



Forage Legumes for Oklahoma

John L. Caddel
Forage Extension Agronomist

Jim D. Enis
Extension Area Agronomist

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Legumes may be used in much of Oklahoma as a means of extending the length of grazing season, increasing the nutritional plane of grazing livestock, and/or reducing the amount of nitrogen fertilizer required in a forage production program. Legumes in tall, fescue pastures can also offset some of the negative effects of fescue toxicity. Several forage legumes are widely adapted to and used in Oklahoma especially in the eastern half of the state. However, several legumes have a vast untapped potential for Oklahoma forage production systems. Some of the important (and potentially important) forage legumes are briefly discussed in this report.

Alfalfa (*Medicago sativa*)

Alfalfa is the most important perennial forage legume for hay production and is sometimes used for grazing. Proper soil fertility and pH, along with well-drained soils, are critical for high forage yields and long-lived stands.

Alfalfa is normally sown between mid-August and mid-September without a companion crop. Companion crops may be useful, though, to help control wind erosion on sandy sites. Alfalfa can, however, be planted during the spring (mid-March through mid-April). When sodseeding alfalfa into grass pastures, the competitiveness of perennial grasses must be minimized. Herbicides or mechanical methods may be necessary to control perennial grasses to allow establishment of the alfalfa.

Alfalfa growth begins in March and continues until the onset of short days and cold temperatures or until drought induced dormancy. Haying at 28- to 35-day intervals or rotational grazing of one to 10 day grazing periods followed by three to five weeks of regrowth is normally the best way to maintain good stand life and high production. Continuous grazing may also be successful if six to eight inches of stem is maintained.

Bloat may be a problem when grazing alfalfa. Carefully read the section on bloat in this fact sheet.

Annual lespedezas

Common (*Kummerowia striata*)

Korean (*Kummerowia stipulacea*)

The annual lespedezas are tolerant of acidity and low phosphorus situations; thus, the species are well adapted to infertile sites and offer forage of high nutritive value during late-summer under low-input production systems. Stocker cattle have been reported to gain better on a combination of lespedeza and bermudagrass than on bermudagrass alone. Seeds should be planted at 25 to 35 lbs./acre during March or April. Light grazing pressure will generally allow the plants to reseed. Yields are lower than other warm-season forages such as bermudagrass or the sudangrass types of annual grasses. As with cowpeas, growing animals perform well when allowed creep access to lespedeza.

Annual medics [Bur clover] (*Medicago* spp.)

This group of cool-season annual forages consists of several different species. In general, they look like clovers but are actually closely related to alfalfa. Some examples of annual medics found in Oklahoma that can make a small, but significant, contribution to forage production programs include: bur clover (*Medicago polymorpha*), button clover (*M. orbicularis*), black medic (*M. lupulina*), and spotted or southern burclover (*M. arabica*).

Little research has been conducted on the medics in the United States. They originated from the Mediterranean area and are used as short-live annuals. The medics germinate in the fall or early-spring and terminate growth in June after flowering.

Commercial seed for the annual medic species is normally difficult to find, and the plant is seldom intentionally sown. The seed may lie dormant in the soil for many years; but, when the medics do appear, they produce excellent forage for grazing and may produce an abundant seed crop. Producers should take advantage of these species and encourage their production.

Arrowleaf Clover

(*Trifolium vesiculosum*)

Arrowleaf clover is a relatively late-production, cool-season annual clover that produces most of its growth during April and May. Arrowleaf clover plants typically mature during late-June through July. If conditions are favorable during early-fall, some growth may be available for grazing in late-fall or early-winter.

Arrowleaf clover is not adapted to calcareous or wet soils and has some degree of drought tolerance. Arrowleaf clover is generally high in digestibility and superior to that of crimson clover at all stages of maturity. Bloat potential with arrowleaf clover is low and is a good choice for pasture mixes where adapted. When arrowleaf clover is kept grazed to a height of 3 to 4 inches during spring, livestock may continue to graze until early-June or later. If a haycrop is desired, grazing should be terminated in early- to mid-May. This allows the clover a chance to regrow before cutting and may reduce some of the problems associated with making hay during the typically rainy May weather in Oklahoma.

With proper grazing management, arrowleaf clover is an excellent reseeding annual due to the high percentage (70 to 90 percent) of hard seed produced. If managed for reseeding, the arrowleaf clover stand may remain viable for many years.

Austrian Winter Peas (*Pisum sativum*)

Austrian winter peas may produce a moderate amount of dry matter used for grazing, as a hay crop, or as a green manure. Winter peas are often used as companion crops with cereal grains and are high in nutritive value. They make a good silage and are relished by cattle and white-tailed deer.

Winter peas are easily established on well-drained loam or sandy loam soils and should be planted during September or October at 20 to 30 lbs. of seed/acre in mixed stands with cereal grains or ryegrass and 30-40 lbs./acre in pure stands. Austrian winter peas are intolerant of low pH soils.

Berseem clover (*Trifolium alexandrinum*)

Berseem clover resembles alfalfa and grows to a height of two feet or more. This annual clover is adapted to alkaline sites and is tolerant of wet soil conditions but performs best on fairly good sites. However, it is not adapted to low fertility sites. Berseem clover may provide fall forage and produces peak forage levels during March through June. Grazing should keep plants between three and four inches in height to encourage new leaf production. Berseem clover is not a particularly good reseeding species but does not cause bloat problems.

Birdsfoot trefoil (*Lotus corniculatus*)

Birdsfoot trefoil is a short-lived perennial with a deep taproot, finer stems, and more leaves than alfalfa. It is highly nutritious and does not cause bloat.

Birdsfoot trefoil is somewhat tolerant of drought and moderate soil acidity; however, pH should be kept above 5.5 for best production. The legume is primarily used in mixes with cool-season grasses because it will not survive in warm-season grass stands.

Grazing should keep the stubble height of birdsfoot trefoil at approximately three to four inches, and rotational grazing should be used to allow some plants to set and mature seed. Allowing plants to set seed will help to maintain healthy, vigorous stands of birdsfoot trefoil. The more prostrate, or Empire, types of birdsfoot trefoil are better adapted to grazing. Birdsfoot trefoil, where adapted, will produce forage from April through early-October.

Cicer milkvetch (*Astragalus cicer*)

Cicer milkvetch is a long-lived, warm-season perennial that spreads by means of rhizomes. The plant may reach a height of two feet or more. Cicer milkvetch is adapted to a wide range of soil types including slightly acid soils to moderately alkaline soils. Cicer milkvetch has a fair level of drought tolerance that makes the species adapted to areas where true clovers may not survive. This forage legume is a very winter hardy species and is used in many areas for soil stabilization.

Forage quality of cicer milkvetch appears to be equivalent to that of alfalfa, although forage yields will generally only be about 75 percent of alfalfa.

Cicer milkvetch does not cause bloat in livestock, but ruminants grazing pure stands of the plant have experienced photosensitization. If photosensitization should occur, animals should be removed from the cicer milkvetch pasture.

Cowpeas (*Vigna unguiculata*)

Cowpeas are annual, viney plants with large leaves. The species is tolerant of drought, low fertility, and soil acidity. Cowpeas, however, do require adequate levels of phosphorus to be productive. Forage nutritive value is high and plants are easily established in May through June. Cowpeas are used as a warm-season planting for white-tailed deer to offset the negative effects of summer stress. Allowing growing animals to have creep access to cowpeas provides for enhanced animal performance during summer when forage nutritive value of other species is typically reduced. Cowpeas does not cause bloat in ruminants.

Crimson Clover (*Trifolium incarnatum*)

Crimson clover is primarily adapted to the southeastern part of Oklahoma and is an early clover with peak production occurring in March through April. Crimson clover is similar to arrowleaf clover in areas of adaptation and will not tolerate calcareous or poorly drained soils but is better suited to acidic soils than arrowleaf clover. Crimson clover may be successfully established into bermudagrass by drilling the seed into a pasture that has been grazed or mowed short. Though adapted only to the southeastern quarter of the state, crimson clover is easy to establish and provides excellent forage. Crimson clover is a relatively poor reseeder due to a lack of hard seed. Plants generally will germinate during the summer and die before fall.

Hairy Vetch (*Vicia villosa*)

Hairy vetch is a dependable, widely adapted, cool-season annual legume used throughout Oklahoma. The plant has a large seed that allows seedlings to emerge through a thatch of three to four inches to reach sunlight. Hairy vetch is fairly tolerant of acid soils, but soils should be well drained.

Hairy vetch has a vine-like growth habit with a peak production period during March and April. Plants bloom in early-May and will have mature seed by late-May. If allowed to mature, hairy vetch has a good reseeding capability.

Dry matter production is normally less than that of other cool-season annual legumes, but the plant is a dependable producer. Hairy vetch can be grazed or harvested as a hay crop.

Cattle grazing pure stands of vetch have developed dermatitis (inflammation of the skin), similar to photosensitization. This has not been a problem when adequate grass was available.

Cattle may develop muscular problems when grazing vetch, especially when the seeds are forming. Moving cattle to a pasture without vetch is the only practical way to control this problem.

Red Clover (*Trifolium pratense*)

Red clover is a short-lived perennial with an upright growth habit that may be used as pasture or as a hay crop. Due to a long-growing season, red clover typically is the highest yielding clover in areas of adaptation. Red clover is typically planted during September through early-October or March through April, at six to eight lbs./acre in drill rows or 12 to 15 lbs./acre broadcast. Soil pH should be above 5.5 for maximum production.

Red clover may be successfully grown in mixtures with bermudagrass or tall fescue and indications are that red clover may also be established in stands of Old World bluestem.

Red clover is not as long lived as is alfalfa; however, stands of red clover may be maintained for many years by reseeding with 2 lbs. of seed/acre every two to four years.

Rose Clover (*Trifolium hirtum*)

Rose clover is a cool-season annual that is somewhat new to Oklahoma. Most varieties of rose clover that have been available in the past were earlier in maturity than either crimson and arrowleaf clover. Drought tolerance of rose clover, however, is typically greater than crimson or arrowleaf clover. Rose clover will not tolerate wet or poorly drained soils but is fairly tolerant of alkaline soils and soils of low fertility. If rose clover is allowed to produce seed the first year, a lower initial seeding rate may be used with a good stand becoming established in the second year.

Most rose clover varieties from California produce relatively low dry matter yields. A Texas release, Overton R-18, has a higher yield potential and is intermediate in maturity to crimson and arrowleaf clover.

Sainfoin (*Onobrychis viciifolia*)

Sainfoin is a cool-season perennial forage legume that does not cause bloat in ruminants. Sainfoin is equivalent to alfalfa in forage nutritive value but is not as competitive as alfalfa in mixed stands; thus, sainfoin generally is planted as a monoculture. Sainfoin is not as drought tolerant as alfalfa nor as good a nitrogen fixer; however, sainfoin is resistant to common alfalfa pests such as the alfalfa weevil. Sainfoin is adapted to dry calcareous soils and, when compared with other legumes, grows well on soils that are low in phosphorus.

Sainfoin will tolerate light to moderate grazing but should be allowed to recover from grazing events; thus, rotational grazing that would be used with alfalfa should receive serious consideration and most grazing of sainfoin should take place during the peak production period in spring.

Subterranean Clover (*Trifolium subterraneum*)

Subterranean (sub) clover is a dense, low-growing, annual legume of medium maturity that will withstand close grazing and continue to produce seed. Following pollination of the small white flowers, the flowers "peg down" and the seeds develop on or just under the soil surface.

Sub clover normally reaches no more than six to eight inches in height and is not as productive as arrowleaf or crimson clover. Sub clover is not suited for hay production.

Sub clover is more tolerant of acid soils than most clovers but does not tolerate a pH above 7.0. Sub clover is tolerant of close continuous grazing and is more tolerant of shade than other legumes but does not do as well as other clovers in grass sods.

Sweetclover (*Melilotus officinalis* or *M. alba*)

White (*Melilotus alba*) and yellow sweetclover (*M. officinalis*) are biennial species that can produce two or more tons of forage per acre. Sweetclover is very similar to alfalfa and has great value as a soil-improving and pasture crop and is best adapted to clay or loam soils at near-neutral or higher soil pH. Sweetclover is relatively drought tolerant and winter hardy and either of the species may be planted in spring or autumn at 10 to 15 lbs. of seed/acre.

Coumarin, an aromatic compound found in sweetclover forage, reduces the palatability to livestock until they become accustomed to the bitter taste. Dicoumarol, a toxic substance that develops from coumarin during heating and spoiling of sweetclover hay, reduces the blood-clotting ability of animals and may result in their death. This problem has been overcome by the development of low-coumarin sweetclover varieties.

White Clover [Ladino] (*Trifolium repens*)

White clover is a perennial legume common across most of the southern areas of the United States. Common white clovers are of shorter stature and do not exhibit the larger leaf of the taller ladino varieties. White clover requires good soil moisture and is not productive under droughty conditions.

White clover is often planted at three to four lbs./acre into existing tall fescue or bermudagrass stands. Best production will be obtained on fertile, well-drained soils if rainfall is favorable. White clover will tolerate wet soil conditions better than most legumes. Because it is often found on wetter sites, white clover may survive a dry spell during the summer months better than other forage legumes.

White clover does not exhibit the same erect growth habit as red clover and mixed grass-clover stands should be grazed fairly close to prevent competition for sunlight from becoming a limiting factor in white clover production. While cattle are grazing pure stands of white clover, bloat potential may be reduced by including free-choice access to grass hay. As with red clover, broadcasting one to two lbs. of seed/acre in the fall or winter may be necessary to maintain a stand for several years.

Other warm-season annual legumes

Mungbeans (*Vigna radiata*), peanuts (*Arachis hypogaea*), pigeon peas (*Cajanus cajan*), and soybeans (*Glycine max*) are similar in many respects to cowpeas. These warmseason legumes perform best under a rotational grazing system that allows the plants to recover from grazing events and produce new leaf material. All of the above legumes also produce hay of high nutritive value.

Soil Fertility Requirements

In general, legumes are typically more sensitive to soil nutrient deficiencies than are forage grasses. However, because of the symbiotic relationship with Rhizobia bacteria, nitrogen fertilizer is generally not required. Phosphorus and potassium, however, are critical to maintaining a productive stand of legumes. An annual soil test should be used to de-

termine the need for phosphorus and potassium and will also indicate if there is a deficiency in micronutrients. Legumes are more sensitive to low soil pH than are most forage grasses and, based on soil test recommendations, lime should be applied when pH soil values fall below 6.0.

Legumes in Grass Pastures

Many legumes may be successfully established into grass pastures. One popular strategy is to sodseed (no till) cool-season annual legumes into bermudagrass pastures. The bermudagrass must be carefully managed to ensure that a minimum amount of residue remains at the time of establishment. If the bermudagrass canopy is not removed, emerging legume seedlings will not be able to compete for sunlight and become established. Forage canopies may be removed by grazing (recommended) or by mowing. Proper use of a cool-season annual legume in bermudagrass will provide forage of high nutritive value during the late-winter and early-spring and the legume will serve as a source of nitrogen for early bermudagrass growth. This may help reduce the requirement and expense of nitrogen fertilizer.

Another popular strategy for utilizing legumes in a grass pasture is to mix red or white clover into a tall fescue or other cool-season grass pasture. The tall fescue has a negating effect on the bloating potential of legumes, and legumes may play a role in reducing the effects of fescue toxicity. A higher level of management is required for this type of program, but the effort may result in improved animal performance and reduce the need for nitrogen application.

Inoculation

When properly inoculated, legumes generally do not require nitrogen fertilizer because of a symbiotic relationship with Rhizobia bacteria. In the symbiotic relationship, bacteria extract atmospheric nitrogen and convert it to a plant-available form within root systems of legumes. Legumes, when properly inoculated, can fix significant amounts of nitrogen. The amount will vary between species, sites, and years but can range from as little as 30 up to 200 lbs./acre. While it is possible to establish without the nitrogen-fixing bacteria, nitrogen fertilizer must be applied and the economic advantage of using legumes is lost.

In pastures where legumes have been used in the past, the Rhizobia may persist for several years. However, when initially establishing legumes, the proper type of bacteria (inoculant) must be introduced into the forage system. This is known as inoculation. Inoculation of seed occurs before planting and is accomplished by applying a sticking agent to the seed and then adding inoculant to the seed. The inoculant should be applied immediately prior to planting the seed.

Inoculated seed should not be stored in a location where the seed will be subjected to high temperatures for a lengthy period of time nor should the seed be mixed with fertilizer. Both practices can be lethal to the bacteria.

Once a field has a successful stand of a legume species, bacteria may remain viable in the soil for two to five years. If present in sufficient quantities, a subsequent planting of the same legume may not require that seed be inoculated at planting.

The most consistent method, however, is to inoculate legume seed with the proper Rhizobia each time the seed is planted regardless of the pasture history. Rhizobia bacteria are host specific and producers should be sure the strain of bacteria is appropriate for the legume being established. Commercial packages of inoculant list the legume species for which the package is effective.

Commercial sticking agents are available from those who provide the inoculant and generally these provide the most appropriate method for inoculating legume seed. A 10 to 50 percent solution of sugar/water or syrup/water may also be used to moisten the seed so that the inoculant will adhere.

Bloat

Certain legumes can create serious bloat problems in ruminants. Bloat is caused by the formation of a stable foam in the rumen. If not relieved, the pressure created by the entrapment of rumen fermentation gases in the foam can lead to death by suffocation in as little as one hour or less.

Environmental aspects may also play a contributing role in bloat. Cattle have been observed to stop foraging prior to passage of a weather front and gorge themselves following the inclement weather. Cattle may need to be moved or a bloat preventative may be required during such times. Frost can also increase the incidence of bloat by disrupting plant cell walls and increasing their rate of fermentation in the rumen. Delay grazing those legumes that are known to cause bloat for a few days following a hard frost.

Legume bloat usually occurs during the lush growth period associated with spring. When using a legume known to cause bloat, the number of problems can be minimized with proper management (Table 1).

Poloxalene, a bloat preventative, must be consumed by cattle daily, both prior to turning cattle onto legumes and thereafter, to be effective. Feed poloxalene at one to two grams per 100 lbs. of body weight/day. Cattle should be accustomed to consuming a mineral mixture, and a feeding strategy that results in cattle getting an effective amount of poloxalene should be used. This may mean hand feeding cattle one to two lbs. of highly palatable supplement containing the desired amount of poloxalene.

While there are reports that feeding either oat hay or sudangrass hay "effectively controlled" bloat of steers grazing the young, lush regrowth of alfalfa, the amount of hay that cattle must consume to decrease bloat is large and in the range of four to six lbs./head/day for 400 to 600-lb. cattle depending on how much of the bloat-provocative forage they consume.

Summary

Each of the forage legumes listed in Table 2 can be grown throughout most areas of Oklahoma if soil fertility is

monitored and adequate precipitation is received during the growing others; nevertheless, any of the legumes will provide a significant contribution to most forage programs regardless of where in the state they are grown. Benefits will generally take the form of a reduced need for nitrogen fertilizer application, an improvement in the nutritional plane of grazing livestock, an extension in the length of the grazing season, and a provision for forage and/or seeds for wildlife.

Each of the forage legumes have special merit but none are the "perfect" forage on a stand-alone basis year-after year. Therefore, more than one legume should be sown into the same pasture. Mixtures of legume species will help to improve the seasonal distribution of the legumes and may serve to reduce the "boom-or-bust" cycle of most forage legumes.

For further information about which of the forage legume species offers the most potential for a forage production, system contact the local county agricultural educator.

Other Oklahoma Cooperative Extension Publications that may be of interest

Extension Circulars

E-943 Alfalfa Harvest and Management: Discussions with Cost-Benefit Analysis.

Extension Fact Sheets

BAE-1716 Round Bale Hay Storage.
PSS-2089 Alfalfa Stand Establishment.
PSS-2117 Forage Quality Interpretations.
PSS-2207 How to Get a Good Soil Sample.
PSS-2225 OSU Soil Test Interpretations.
PSS-2239 Causes and Effects of Soil Acidity.
PSS-2559 Tall Fescue in Oklahoma.
PSS-2567 Grazing Systems for Pastures.
PSS-2584 Forage-Budgeting Guidelines.
PSS-2587 Bermudagrass for Grazing or Hay.
PSS-2588 Hay Judging.
PSS-2589 Collecting Forage Samples for Analysis.
PSS-2761 Weed Control in Alfalfa.

Agronomy Production Technology Reports

PT-95-12 Broomsedge Management.
PT 95-13 Arrowleaf Clover.
PT 95-14 Cool-season Perennial Forages Grasses for Oklahoma.
PT 95-17 Red Clover.
PT 95-24 Alfalfa Varieties for Oklahoma, 1995.
PT 95-28 Cool-season Perennial Grass Establishment.
PT 95-29 White Clover.

Table 1. Management strategies to minimize bloat potential in livestock.

- Never turn hungry cattle into a lush legume pasture. Allow cattle to fill on grass hay first.
- Provide a bloat preventative to livestock several days prior to and while grazing legumes of known bloat potential.
- When first turned into lush legume pastures, watch cattle closely for several days for distended rumens indicating bloat.
- If possible, fill cattle with hay or other roughage immediately before or after the passage of a weather front.
Delay grazing bloat-causing legumes for a few days following freeze damage.
- Allow livestock to have free-choice access to grass hay while grazing lush legumes.

Table 2. Legume Summary

Legume species	Growth habit	Seeding rate ¹ (lbs./acre)	Planting date	Production period ²	Minimum Precipitation ³	Inoculum type
Alfalfa	Perennial	8-20	Aug-Sept, Mar-April	Mar-Nov	18	A
Annual medics	Annual	6-8	Sept-Oct	April-June	22	N
Arrowleaf clover	Annual	8-10	Sept-Oct	Mar-July	28	O
Austrian Winter Peas	Annual	30-40	Sept-Oct	Mar-April	26	C
Berseem clover	Annual	10-20	Sept	Nov-Dec, Mar-June	30	R
Birdsfoot trefoil	Perennial	4-8	Aug-Sept	April-Oct	26	K
Cicer milkvetch	Perennial	20-25	Mar-April, Sept-Oct	May-Sept	18	⁴
Cowpeas	Annual	40-100	May-June	June-Sept	30	EL
Crimson clover	Annual	20-30	Sept-Oct	Nov, Mar-April	28	R
Hairy vetch	Annual	20-25	Sept-Oct	Mar-May	20	C
Korean lespedeza	Annual	20-25	Mar-April	July-Sept	30	EL
Common lespedeza	Annual	20-25	Mar-April	July-Sept	30	EL
Red clover	Perennial	6-15	Sept-Oct, Mar-April	April-July	30	B
Rose clover	Annual	10-15	Sept-Oct	Mar-May	20	WR
Sainfoin	Perennial	35-40	Mar-April	Mar-June	18	F
Subterranean clover	Annual	10-20	Sept-Oct	Nov-Dec, Mar-May	30	WR
Sweetclover	Biennial	10-15	Sept-Oct, Mar-April	May-Aug	16	A
White (ladino) clover	Perennial	3-4	Sept-Oct, Mar-April	Mar-June, Oct-Nov	30	B

¹ Use the lower seeding rate when using drills that place seed in contact with the soil.

² Production period may be longer with high levels of precipitation during summer months.

³ Minimum average inches of precipitation required for satisfactory production.

⁴ Astragalus Spec. 1 type inoculum.

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