

Annual and Perennial Forage Clovers for Arkansas

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Introduction

Clovers and other legumes are highly desirable species in pastures and hay meadows. First, legumes are able to obtain nitrogen from air through their symbiotic relationship with *Rhizobium* bacteria and, therefore, are not dependent on nitrogen fertilizer. The fixed nitrogen is primarily used to support clover growth, but parts of it become available to neighboring grass plants when clover tissue dies. A second valuable role of clovers is to increase forage quality of pastures, hays or silages. Legumes are higher in crude protein and digestibility than most grasses commonly used in Arkansas. Animals usually consume diets higher in quality than grass alone when pastured on grass/legume mixtures or fed grass/legume hays. As a result, animal performance often improves when a clover is included in pastures, even though total forage yield may not increase. Adding clovers to endophyte-infected tall fescue pastures also improves performance of cattle by diluting the toxicity of the endophyte. A third advantage is that clovers can help even out the forage supply over the grazing season by providing grazing time when other forages are not as active or dormant.

Clovers are implicated in some health problems for livestock. Many clovers can cause bloat in grazing

ruminants. Not all clovers cause bloat, and the problem is unlikely even with bloat-inducing types unless the proportion of clover in the stand is greater than 50 percent. A few clovers synthesize estrogen-like compounds called phytoestrogens that can cause reproductive problems in livestock, especially sheep. Sheep should not be grazed on these clovers during the breeding season. On rare occasions, some clovers become infected with a fungus that causes “slobbers” or excessive salivation in cattle and horses. If this occurs, animals should be removed from the offending forage.

In summary, clovers are beneficial additions to many forage programs because of improved forage growth distribution, increased forage yield, increased forage quality and reduced nitrogen fertilizer costs. These benefits lead to increased animal performance and profitability of the livestock enterprise. Winter annual clovers are considered better adapted to soil and environmental conditions in southern Arkansas than perennial clovers. Perennial clovers are slower to establish than annuals and are not very long-lived in the hot, humid Coastal Plains region of southern Arkansas.

In this fact sheet, the characteristics of annual and perennial clovers are described including procedures for establishment.

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Perennial Clovers

White Clover

White and ladino clover are the same species. The only difference is that ladino-type cultivars have been selected for a taller plant and higher yields. These traits make ladino more suitable for hay than common or wild-type white clover (also called Dutch white clover). Common white clover grows very close to the ground and is perfectly adapted for use under continuous grazing systems or for livestock species that graze close to the ground, such as sheep or horses. It is difficult for animals to kill common white clover through overgrazing.

White clover is cold-tolerant throughout the state and is among the most tolerant clovers for wet soil conditions. However, it will not tolerate summer heat and drought very well. In northern parts of the state, plants go dormant during summer. In southern parts of the state, they likely will die in summer. However, common white clover is a prolific reseed, so stands will probably regenerate each fall. White clover is generally a very good reseed, but some ladino types are poor reseeds. White clover is shade-tolerant but can be shaded out of mixtures by taller grasses if canopy height is not carefully managed by hay cutting or grazing management. It does not generally persist well in mixtures with tightly sodded grasses like bermudagrass or bahiagrass. White clover spreads laterally via aboveground stems called stolons. Bloat potential of white clover is considered high.

Planting rate is 2-3 lb/acre. Proven white clover varieties for Arkansas include 'Osceola', 'Louisiana S-1', 'Regal', 'Patriot' and 'Durana', and there are many newer varieties that may also work well. When testing newer, unproven varieties, producers should start by seeding a small area to check for local adaptability.

Red Clover

Red clover is classified as a perennial but is generally considered to act like a biennial with a useful stand life of only two to three years. In south Arkansas, it often acts like an annual and does not survive through extremely hot summers. It has

excellent cold tolerance. Like white clover, it will go dormant during the summer heat, but it flowers later than white clover during a more defined period. Red clover is not tolerant of frequent close grazing and is best suited to hay meadows or paddocks that are rotationally stocked. Red clover is reasonably shade-tolerant and is particularly well-suited to mixtures with tall grasses like tall fescue and dallisgrass. It has the best seedling vigor of any perennial clover, which makes it a good choice for overseeding into cool-season perennial grasses. Natural reseeding is unlikely to be sufficient to maintain stands. It has excellent forage quality and contains a higher proportion of bypass protein than most other forages. As a result, cattle sometimes perform surprisingly well on this forage.

Red clover can cause bloat. It contains phytoestrogens that can impair the fertility of sheep but is not likely to cause fertility problems if grown in mixed grass/legume stands. Red clover is the clover most commonly implicated in cases of slobbers, but this is an unusual problem that should not discourage use of the clover.

Planting rate for red clover is 10-12 lb/acre. 'Cherokee', 'Kenland', 'Kenstar' and 'Redland II' are proven varieties for Arkansas. There are many others that may also work well.

Alsike Clover

Alsike clover is better suited for the northern tier counties of Arkansas than for more southern ones. It has better tolerance of wet and acid soils than most clovers. Alsike clover is not tolerant of shade. It should not be used for horse pastures because it has a tendency to cause photosensitization, or sun scald, in that livestock species. Seeding rate is 4-6 lb/acre.

Sweetclover

The two sweetclover species (yellow and white) are not true clovers. These are biennial plants that reseed well to form "perennial" stands. Sweetclover is extremely tall, up to 8 feet. They are winter-hardy throughout Arkansas and tolerant of drought but do not tolerate acid soils. Sweetclover contains a bitter compound called coumarin which is extremely distasteful to animals. In moldy sweetclover hay,

coumarin is converted into the toxic compound dicumarol which causes sweetclover poisoning in cattle. Low-coumarin sweetclover varieties are available (white 'Polara' and yellow 'Norgold'). Planting rate is 10-15 lb/acre.

Annual Clovers

In Arkansas, all the annual clover species perform best as winter annuals, meaning that they germinate in fall, grow through the winter, flower and set seed in spring or early summer and then die. For some species, the seeds that were naturally produced will continue the cycle in the following year, while others must be replanted every year. Annual clovers can be overseeded onto dormant warm-season grasses, either alone or in combination with small grains and annual ryegrass.

Because annual clovers complete their life cycle each year, they must be re-established from seed. The clover stand can be re-established either by replanting each year or relying on natural reseeding. Reliance solely on natural reseeding increases risk of establishment failure, because the producer depends on good conditions in late spring for clover seed production as well as in the fall for seed germination and seedling development. For natural reseeding to occur, grazing and hay harvest should be managed to allow some of the clover to mature in late spring for seed production.

Crimson Clover

Crimson clover is the standard against which other annual clovers are compared in Arkansas. It has the best seedling vigor of the annual clovers. It is the earliest to mature of the commonly used annual clovers, flowering in early April in south Arkansas and about three weeks later in northern regions. This limits its usefulness as a hay crop, but it is widely used to overseed bermudagrass. Crimson clover is not tolerant of wet, poorly drained or alkaline soils but has good tolerance to soil acidity. Bloat is usually not a severe problem but can occur. Its reseeding potential is fair if heads are allowed to ripen and if clover weevils do not destroy the seeds. Seeding rate is 10-30 lb/acre. 'Dixie' is the standard variety. 'Tibbee' is another good forage variety.

Arrowleaf Clover

Arrowleaf clover is a tall clover that holds its quality well for a longer period of time than most annual clovers. It is among the latest-maturing clovers and may produce forage into June. Its late maturity makes it a good match to be grown with annual ryegrass. Arrowleaf clover will germinate at cooler temperatures than crimson clover. It is not tolerant of infertile, acid soils. Animals rarely bloat on arrowleaf clover. Periodic grazing to a height of 2 to 4 inches promotes new growth and reduces plant disease outbreaks. The purplish-red color of arrowleaf clover leaves is a symptom that the plant is stressed by something such as nutrient deficiency, insects, diseases or weather. Arrowleaf reseeds well under grazing, but much of the seed it produces is hard, which makes year-to-year stand regeneration somewhat unpredictable. Regrowth (and reseeding) should not be expected after a hay crop is harvested. Planting rate is 5-7 lb/acre. Standard varieties are 'Yuchi' and the disease-tolerant 'Apache.'

Ball Clover

Ball clover is another low-growing clover with excellent tolerance of close grazing. It also has good tolerance of wet, clay or loam soils. Ball clover tolerates lower soil acidity than crimson clover. Ball clover has poor cold tolerance and is best suited to southern Arkansas. Bloat is a serious concern with this clover, and it should not be used in pure stands. Reseeding capability under grazing is excellent because flowers are produced close to the ground. Much of the seed is hard. Seeding rate is 2-3 lb/acre. Improved varieties are not available.

Berseem Clover

Berseem clover is a relatively new addition to the list of clovers that can be grown in Arkansas. Older varieties lacked enough cold tolerance for even southern tier counties. The newer variety 'Bigbee' has enough cold tolerance to be worth risking in the southern half of the state, although it will likely winterkill in a severe winter. It is not suitable for northern Arkansas. Bigbee berseem clover has excellent tolerance of wet soils and poor drainage. It does not tolerate acid soils well, doing better on near-neutral and slightly alkaline soils. Berseem clover

requires good soil fertility and will respond to boron fertilizer. It matures about a month later than crimson clover. Bloat is very unusual on berseem clover pasture. Berseem performs well under grazing if not grazed closer than 3-4 inches. Bigbee has potential to reseed itself but is likely to be undependable. Planting rates are 10-20 lb/acre.

Hop Clover

There are two species of hop clover, large hop clover and small hop clover. Hop clovers are actually medics, not true clovers, and are closely related to alfalfa. Both hop clovers are naturalized throughout Arkansas and are most often found on infertile, acid, unproductive ground. Hop clovers do not compete well with other forages when fertility is good. Dry matter production is low, maturity is very early and plants do not regrow well after being grazed. As a result, hop clover is rarely planted in pastures, but it can contribute some forage for grazing and limited amounts of recycled nitrogen. Natural reseeding capability is excellent. Planting rate is 3-4 lb/acre. Improved varieties are not available.

Persian Clover

Persian clover is one of the best clovers for wet, poorly drained soils. It does not tolerate acid soils, and cold tolerance is poor. It is best suited for southern Arkansas. Persian clover is one of the most dangerous clovers for causing bloat and should never be grazed if stands are more than 50 percent clover unless a bloat preventative is being fed. It tolerates close grazing well and has excellent seed production, but a high proportion of hard seeds can make stand regeneration unpredictable from year to year. Seeding rate is 3-5 lb/acre. 'Nitro' is an available improved variety.

Rose Clover

Rose clover is a drought-tolerant species that has been widely used in California for years. A newer variety, 'Overton' (also often referred to as R18), was developed by Texas A&M University and has better adaptation to the rainfall and humidity conditions in Arkansas than do other available varieties. Rose clover is tolerant of poor soil fertility and alkaline

soils, but does not like acid or wet soils. Overton rose clover is a late-maturing clover with good reseeding ability if heads are allowed to mature. It makes a high proportion of hard seeds. In Hope, Arkansas, it appears to be resistant to clover weevils. Rose clover tolerates grazing well. Bloat is not usually a problem when grazing rose clover. Seeding rate is 15-20 lb/acre.

Subterranean Clover

This clover is so named because it buries its seed pods underground. This trait results in excellent reseeding potential. Subclover is a low-growing clover with excellent tolerance to close grazing and continuous stocking management. It has poor cold tolerance and is best suited to use in the southern half of Arkansas. Subclover has a relatively high rate of N fixation under ideal conditions. It is too short in stature to contribute yield to hay crops but can be used to fix N for hay crops. It is a mainstay of the Australian grazing industry, and most available varieties were developed there. A limiting factor to its usefulness in Arkansas is that light August rains often trigger seeds to germinate too early, before adequate moisture is available for growth. As a result, seedlings die. Harder-seeded varieties are being introduced into this country in an attempt to address this problem. This is the most shade-tolerant of the clovers and tolerates some wetness and soil acidity. Subclover can cause bloat. It is the clover most likely to be implicated in phytoestrogen fertility problems in sheep. However, most newer varieties have been bred for lower phytoestrogen content in order to reduce this problem. Planting rates are 10-20 lb/acre. Varieties with proven track records for Arkansas are 'Mt. Barker' and 'Denmark', and new varieties are continually being introduced from Australia.

Clover Establishment

The first step in successful establishment of clovers is proper site selection. Factors such as soil texture and drainage should be considered when matching a clover species to a specific site. Select a site well in advance so weed management and improvements in soil fertility and pH can take place. Weeds should be suppressed using a herbicide with short residual activity such as 2,4-D or Weedmaster.

Soil samples should be collected and analyzed so that any required phosphorus, potassium or lime can be added well in advance of planting. (Refer to *FSA2121, Test Your Soil for Plant Food and Lime Needs*, for information on soil sampling and analysis.) Soil pH should be near neutral (> 6.0). When clovers are to be planted in acidic soils, lime should be applied at least 6 months before seeding to allow the soil pH to adjust. Most clovers respond to improvements in soil fertility. Potassium is a very important nutrient for clovers, and attention should be paid to supplying adequate amounts according to soil test recommendations. Phosphorus should also be applied according to soil tests. Many clover species will respond to boron fertilization at 1-2 lb/acre every one to two years, especially when grown on sandy soils.

Nitrogen fertilizer application to clovers should be avoided as much as possible. When abundant soil N is available, clovers will use that instead of fixing their own N, which reduces one of the benefits of using clover in the first place. Also, when N is applied to grass/clover mixtures, the grass usually responds faster than the clover, which can lead to excessive shading of clover and its loss from the stand. If N fertilizer must be applied to keep grass productive, rates should be kept to 30 lb N/acre or less at each application.

Clovers can be established by broadcasting or drilling seed into a grass sod or following tillage. Establishing clovers by broadcasting following tillage increased the clover stand counts by 41 percent in southern Arkansas. Stand counts were only 50 percent for clovers broadcast onto a mixed grass sod but increased to 91 percent with tillage. Seed should be planted shallow. It can be drilled to a depth of 1/4 to 1/2 inch or broadcast. Seeding rates should be increased by 20 to 25 percent if clovers are established by broadcasting seed. Clover seed should be inoculated with the correct species of rhizobia before planting to ensure good nitrogen fixation potential (see *FSA2035, Forage Legume Inoculation*, for detailed information about legume inoculation).

When interseeding clovers into a sod, it is important to remove existing forage to a height of 3 inches or less.

Seeding in warm-season grass can be done as early as October 1 in northern Arkansas, otherwise October 15 to November 15 when cool nighttime temperatures (50 to 60 degrees F) slow grass growth and reduce competition. Because fescue grows vigorously in the fall, fescue sod must be grazed short or lightly disked to reduce competition before interseeding clovers.

Late-maturing clovers (red or arrowleaf) grown with perennial warm-season grasses will reduce late spring growth of the grasses. Clovers may be shaded out if grasses are allowed to outgrow them, but may improve forage quality over grass alone. Early (crimson) and medium-maturing (berseem and rose) clovers can allow earlier grazing of perennial warm-season grass pastures and will supply nitrogen to the grasses under proper management. Late-maturing clovers grown with cool-season grasses (tall fescue or small grains) can lengthen the grazing season, improve forage quality and reduce the toxic effect of fungal endophytes found in fescue. Low-growing or prostrate clovers are generally more grazing tolerant than upright-growing clovers. Preferred site, soils, climate and management of many common clovers are shown in Table 1.

Many clovers produce a percentage of "hard" seeds that do not germinate immediately after planting. The seedcoat of hard seed is impervious to water, which delays germination for long periods. Hard seed may survive passage through the digestive tracts of animals and can remain viable in soil for 30 years. Delayed germination by hard seed of annual legumes grown in harsh environments helps maintain stands from volunteer seedlings when conditions are not favorable for seed production in a particular year. Clover species that produce a high percentage of hard seed provide more dependable volunteer stands than those that produce more soft seed.

Good stand establishment and forage production depend on a variety of factors including soil fertility, moisture, pH, seed-to-soil contact and inoculation of seed with nitrogen-fixing bacteria. (Refer to *FSA2035, Forage Legume Inoculation*, for information on inoculation of legumes.)

Table 1. Plant characteristics and site requirements for annual and perennial clovers commonly grown in Arkansas

Clover ^a	Plant Characteristics										Preferred Soil Characteristics		
	Common Uses	Seeding Rate (lbs/A)	Reseeding Ability	Cold Tolerance	Relative Maturity	Arkansas Adaptation	Flowering Date	Bloat Potential	pH	Texture	Drainage		
Arrowleaf	Hay/grazing	8-10	High	Good	Late	Statewide	Early June	Yes (low)	5.8-7.0	Sandy Loam to Silt Loam	Good		
Ball	Grazing	2-3	High	Good	Medium	Southern	Early May	Yes (high)	> 6.0	Sand, Loam or Clay	Fair		
Berseem	Grazing	12-15	Low	Poor	Medium	Southern	Mid May	Yes (low)	6.5-8.0	Loam to Clay Loam	Poor		
Crimson	Grazing	15-20	Low	Medium	Early	Statewide	Early April	Yes (medium)	6.0-7.0	Sand to Silt Loam	Good		
Persian	Grazing	3-5	Medium	Fair	Medium	Southern	Early May	Yes (medium)	6.0-8.0	Loam to Clay Loam	Poor		
Rose	Grazing	15-20	High	Good	Medium	Statewide	Late April	Yes (medium)	6.0-8.0	Sand, Loam or Clay	Good		
Subterranean	Grazing	12-15	Medium	Fair	Medium	Southern	Mid April	Yes (medium)	6.0-7.0	Loam to Clay Loam	Fair		
Alsike Clover	Hay/grazing	4-10	Medium	Good	Late	Northern	May-Sep	Yes (medium)	5.8-7.0	Loam to Clay Loam	Good		
Red	Hay/grazing	10-12	Low	Good	Late	Statewide	Mid May-June	Yes (medium)	6.0-8.0	Loam to Clay Loam	Good		
Sweetclover	Grazing/conservation	5-15	High	Good	Late	Statewide	May-Sep	Yes (medium)	7.0-8.0	Loam to Clay Loam	Moderate to Excellent		
White	Grazing	3-5	Low	Good	Medium	Statewide	May-Sep	Yes (high)	6.0-7.0	Loam to Clay Loam	Poor-Good		

^aClovers should be planted between September 1 and November 1 in prepared seedbeds or between October 15 and November 15 when seeded in sod.

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