

non-bloat legumes fact sheet

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Legumes are a great addition to a forage stand; not only are they a valuable high protein feed but bacteria located in nodules on their roots convert nitrogen in the atmosphere into a form of nitrogen easily taken up by plants. However, legumes such as alfalfa and clovers can also cause bloat.

This factsheet discusses three available non-bloat forage legume options that may be a fit for your operation. Birdsfoot trefoil, sainfoin, and cicer milkvetch contain tannins that bind proteins released from plant tissue in the rumen. This prevents the buildup of foam and allows the proteins to be digested as a by-pass protein instead. Condensed tannins greater than 1% of total diet dry matter may reduce feed intake and relative palatability.

helpful to know

Normally, a ruminant simply belches up their digestive gases. The combination of rapidly releasing proteins, saponins, and hemicellulose found in most legumes, can cause frothy bloat. A frothy foam builds up and prevents gas bubbles from rising to the top of the rumen where it can be released.

The gas ends up trapped in the animal, leading to a distended abdomen and, in severe cases, death.

birdsfoot trefoil

Lotus corniculatus

Current varieties: Leo, Bruce, Norcen, Pardee

Top strengths

- Tolerates low pH soils
- Suited to higher moisture soils
- Retains quality better than standing alfalfa

Top weaknesses

- Lodges easily
- Lower yields than alfalfa
- Needs to go to seed to persist in stand

Best suited for pasture

Key management practice: allow to set seed every 3-4 years to support stand persistence

Birdsfoot trefoil is a perennial producing fine stems up to 75 cm (30 in) tall growing erect or prostrate. This legume gets its name from the shape of its seed pods forming at right angles to the stem and looking like a bird's foot. Its taproot system is shorter than alfalfa but deeper than red clover.

Birdsfoot trefoil grows well in high acidity and poorly drained soils, making it a good candidate for some soils within the Bulkley-Nechako and Fraser-Fort George (BNFFG) regions. It grows well in regions with 400-600 mm of annual precipitation and can tolerate 2-5 weeks of spring flooding as well as wet soils during the growing season. For reference, annual precipitation is 509mm in Smithers, 489mm in Vanderhoof, and 595mm in Prince George. Because it prefers wet soils, birdsfoot trefoil is less drought tolerant and is **best suited to loam and clay-based soils. Soil acidity tolerance is comparable to alsike clover.**

Winter hardiness is variable and depends on good snow cover and adequate rest before frost. Although it is considered a shorter-lived forage legume, stand longevity can be extended by allowing plants to go to seed every 3-4 years.

Birdsfoot trefoil is best suited for pasture. Leaf loss after cutting and difficulty curing make it challenging as a hay crop. Recovery between harvests is 45-60 days under good growing conditions. If used for hay, cut at early bloom for maximum quality and yield.

birdsfoot trefoil, continued

Grazing should not be continuous to avoid damaging crowns. Birdsfoot trefoil is best used during summer months. Early spring grazing and grazing during the six weeks prior to first frost should be avoided. Winter bale grazing over birdsfoot trefoil can cause winterkill. Feed value is comparable to alfalfa although yield is about 20 to 50% less, depending on the variety. Crude protein at full bloom is approx. 9%.

Birdsfoot trefoil can be slow to establish although it can be quite competitive in poor soils. In some areas where it grows abundantly, such as roadside ditches and field margins, it may even be considered weedy. Seed should be inoculated with species specific *Rhizobium* loti. When seeding birdsfoot trefoil for the first time, the amount of inoculant can be doubled. Seed are quite small (370,000 seeds per pound) and require a shallow seeding depth of 1/4 inch. Seeding rate for a pure stand is around 8 pounds per acre, assuming pure live seeds (PLS) at 75%. Try not to use a nurse crop to reduce competition. During the establishment year, hold off on cutting or grazing until plants are in full bloom. In mixtures, it pairs well with timothy and tall fescue. It can also be paired with other low growing grasses or legumes.



Birdsfoot trefoil flowers

Photo credit: T. Mulhern Davidson



Mature plants in bloom

Photo credit: J. MacKenzie

sainfoin

Onobrychis viciifolia

Current varieties: Nova, AC Mountainview

Top strengths

- Drought tolerant
- Good forage quality for late season or stockpiling

Top weaknesses

- Stand persistence
- Poor competitor
- High seed cost

Best suited for hay, pasture, and stockpiling

Key management practice: allow long grazing recovery and allow plants to set seed every 3-4 years to support stand persistence



Brilliant pink flowers of sainfoin leaflets

Photo credit: USDA plant sheet

sainfoin, continued

Sainfoin is a perennial growing up to 1 metre tall. The taproot system is deep and branched. Sainfoin will grow best on lighter textured soils and in areas with annual precipitation ranging from 300 to 600 mm. It will only tolerate a few days of flooding or water saturated soils. Sainfoin has a very low tolerance for having “wet-feet” and does not tolerate soil acidity or salinity. In fields where alfalfa struggles to establish or persist due to high water table or soil acidity, sainfoin will not be a suitable substitute.

The upright growth and excellent leaf retention makes it well suited for hay production. It can be cut at 50-100% bloom, unlike alfalfa, sainfoin maintains nutritional quality into full bloom, offering 18% protein and 63% digestibility. Sainfoin’s hollow stems cure well despite having a higher moisture content than alfalfa. Under dryland production, sainfoin generally provides 1 cut per season but it can provide 2 cuts under irrigation. Recovery between cutting or grazing takes around 60-80 days under good growing conditions. If used in a rotational grazing system, a good amount of carry-over should be left on the plants. Sainfoin can be grazed mid-summer or stockpiled for fall or early winter grazing. If stockpiling, grazing should be delayed until after first frost to keep root reserve high for more successful overwintering. Sainfoin has good leaf retention following frost which makes it an ideal legume for stockpiling.

To maintain sainfoin in a stand, it needs to be allowed to set seed at least once every 3-4 years. Winter hardiness of sainfoin is moderate and largely depends on the health of the crown and requires good rest during the 4-6 weeks before killing frost to allow for well stocked root reserves going into winter.

Sainfoin has a large seed (only 30,000 seeds per pound compared to about 220,000 seeds per pound for alfalfa). Recommended seeding rate for a pure stand is 30 pounds per acre, which makes it a relatively expensive legume to seed. Plant shallow at $\frac{3}{4}$ inch depth into a firm and clean seedbed. It is a poor competitor and should not be planted with a nurse crop. Sod-seeding into existing stands has also not been successful in past trials. Fields should be fertilized

Sainfoin leaves are composed of 11-29 paired leaflets



Photo credit: J. MacKenzie

Young sainfoin stand



Photo credit: SK Forage Seed Commission

based on soil test requirements. Sainfoin inoculant is often unavailable, and a clover or alfalfa inoculant may be used instead. Seed scarification is not really feasible as most sainfoin seed is sold with pods attached.

In mixtures, sainfoin will be outcompeted by creeping rooted grasses and is best combined with bunchgrasses or less aggressively spreading grasses like meadow brome, hybrid brome, Russian wildrye, or timothy. An additional way to reduce competition from other legumes and grasses in your mixture is to seed sainfoin in alternating rows or at a different angle, while seeding the remainder of the mixture on its own. Seeding sainfoin separately may help manage the larger, heavier seed or if your seeder does not have a separate seed box.

cicer milkvetch

Astragalus cicer Current Varieties: Oxley, AC Oxley II, AC Veldt, Windsor

Top strengths

- Good forage quality for late season or stockpiling
- Winter hardy

Top weaknesses

- Slow establishment
- Not well suited for hay

Best suited for grazing because of prostrate growth and high moisture content

Key management practice: allow sufficient time for good establishment

Cicer milkvetch is a long-lived, non-bloating perennial legume. It grows a deeply branched taproot, although not as deep as alfalfa, and strong rhizomes. Stems start out erect but soon fall over as they grow up to 120cm (47 in.) long. Flowers are a pale yellow. Seed pods turn black as they ripen and make a characteristic rattling sound when shaken. Cicer milkvetch prefers moist soils with a minimum annual precipitation of 400mm. It can tolerate 1-2 weeks of spring flooding and can tolerate a water table within 1 m of the soil surface. It grows best in silty loam or clay loam soils. It will not do well in deep sandy soils. It has moderate acidity tolerance (pH>6.0) and salinity tolerance (E.C. rating below 5ds/m).

Seed is about double the size of alfalfa (around 122,000 seed per pound). Cicer milkvetch has a large percentage of hard seed and should be scarified for faster and uniform germination. Seed should get in the ground within a week of scarification or else seed viability will decline. Inoculation with rhizobia bacteria of the strain *Astragalus* is recommended for proper nitrogen fixation. Seeding depth should be ½ to ¾ inches. Establishment can take up to 2 or even 3 years. Seed has also been successfully spread through grazing animals when fed mixed with minerals or through bale grazing of cicer milkvetch.

Cicer milkvetch flower (left) and seed pods (right)



Photo credit: AAFC

Cicer milkvetch leaves are made up of 13-27 hairy paired leaflets



Photo credit: AAFC

Combining cicer milkvetch with a shorter-lived legume such as sainfoin or clover, can help bridge the time until cicer milkvetch becomes well established. Once established, it is very competitive. When grazed as a pure stand, photosensitization was observed in some trials in the United States although this was not seen in any grazing trials in Western Canada or when used in mixtures. In mixtures it can be combined with a wide range of grasses, such as meadow and smooth brome, orchard grass, creeping foxtail, or tall fescue, to name a few. Yield of a well-established stand is approximately 80% of alfalfa, depending on the variety.

The best use for cicer milkvetch is grazing. It maintains leaves and feed quality well into fall and even after frost, making it a good candidate for stockpiled grazing. The plant rhizomes allow for good tolerance of hoof action. When used for hay, harvest around 25% bloom to maximize yield and quality. Run the crop through a conditioner to speed up the otherwise slow dry-down. The prostrate growth habit also makes it more challenging to cut for hay. Recovery between harvests takes 45-60 days under good growing conditions. Leave at least a 4-inch (10 cm) stubble to support faster re-growth. Allowing plants to go to seed every 3 years encourages new seedlings in the stand.

dryland forage

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Bruce birdsfoot trefoil: cultivar description

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Forage U-Pick Tool

<https://upick.beefresearch.ca>

Sanfoin in Alberta

<https://www.alberta.ca/assets/documents/af-sainfoin-in-alberta-bulletin.pdf>

Sainfoin USDA Plant sheet

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Sainfoin: An alternative forage

<https://agresearch.montana.edu/wtarc/producerinfo/agronomy-nutrient-management/Sainfoin/SainfoinProd.pdf>

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