



# SAINFOIN

## QUICK GUIDE

*An alfalfa alternative for water-short regions*

Increasing water challenges in the Colorado River Basin, combined with the high percentage of irrigation water dedicated to growing hay and pasture crops, have stimulated interest in exploring more drought-resilient alternatives to the alfalfa and grasses typically grown in the region. Sainfoin, a legume with a nutritional profile comparable to alfalfa, has emerged as a promising alternative under certain conditions.

### ABOUT THIS GUIDE

*This quick guide summarizes insights and practical recommendations for growing sainfoin for forage in Colorado and other areas with similar growing conditions, gleaned from an in-depth literature review and ongoing field trials conducted by Colorado State University in collaboration with The Land Institute, with the support of Trout Unlimited, American Rivers, and The Nature Conservancy. For additional background, details, and citations, see the technical report *Best Management Practices for Establishment of Sainfoin in the Upper Colorado River*, which is available from Dr. Perry Cabot at [Perry.Cabot@colostate.edu](mailto:Perry.Cabot@colostate.edu).*

## At a Glance

### ✓ BENEFITS

- Performs well under reduced or variable water supply and often persists better than alfalfa where irrigation is limited or inconsistent, although it typically yields less than alfalfa under full irrigation.
- Matures earlier in spring than alfalfa, with peak productivity at the first cutting; regrowth after the first cutting is less vigorous than alfalfa's.
- Contains condensed tannins that reduce the risk of frothy pasture bloat in cattle, providing good palatability, nutritive value, and improved protein-use efficiency.
- Resistant to the alfalfa weevil (*Hypera postica*) and to certain nematodes such as the alfalfa stem nematode.

### ⚠ CHALLENGES

- Hard to establish under dryland conditions.
- Seedlings establish slowly and compete poorly with weeds — a clean seedbed and early weed management are essential.
- Markets for sainfoin hay are less well-established than markets for alfalfa.

## Growing Conditions & Field Suitability

### Water Needs

Sainfoin is adapted to semi-arid growth conditions, performing best in regions receiving 12–19 inches of annual precipitation or where irrigation is available. Mature plants can tolerate intermittent moisture stress. Seedlings, on the other hand, require adequate and consistent soil moisture during germination and early growth — establishment will likely fail when seed is planted into dry soil without timely precipitation or irrigation.

### Soils

Sainfoin is best adapted to deep, well-drained, moderately fertile, weakly saline (below 8 dS/m), calcareous soils with a neutral to slightly alkaline pH. Because sainfoin relies on a deep taproot, performance is poor in shallow, compacted, or dense soils, or where restrictive layers are present. The crop is sensitive to waterlogging and stands often decline in fields with slow internal drainage, heavy clay soils, low areas, or ponding.

### Cultivars

The choice of cultivar is important for success with sainfoin. Early varieties from Europe did not adapt well to dry conditions in the Western U.S.; those introduced from Turkey and Russia have performed better and exhibited similar performance to other forage legumes across various applications.

Sainfoin cultivars are commonly grouped into two functional growth types based on their regrowth characteristics following harvest:

|                   | Common (single-cut)                                 | Giant (multi-cut)                          |
|-------------------|-----------------------------------------------------|--------------------------------------------|
| Regrowth          | Limited after first harvest                         | Re-flowers; capable of multiple harvests   |
| Stand life        | Long — often 7–10 years                             | Shorter — typically 3–4 years              |
| Best suited to    | Marginal land, high-altitude sites, dryland/pasture | Fertile land, rapid early growth           |
| Example cultivars | Eski, Melrose, Nova, Shoshone                       | Delaney (leading U.S. commercial standard) |

The “giant type” is normally recommended for fertile lands, while the “common type” is considered best adapted to less fertile, marginal land or high-altitude sites. Modern cultivars often contain genetic contributions from both growth types because of historical crossing.

Delaney is the most consistently available giant, multi-cut type in the United States and has become the primary commercial standard. North American single-cut cultivars include Eski, Melrose, and Nova. Shoshone is also primarily classified as a single-cut type; however, it combines the persistence typical of common types with improved productivity, drought tolerance, and competitiveness, allowing it to perform well under both dryland and irrigated conditions.

## Seed Characteristics

### Podded Seeds

Sainfoin seed is enclosed within a single-seeded pod that is typically not removed during threshing. Because the pod contributes substantially to seed weight and the seed itself is relatively large, sainfoin contains far fewer seeds per unit weight than alfalfa. As a result, higher bulk seeding rates are required, increasing seed cost.

## Scarification

Scarification is an important consideration for sainfoin seed performance because the seed is enclosed in a hard, woody pod that can limit water uptake and delay germination. This hard-seed characteristic affects both the rate and uniformity of stand establishment, particularly under dry or variable soil moisture conditions. In natural settings, scarification occurs gradually through environmental processes such as freeze–thaw cycles, repeated wetting and drying, soil abrasion, and microbial activity, which weaken or crack the pod and allow germination to occur over multiple seasons. This staggered emergence can enhance stand persistence and resilience in semi-arid environments by spreading establishment risk across years.

Commercial scarification — through mechanical abrasion, cracking, or dehulling to produce naked seed — can improve germination speed and uniformity; however, these treatments add significant processing cost and are used sparingly. Most sainfoin seed is therefore marketed with the pod intact, relying on natural scarification to support establishment and long-term stand stability.

## Establishment Requirements

### Inoculant

**KEY TIP:** Alfalfa inoculants will not work on sainfoin. Effective nitrogen fixation depends on inoculation with a compatible *Rhizobium* strain — sainfoin requires the F-type inoculant, *Rhizobium leguminosarum* bv. *viciae* (Burton and Curley 1968). Treat seed with a sainfoin-specific inoculant prior to planting to promote nodulation and early growth.

### Seedbed Preparation

A firm seedbed that provides good seed-to-soil contact is essential for uniform germination and emergence. Because sainfoin seedlings establish relatively slowly and compete poorly during early growth, careful attention to seedbed condition and planting depth is one of the most important factors influencing stand success.

Seedbed preparation should produce a smooth, firm surface while avoiding excessive compaction or soil crusting, both of which can restrict seedling emergence. Overworked or fine-textured soils that crust following irrigation or rainfall can reduce stand establishment; conversely, soils that are loose or fluffy at planting increase the risk of uneven depth control and poor seed placement.

Both conventional tillage and no-till systems can be used successfully if seed placement and soil conditions are managed carefully. In tilled systems, final packing or rolling prior to planting helps ensure adequate firmness. Under no-till conditions, residue management is important to allow proper seed placement and early seedling emergence — moderate surface residue may help conserve soil moisture and suppress early weed growth, but excessive residue can interfere with seed-to-soil contact and depth control.

Like any small-seeded forage, no-till establishment of sainfoin can succeed where soil moisture is adequate and existing vegetation is fully controlled prior to planting, but careful attention to shallow seed placement and early-season competition is essential due to the crop's slow seedling development.

### Timing

Successful sainfoin establishment depends more on environmental conditions than on calendar date — planting should occur when soil moisture and temperature conditions support rapid emergence and early root development. Spring seedings are generally preferred in colder regions, where soils warm slowly and winter injury risk is high. Under favorable conditions, both spring and late-summer plantings may produce normal yields in the first production year; however, planting too late increases the risk of poor establishment, as seedlings may not develop sufficient root reserves to survive winter.

Sainfoin germinates over a relatively broad temperature range but establishes best when soil temperatures are between about 50–68°F (10–20°C) and should not be planted when temperatures are below approximately 41°F (5°C).

Sainfoin and alfalfa have similar environmental requirements for germination and early growth, so planting dates appropriate for alfalfa generally work well for sainfoin. Both species can germinate at soil temperatures near 40°F (4–5°C) and establish best when soils are warm and moisture is adequate, so recommendations for spring or late-summer seeding windows are typically comparable between the two crops.

### Seeding Method & Depth

Drilling is generally preferred because it provides uniform depth and good seed-to-soil contact, resulting in more reliable establishment. Broadcast seeding can be successful if followed by packing or light harrowing, but higher seeding rates are typically required and stands may be less uniform.

Although unhulled sainfoin seed is larger than most perennial forage legumes, emergence declines when seed is placed too deeply. Recommended planting depth is shallow, typically ½ to ¾ inch (15–20 mm) — stands are often poor when seed is placed deeper or into loose, cloddy soil.

### Seeding Rates

For podded seed — the form most commonly marketed in the United States — recommended seeding rates typically range from about 25 lb/ac under dryland conditions to 40–50 lb/ac under irrigation. Lower rates are appropriate for dryland systems because soil moisture limits the number of plants that can be supported, whereas higher rates under irrigation help achieve rapid canopy closure and maximize early productivity.

These recommendations correspond to target within-row populations of approximately 30–42 live seeds per meter (9–13 seeds per foot), regardless of row spacing — roughly 3–5 plants per square foot after establishment, assuming typical field emergence and early stand loss.

**EQUIPMENT NOTE:** Because sainfoin seed is enclosed in a rough, spiny pod, seed flow can be irregular and may bridge or plug drill boxes. Check planting equipment frequently during operation to ensure uniform delivery and consistent stand establishment.

### Weed & Pest Management

Weed control is most critical during the establishment year, when sainfoin seedlings grow slowly and compete poorly with aggressive weeds. Herbicide options for sainfoin are limited compared with most forage crops, making preventive management and clean field conditions essential for successful production. Beginning in the second growing season, sainfoin becomes more competitive as plants develop a basal rosette and expand crown growth, reducing — but not eliminating — the need for weed management.

Eptam (EPA reg. 10163-283) is a soil-applied herbicide labeled for use at establishment. It should be applied pre-plant at 2.25–4.25 pints per acre, based on soil texture and geographic region, and incorporated according to label directions.

### Fertilizer

Sainfoin has relatively low nitrogen fertilizer requirements because it fixes atmospheric nitrogen, but adequate phosphorus and potassium are essential for successful establishment and stand persistence. Phosphorus is particularly important for root development and effective nodulation, and deficiencies often result in weak or thin stands. Potassium supports plant vigor, winter survival, and tolerance to environmental stress. Soil testing prior to planting is recommended, and any needed P and K should be applied and incorporated before establishment, as correcting deficiencies after stands are established is difficult and less effective.

## Establishment-Year Water Management

Irrigation management during the establishment year should focus on maintaining moist, but not saturated, soil conditions in the upper root zone — light, frequent irrigations are often more effective than large applications that create saturated conditions.

Although mature plants tolerate intermittent drought, seedlings are sensitive to moisture stress and require consistent moisture to ensure uniform emergence and root development. Sainfoin requires good soil drainage and is intolerant of flooding, prolonged waterlogging, or standing water.

## Stand Persistence & Reseeding

Sainfoin is a perennial forage that regrows from crown buds and a deep taproot following harvest. After cutting for hay, regrowth originates from buds at the crown rather than from new seedlings, so maintaining adequate leaf area and protecting crown tissue are important for plant survival. To support vigorous regrowth and reduce plant stress, a minimum stubble height of about 3 inches should be maintained after harvest. Under irrigated conditions, individual sainfoin plants typically persist for four to six years, although stand life varies with soil conditions, irrigation management, and harvest practices.

**NRCS RECOMMENDATION:** Long-term stand persistence depends on natural reseedling as well as survival of existing plants. Allow stands to produce and drop seed periodically — at least one seed crop before harvest, beginning no earlier than the second year after establishment — to encourage stand renewal.

## Water Use

While alfalfa is typically managed as a high-water-use crop to maximize yield, sainfoin is better suited to conditions where water supply is limited, variable, or managed conservatively.

Seasonal evapotranspiration (ET) requirements for alfalfa commonly range from approximately 32 to 63 inches, depending on climate, soil conditions, and harvest frequency. Studies indicate that sainfoin can maintain acceptable productivity at lower seasonal water use, generally producing about 80–85% of alfalfa yield under full irrigation, with a more gradual decline in yield as water availability decreases.

Sainfoin should not be managed as a high-water-use crop. Its primary advantage is not maximum yield under intensive irrigation, but the ability to persist and remain productive under reduced or variable water availability — making it well suited to production systems where water supply, soil drainage, or long-term resource sustainability limit the practicality of high-input forage crops.

## Companion Planting

Sainfoin is sometimes included with alfalfa or grasses to improve total forage production and reduce bloat risk in grazing systems. Mixture rates should be adjusted to reflect the desired proportion of each species. In some production systems, small amounts of compatible grasses have been included to help suppress weeds during establishment.

Sainfoin tends to perform best when grown with non-aggressive bunchgrasses. Ditterline and coauthors report good compatibility with species such as Russian wildrye and crested wheatgrass, which have upright growth habits and limited lateral spread.

Establishment by interseeding into existing stands is typically less reliable for sainfoin than for smaller-seeded forage species. Because sainfoin seed is enclosed in a large, rough pod, it tends to remain in surface residue rather than reaching the soil, resulting in poor seed-to-soil contact and reduced emergence.