

Descriptive Information on Cool-Season Forage Legumes



ARROWLEAF CLOVER

Arrowleaf clover is one of the major annual clover species grown in the southeastern USA. It is native to the Mediterranean region, Balkan Peninsula, and areas west and north of the Black Sea. It has large white flowers with a pinkish cast and can grow over 4 ft tall if not grazed or cut. Arrowleaf clover is more sensitive to soil pH than some of the other legumes. It is best adapted to loam and sandy soils with a pH of 6 to 7 but does not grow well on clay or poorly drained soils. Seedling emergence is delayed on soils with a pH below 6 and can be affected by iron chlorosis on soils with a pH above 7. Seedling growth is poor with seedlings staying in a rosette stage until late February. This results in very little forage production until early March. Arrowleaf clover is the latest maturing, and therefore the highest yielding, annual clover with growth

continuing through June and early July if moisture is adequate.

Arrowleaf clover seed are small with 400,000 seed/lb. Because up to 90% of the seed are hard only scarified seed should be planted at 8 to 10 lb/acre. Fall planting should be delayed until night temperatures drop to the low 60's for the best seed germination. Arrowleaf clover is an excellent reseeded but the volunteer stand may be poor the first autumn because of the high hard seed percentage. Planting an additional 4 to 5 lb/acre of scarified seed the first reseeding year will ensure that an adequate amount of soft seed is present to obtain a good stand.

Virus diseases have become a major problem with arrowleaf clover. Leaves of affected plants will be crinkled, have a light and dark green mosaic pattern, and a chlorotic appearance. Root rots have also been a problem. Early symptoms are poor stands in the autumn because of seedling loss. Surviving plants will do poorly during the winter because of root damage and may die when grazing begins. Leaves of arrowleaf clover may turn red because of stress due to disease, low temperatures, or other environmental factors. Plant breeding efforts at the Texas A&M University Agricultural Research and Extension Center at Overton have resulted in new germplasm that has tolerance to bean yellow mosaic virus. Arrowleaf clover seed coated with a fungicide has provided some protection against the root diseases. Early planting from mid-September to mid-October has also improved seedling survival against these diseases.



BALL CLOVER

Ball clover, which was introduced from Turkey, has small ovate leaflets and small white to yellowish-white flowers. If not cut or grazed, stems can grow up to 3 feet and are prostrate to partially erect, often forming a thick mat. This prevents using ball clover for hay and makes harvesting seed difficult. Seed are very small (approximately 1,000,000 per lb) with a recommended seeding rate of 3 lb/acre. Ball clover does best on loam and clay soils but has done well on relatively level sandy soils near creek or river bottoms that maintain good soil moisture. It does not have good drought tolerance, and growth will be reduced in a hot, dry spring. It prefers a soil pH of 6 or higher. Ball clover cannot tolerate wet soils as well as white clover. It is medium maturity, flowering about a month later than crimson with yields usually slightly less than crimson.

Ball clover has excellent reseeding. Hard seed content is about 60% and it will produce some flowers even under close grazing. In 1966, there were an estimated 100,000 acres of ball clover in Alabama. Ball clover does have a high bloat potential and should be managed accordingly.



BERSEEM CLOVER

Berseem clover, also called Egyptian clover, is believed to have originated in Syria. It was introduced into Egypt in the 6th Century and is now grown on half the cultivated land in that country as a winter cover and green manure crop. Berseem clover is also a prominent legume in India. It has oblong leaflets, hollow stems, large white flowers, and can grow up to 2.5 ft. tall. Berseem clover was evaluated throughout the southeastern United States in the early 1950's. Although high yielding, berseem clover lacked cold tolerance. Bigbee berseem, a joint release by the USDA and the Mississippi Agricultural and Forestry Experiment

Station in 1984, has improved cold tolerance. However, even Bigbee berseem is considered less cold hardy than most of the other annual clovers.

Berseem clover is well adapted to river bottoms and clay soils with a pH of 6 to 8. It has persisted in river bottoms that are subject to temporary flooding. If inundated for 4 to 5 days, top growth will die. But after the water drains off, new shoots will develop from the crown. Berseem clover has medium size seed with 207,000 seed/lb. Recommended seeding rate is 12 to 16 lb/acre. Bigbee berseem has excellent seedling vigor with growth 8 to 10 inches tall by December if planted on a prepared seedbed in late September or early October along the Gulf Coast.

Grazing should begin when it is 6 to 8 inches tall to stimulate tillering and limit frost damage. Bigbee berseem clover begins flowering in late April. It does well under irrigation in southern California and is

used as a summer green manure crop in crop rotations in the mid-west. Bloat potential of berseem clover is low but animal losses due to bloat have been reported.



ANNUAL MEDICS

The annual medics are a group of species belonging to the *Medicago* genus that are native to the Mediterranean region. Most species are better adapted to neutral and alkaline soils in low rainfall (<35 in.) areas than most clover species. Lack of cold tolerance limits the northern adaptation of most species. Annual medics produce small yellow flowers that mature into pods. Some of the commonly known species in the USA form spines of various lengths. However, some species have no spines on the pods. Individual plants may produce over a thousand pods.

Burr medic, or burr clover, (*M. polymorpha*) was introduced sometime in the ninetieth century and has become naturalized in South Texas and the West Coast. Burr medic as well as other species of annual medic volunteers on thousands of acres each autumn. Spotted burr medic (*M. arabica*) is more common in the lower soil pH areas. Black medic (*M. lupulina*) is common from South Texas well into Oklahoma. It is the predominant annual medic on much of the blackland soils of Texas. Black medic develops a smooth black cluster of pods with normally only one seed per pod. Button medic (*M. obicularis*) has a large flat smooth pod and is best adapted to the north central Texas. Little burr medic (*M. minima*) has become naturalized in the Texas Hill Country and is a small plant with smaller seed than most medics. The pods have long spines and the plant is very pubescent.

Annual medics are dependable reseeder because of persistent hard seed and excellent seedling vigor. These hard seed remain viable in the soil for long periods of time. Annual medics are grown for forage, as a nitrogen source, and a soil improvement crop. Often times, the annual medics will have a higher protein content and a lower fiber content than clovers, and this contributes to a potential for bloat. However this can be overcome by proper management of livestock and providing other forage to the grazing animals such as frosted mature grass, hay, or planting ryegrass or small grains with the medic. Annual medics are excellent winter forages for domestic livestock and wildlife. In the Midwestern USA annual medics are being evaluated as a summer annual as intercrops for small grains and corn.

'Armadillo' burr medic, a selected ecotype from South Texas, was released in 1998 and is adapted south of I-20 in Central and West Texas. Armadillo performs poorly on sandy acid soils. 'Estes' button medic is currently being marketed for North Central Texas. Several annual medic species are currently under evaluation for potential release to extend the range of use.

CRIMSON CLOVER



Crimson clover is native to Europe and is the most widely adapted annual clover species grown in the southeastern United States. It has scarlet or deep red flowers and is used extensively for roadside stabilization and beautification throughout the southeastern United States. Crimson clover grows on soils ranging from sands to well-drained clay soils with a pH of 5 to 7. Best growth occurs at a pH of 6 to 7. Iron chlorosis has been a problem on calcareous soils at a pH of 7.3 or higher. Recommended seeding rate is 16 to 20 lb/acre. Crimson clover seed is one of the larger seeded annual clovers with 150,000 seed/lb and has excellent seedling vigor.

If planted early, it can produce a substantial amount of forage in the autumn and has earlier forage production than the other clover species. However, winter temperatures about 15°F or lower have caused some top kill that will reduce early spring growth.

Crimson clover is the earliest maturing annual clover. The combination of good seedling vigor and early maturity makes it ideal for overseeding warm-season perennial grasses. Crimson clover is considered a poor reseeder because of hard seed levels of only 10%. Most soft seed germinate with the first rain after seed maturation. Range in maturity of present varieties is about 12 days. Columbus crimson, which is not available at this time, is about 4 weeks later. Early forage production of Columbus is probably lower than the other varieties.

Another variety is being developed at the Texas A&M University Agricultural Research and Extension Center at Overton for growing with annual ryegrass and managed as an annual reseeding pasture. It will flower about 2 weeks later than available varieties and the same time as TAM 90 annual ryegrass. Hard seed percentage will be from 60 to 80% which should provide excellent reseeding.



PERSIAN CLOVER

Persian clover is native to Asia Minor and the Mediterranean region. The actual time of introduction to the United States is not known, but it was found growing in Wilcox County, Alabama in 1923. Common Persian clover has small leaves and reaches a height of 12 to 18 in. with small, light purple flowers. It is found on loam and clay soils, especially in low-lying areas with soil pH of 6 to 8.

Seedling growth is best at a pH of 7 to 8. Persian clover spreads during flooding because the calyx swells at seed maturity and serves as a float, allowing the seed to move to other flooded areas. Recommended seeding rate is 6 to 8 lb/acre. The seed are small with 600,000 seed/lb.

Abon Persian clover, a joint release of the USDA and the Texas Agricultural Experiment Station, was developed at the Texas A&M University Agricultural Research and Extension Center at Beaumont in the early 1960's. Abon Persian clover was selected for improved hard seed production and higher yields. Grazing can begin 4 to 8 weeks earlier in the fall and extend 4 weeks later in the spring than common Persian clover. Abon has larger leaves and taller stems than common Persian and in southeast Texas,

flowers in May and produces mature seed about June 10. Persian clover does have a high bloat potential. Abon Persian would probably not survive temperatures below 10 F. There is no commercial seed available of Abon Persian clover, but seed is available of varieties selected in Australia.



RED CLOVER

Red clover is a weak perennial with stands lasting 2 to 3 years in the northern 2/3 of the United States but usually only 1 year in the Lower South (35° N latitude southward). Red clover is best adapted where summer temperatures are moderately cool to warm with good soil moisture conditions. It prefers loam to clay loam soils as long as they are well drained. It will grow on flat sandy soils (flatwoods) with good moisture. Soil pH needs to be above 6. In the South, red clover reaches a height of 2 to 2.5 ft. with numerous leafy stems rising from the crown. Hairs are present on both leaves and stems. Flower color varies from light pink to rose purple to magenta.

It has a tap root that gives it some drought tolerance.

Recommended seeding rate is 10 to 12 lb/acre planted at a ¼ to ½ in. depth. Red clover will grow into June and July if moisture is available. Cherokee red clover is the only variety developed in the South so it begins spring growth earlier than other varieties. Red clover can be used for both hay and grazing but does not tolerate close grazing.



ROSE CLOVER

Rose clover is native to the Mediterranean region and Asia Minor and is one of the few clover species that is adapted to low rainfall areas. Most of the rose clover acreage is on the California rangelands that receive at least 10 in. of rain during the winter growing season. Overton R18 was selected for climatic and soil conditions in the southeastern US at the Texas A&M University Agricultural Research and Extension Center at Overton. It matures 4 weeks later with twice the production compared to the early varieties grown in California and Australia. Rose clover is adapted to all soil types with a pH of 5.5 or higher but does not tolerate poorly wet soils. Some iron chlorosis

problems have been reported on calcareous soils with soil pH near 8.0. Optimum pH for seedling growth is 6.0 to 6.5. Recommended seeding rates are 12 to 16 lb/acre. Rose clover has a medium size seed with 164,000 seed/lb. Poor seedling growth and nodulation is a major limitation of rose clover that results in later spring growth than the other legume species.

Its greatest success has been in North Central Texas and Central Oklahoma where the annual rainfall is 25 to 30 in., which limits the growth of most other legumes. The good drought tolerance is due to a

deep rooting depth. Rose clover is an excellent reseeder because of a hard seed percentage of 90%. California data have shown that if volunteer clover stands are lost to drought or insects several years in a row, there would still be sufficient hard seed remaining to reestablish the rose clover stand.



SUBTERRANEAN CLOVER

Subterranean clover, also called subclover, is native to the Mediterranean region. Subterranean clover is the common name for three *Trifolium* species, subterraneum, brachycalycinum, and yannicum. Most varieties grown in the United States are subterraneum species. Subclover is best adapted to soils ranging from a fine sandy loam to clay with a pH from 5.5 to 7. Like arrowleaf, it usually becomes chlorotic and stunted on soils with a pH above 7.3. The brachycalycinum species of subterranean clover is adapted to soil pH's above 7.0 but has less cold tolerance. Subclover has a low growth habit which forms a dense sod that seldom exceeds a 10-in. height. Its short height is deceiving. Forage yield of a 5- to 6-in. high subclover pasture is similar to a 12-in. high arrowleaf clover pasture.

Flowering and seed development in subclover are different from other clovers. After pollination, the flower develops in a burr. At the same time the stem bearing the burr bends downward, placing the seed in the soil surface. Therefore, grazing can continue during this time without reducing seed production. In fact, seed production is reduced if subclover is not kept grazed down to a 2- to 3-inch height during flowering. The stoloniferous growth habit of subclover makes it well suited for close grazing animals like sheep, goats, and deer.

With about 55,000 seed/lb, subterranean clover is the largest seeded cool-season annual clover. Therefore, it is quick to emerge and has excellent seedling vigor. Recommended seeding rates range from 16 to 20 lb/acre. However, good stands have been obtained with only 8 lb/ac when planting in a pure stand on a clean, firm seedbed using a drill. Planting depth is critical on subclover. Seed should not be placed deeper than ½ inch. Early forage production is reduced with the lower seeding rates but thick solid stands develop by spring. Near Interstate 10 and south, seedling vigor of subterranean clover is greater than crimson clover. Moving north, crimson clover seedling growth is greater because of better growth at cooler temperatures. Hard seed percentage can be low because of rainfall during seed maturation that results in unreliable reseeding. Reseeding appears to be better on heavy soils than lighter soils.



SWEETCLOVER

Sweetclover is not a true clover (*Trifolium* sp.) but is a *Melilotus* genus. At one time, it was the most widely grown forage legume in the United States. It is one of the most drought-tolerant legumes and was grown for forage and soil improvement, particularly in the Great Plains and the Corn Belt. Sweetclover will grow almost anywhere there is a minimum

of about 17 in. rainfall and soil pH is neutral to alkaline. The three general cultivated types of sweetclover are biennial yellow flower, biennial white flower, and annual white flower. Hubam and Floranna were annual white flower types that were grown in the southern USA. In the late 1940's and early 1950's, over 9 million pounds of sweetclover seed were produced in Texas annually. The advent of cheap nitrogen fertilizer after World War II and the spread of the sweetclover weevil (*Sitona cylindricollis*) eliminated most of the sweetclover acreage in the United States. However, it is still grown in Canada. Both white and yellow flower types are found growing along roadsides throughout the United States.

Sweetclover can be planted in the southern states in October at 12 to 16 lb seed/acre. Successful stands have been obtained in Central Texas when seeded in late January and February. It has a medium seed size with approximately 260,000 seed/lb. Sweetclover plants are 3 to 7 feet tall at maturity depending on variety. Annual sweetclovers are late maturing, flowering from May through June in the southern United States. Sweetclovers contain coumarin that causes a bitter taste to which animals become accustomed. If sweetclover is baled at too high a moisture level, the coumarin changes to dicoumarol, a blood anticoagulant. Cows eating the moldy hay can die of internal bleeding. Genes for low coumarin have been found in a wild sweetclover type but none of the annual sweetclover varieties contain the low coumarin gene. A breeding program has been initiated at Texas A&M University Agricultural Research and Extension Center at Overton to transfer the low coumarin gene to annuals. At this time, only seed of Hubam sweetclover is available.