spacing		
	18 cm (7 in)	25 cm (10 in)	30 cm (12 in)
36	28 kg/ha	20 kg/ha	17 kg/ha

\*\* Calculation based on 98% Pure Seed with 85% Germination and a seed size of 71,600 seeds/kg .

For areas receiving 300 to 400 mm precipitation, for dryland hay or pasture, growers should target a seeding density of 30 PLS seeds/meter of row, primarily for use of in mixed grass Brown soil zone.

- Row spacing's are typically 25 to 30 cm for drier soil zones and no wider than 30 cm
- Table 2 provides an example of seeding rates (kg/ha) for a seeding density of 30 PLS seeds/meter of row
- The same seeding density in a broadcast seeding is obtained at a seed density of only 93 to 140 seeds/m<sup>2</sup> (9-13 seeds/ft<sup>2</sup>).

**Table 2:** Sainfoin seeding rates (kg/ha) of PLS) for increasing row spacing where annual precipitation is less than 400 mm

PLS seeds /m of row	Seeder Row Spacing	
	25 cm (10 in)	30 cm (12 in)
30	18 kg/ha	14 kg/ha

\*\* Calculations based on 98% Pure Seed with 85% Germination and a seed size of 71,600 seeds/kg.

## Seeding Sainfoin in Mixed Forage Stands

Forages for pasture and hay are usually seeded in mixtures. There are three general purposes for a mix:

1. Insurance (risk of failure increases with varying soil, topography and environmental conditions).
2. Diversity of use (hay, grazing, reclamation, persistence, weed control).
3. Yield and quality balanced with cost and risk (legumes are productive but too much is risky).

Mixed forage stands may be seeded randomly by broadcasting the seed evenly over the field or by drilling a mixture of seeds into rows. Seed suppliers will usually custom mix and bag special seed mixtures.

- Seeding every species in the mix into every row has the advantage of seeding in one operation. However, pre-mixed seed often separates in the seed box, or is distributed unevenly by the seed equipment, especially if the seeds in the mix are very different in size, weight or if they have awns or hairs.
- Broadcast seeding pre-mixed seed risks uneven distribution of plants in the field.

- Row seeding every species into the same row increases the density of seed and seedling competition within the row.
- Sainfoin seed is large and heavy. Seedlings are not as competitive for light, moisture and nutrients after emergence as other forages.

If sainfoin is to be mixed with other legumes or grasses, agronomists usually recommend seeding in alternating rows with sainfoin in its own row.

## Selecting Species for The Mixture

If a mix of sainfoin and grass or another legume is to be sown, match the harvesting characteristics and regrowth abilities as well as possible.

A single cut sainfoin matched with a double cut clover or alfalfa is not a marriage that will last. Similarly, smooth brome is a creeping rooted grass that will more aggressively compete for light and moisture. Meadow brome or hybrid brome might be a better choice.

Predicting a specific mix of plants and dry matter content from a particular seed mix is at best, a guess.

- In theory, if sainfoin yields are equal to the total of the other species in the mix, then a 1:1 alternate row seeding should predict an even ratio of forage drymatter from the two components.
- Seeding in alternating rows means that an 18 cm seed row is actually a 36 cm row spacing for each species. As illustrated in Table 1, sainfoin's pure seeding rate in 18 cm rows is 28 kg/ha. For alternate rows (36 cm) the bulk seeding rate would decrease to 14 kg/ha. Remember the seeding rate is exactly half for each forage component.
- Seeding rates within each row should stay at recommended levels for pure seeding.
- Cross seeding perpendicular rows may improve plant density. Minimum row spacing should not be less than 22 cm (9 in) in order to reduce competition between species within row.
- For broadcast seedings, select the rate for each species and sainfoin but seed the sainfoin in a separate operation from the other species.