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FORAGE LEGUMES FOR TEXAS

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Forage legume species are divided into annuals, perennials and biennials, and each of these categories is further divided into cool- and warm-season forages. Annuals germinate, grow, and mature in one growing season and therefore must be established from seed each year. Perennials have the ability to live more than one year under appropriate climatic conditions. They usually go dormant sometime during the year and then initiate new growth from roots, crowns, rhizomes, or stolons. Biennials require two growing seasons to complete their life cycle with the first season devoted to vegetative growth and flowering occurring in the second season. Warm-season annual forages begin growth in the spring and often die in the autumn with the first killing frost. Cool-season annual forages generally begin growth in autumn and develop mature seed in late spring or early summer. A general description of each forage class; description of selected species adapted to Texas and a list of recommended varieties follow.

Cool-Season Annual Legumes

Cool-season annual legumes are the most extensively used legumes in the southeastern United States. They are usually overseeded on warm-season perennial grasses, often in combination with annual ryegrass. In addition to providing forage with high nutritive value during the spring they can add nitrogen to the pasture system through N₂-fixation in association with *Rhizobium* bacteria. Other benefits are spring weed control, nitrogen sources for organic farming systems, and wildlife food plots. They are more soil specific than grasses and generally require a minimum soil pH of 6.0. They must establish from seed each autumn but some of the species have a high percentage of hard seed that permits volunteer reseeding if managed properly.

Annual Medics

The annual medics are a group of species belonging to the *Medicago* genus that are native to the Mediterranean region. They are annual relatives of alfalfa. Most species are best adapted to soils with a pH of 7 and higher and persist in lower rainfall areas than most clover species if rainfall occurs in late autumn and winter. Annual medics are more active winter growers than most annual clovers but most annual medic species also lack cold tolerance which limits their northern adaptation. They produce small yellow flowers that mature into spiny or smooth pods.

Annual medics are dependable reseeder because they produce a high level of hard seed and have excellent seedling vigor. This excellent seedling vigor makes them one of the easiest winter annual legumes to establish. Annual medics can easily establish with a light disking, broadcast seeding, and then dragging the pasture to cover the seed. Annual medics do have a high bloat potential. 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 with the medic. Annual medics are best adapted in Texas to the Blackland Prairie ecoregion. (see Fig. 1; <http://overton.tamu.edu/loverforageres.htm> for Texas ecoregion information)

Burr medic, or burr clover, (*M. polymorpha*) was introduced sometime in the nineteenth century and has become naturalized in South Texas and the West Coast. Armadillo burr medic, was selected from a naturalized ecotype in South Texas, and was released by the Texas Agricultural Experiment Station at Beeville in 1998. Armadillo is adapted south of Waco in Central and South Texas. Recommended seeding rates are 5 to 10 lbs per acre. Armadillo does well when grown with bermudagrass and kleingrass providing the perennial grasses are managed to be grazed short in the autumn to allow the seedlings to establish.

Button medic (*M. orbicularis*) has a large flat smooth pod and is best adapted to north central Texas. Estes button medic is currently being marketed for North Central Texas. A problem that is unique to this species is that the pod is very large and fleshy, and it is highly palatable to deer. Nearly complete removal of all pods has been observed when using this legume in deer food plots.

Little burr medic (*M. minima*) has become naturalized in the Texas Hill Country and has smaller leaves and smaller seed than most medics. The pods have long spines and the plant is very pubescent. Devine little burr medic was released in 2005 by Texas Agricultural Experiment Station at Beeville. Devine originated from a kleingrass pasture near Devine, TX, and is best adapted in the I-35 corridor from south of San Antonio to nearly the Oklahoma border. Recommended seeding rates are 3 to 5 lbs per acre. Devine grows well with most perennial grasses provided the grasses are managed to be grazed short in the autumn to allow the seedlings to establish.

Other annual medics include Barrel medic (*M. truncatula*), Spotted burr medic (*M. arabica*), and Black medic (*M. lupulina*).

Arrowleaf clover (*Trifolium vesiculosum* Savi)

This is one of the major annual clover species grown in the southeastern U.S. Arrowleaf clover has large white flowers that turn slightly pink as they mature and can grow over 4 ft tall if not grazed or cut. This clover is best adapted to well drained loam and sandy soils but is more sensitive to soil pH than other legumes with a preference of 6.5 to 7 pH. Iron chlorosis can be a problem on soils with a pH above 7. Arrowleaf clover is late flowering, and usually the highest yielding annual clover with growth continuing into June if moisture is adequate. Seedling growth is slow with seedlings staying in a rosette stage until late February. This results in very little forage production until early March. Arrowleaf clover has excellent reseeding potential with up to 90% hard seed. Only scarified seed should be planted at 10 lb/acre. Apache arrowleaf, developed at Overton and released in 2001 by the Texas A&M University System, has tolerance to bean yellow mosaic virus disease and is the recommended variety. Arrowleaf clover is best adapted in Texas to the Piney Woods and Post Oak Savannah ecoregions.

Ball clover (*Trifolium nigrescens* Viv.)

If not cut or grazed, ball clover 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 unless it is grazed before flowering. Ball clover has small ovate leaflets and small white to yellowish-white flowers. Seed are very small (approximately 1,000,000 per lb) with a recommended seeding rate of only 2 to 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 can tolerate wet soils but not 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. Ball clover does have a high bloat potential and should be managed accordingly. Since there are no commercial varieties at this time only common ball clover seed is available. Ball clover is best adapted in Texas to the Piney Woods and Post Oak Savannah ecoregions.

Crimson clover (Trifolium incarnatum L.)

This native of Europe is the most widely adapted annual clover species grown in the southeastern United States. Crimson clover has scarlet or deep red flowers and is used extensively as a forage crop and for roadside stabilization and beautification throughout the southeastern United States. This clover grows on soils ranging from sands to well-drained clay soils with 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 is one of the larger seeded annual clovers with 150,000 seed/lb and has excellent seedling vigor. If planted early, it can produce some forage in the autumn and has earlier forage production in the spring than the other clover species.

Crimson clover is also one of the earliest maturing annual clovers. The combination of good seedling vigor and early maturity makes it ideal for overseeding warm-season perennial grasses. Present crimson clover varieties are considered poor reseeder because hard seed levels are only about 10%. Most soft seed germinate with the first rain after seed matures in May. Range in maturity of present varieties is about 12 days. Flame and AU Robin are early varieties and Tibbee and Dixie are late varieties. Crimson clover is best adapted in Texas to the Piney Woods and Post Oak Savannah ecoregions.

Rose clover (Trifolium hirtum All.)

This hardy clover species is native to the Mediterranean region and Asia Minor and is one of the few clovers that is adapted to lower 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 AgriLife 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 drained soils. Some iron chlorosis problems have been reported on calcareous soils with soil pH near 8.0. Optimum pH for seedling growth is 5.5 to 7.0. Recommended seeding rates are 12 to 16 lb/acre. Rose clover has a medium size seed with 164,000 seed/lb. Slow seedling growth is a 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 clovers. The good drought

tolerance of rose clover 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. Rose clover is best adapted in Texas to the Piney Woods, Post Oak Savannah and Blackland Prairie ecoregions.

Annual Sweetclover (Melilotus alba Medik.)

At one time, sweetclover 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. of rainfall and soil pH is 7.0 or higher. 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 AgriLife Research and Extension Center at Overton to transfer the low coumarin gene to annuals. At this time, only seed of Hubam sweetclover is available. Annual sweetclover is best adapted in Texas to the Blackland Prairie ecoregion.

Vetch (Vicia)

There are many different species of vetch including 15 that are native to the US. Cold-hardy vetch species such as hairy vetch are adapted over a wide area of the US. Common vetch is less cold-hardy and is limited to areas with mild winters such as the Gulf Coast area. Vetch is adapted to a wider range of soil types and pH's than most other forage legumes. It grows on sand, loam, and clay soils from pH 5 to 8. It also has excellent seedling vigor because of its large seed. There are approximately 16,000 seed/lb for hairy vetch with a recommended seeding rate of 20 to 25 lb/acre. Optimum planting depth is 1 to 2 inches because of the large seed. Stems bear leaves with pinnate leaflets and terminate in tendrils that attach themselves to stems of other plants. White or purple flowers, depending on the species, are borne in a cluster or raceme. Hairy vetch flowers during April and May. Seed and pod characteristics vary with species.

The main use for vetch is for a green manure crop because it maintains a high nitrogen concentration through plant maturity. A mature crop of hairy vetch will contain about 150 lb nitrogen/acre. Vetch does not tolerate close grazing and should not be grazed shorter than 6 in. Insects are the main disadvantage of vetch. Pea aphids, corn earworm, fall armyworm and spider mites can be problems. The vetch bruchid or weevil destroys the interior of the seed reducing seed yields, which is the main reason for poor reseeding. Hairy vetch is best adapted in Texas to the Piney Woods, Post Oak Savannah and Blackland Prairie ecoregions.

Cool-Season Perennial Legumes

A few cool-season perennial legume species are grown in the southern United States. Their acreage in the southern United States is limited by preference for loam and clay loam soils. Perennial clovers often act like annuals because of poor summer persistence.

Alfalfa (Medicago sativa L.)

The "Queen of Forages" is the best-known forage legume in the United States. Alfalfa is the only forage known to have been cultivated before the era of recorded history. Although classified as a cool-season legume, it grows throughout the summer if moisture is available. Because of this long growing season it has the capacity to produce large yields of high quality forage. Alfalfa is best adapted and grown most extensively in the mid-west US. However, varieties have been developed that are adapted to most climates throughout the United States.

Alfalfa does best on deep, well-drained loam to clay loam soils with a pH of 7.0 or higher. In the eastern half of Texas, the optimum sites are well-drained river bottoms of the

Brazos, Colorado, and Red Rivers. Alfalfa can be grown on any soil with good internal drainage and a subsoil pH of 5.5 or higher. Lime can be added to raise the surface soil pH to near 7 and nutrients limiting for optimum growth can be applied. When sandy acid soils are limed to pH 7, boron is critical for alfalfa if soil boron is less than 1.0 ppm. Autumn planting dates are preferred over spring because of fewer weed problems. Recommended seeding rates are 16 to 20 lb/acre planted at ¼ in. depth in clay soils to ½ in. depth in sandy soils in a clean, firm seedbed.

Alfalfa can be a very profitable forage crop, but it requires a high level of management. Chemical weed control is required to obtain good clean stands. Most disease problems have been solved by selecting for resistance. Alfalfa weevil and three-cornered alfalfa hopper are the main insect problems but all can be controlled with insecticides. Its primary use is hay for dairy cows and horses. With the development of grazing tolerant varieties, more alfalfa is being used for grazing.

For more information regarding alfalfa in east Texas see the following web site (<http://overton2.tamu.edu/soils/alfalfa.htm>).

White clover (Trifolium repens L.)

While perennial in nature, white clover in the southeastern US generally persists as a re-seeding annual. There are small, medium, and large (ladino) white clover types. Although a smaller plant, small and medium types are better seed producers than large types, which is important for reseeded in the south. Recommended varieties are Louisiana S-1 and Durana. White clover requires good soil moisture, is usually found on clay loam, bottomland soils, and is not productive under droughty, upland conditions.

White clover is often planted at 3-4 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 legume species. Because it is often found on wetter sites, white clover may survive a drought 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 at a 4 to 6 inch height to prevent competition for sunlight from becoming a limiting factor in white clover production. When cattle graze pure stands of white clover, bloat potential may be reduced using Bloat Guard blocks, feeding grass hay or grown in grass mixtures. White clover is best adapted in Texas to bottomland sites in the Piney Woods, Post Oak Savannah, Blackland Prairie and Gulf Prairies ecoregions.

Warm-Season Annual Legumes

Both annual and perennial warm-season legumes are used more for wildlife than livestock. It is difficult to grow warm-season legumes in association with warm-season perennial grasses because the warm-season grasses are so well adapted and competitive.

Cowpea (Vigna unguiculata)

This species is an annual viney plant with large leaves; and fairly tolerant of drought, heat, low fertility, and moderate soil acidity. Cowpeas, however, do require adequate levels of P and K to be productive. Forage nutritive value is generally high and plants are easily established from May through June. Many times cowpeas are used as a warm-season food plot for white-tailed deer to offset the negative effects of summer stress. Cowpeas do not cause bloat in ruminants, but are not found immediately palatable by cattle. Iron & Clay is an old forage-type cowpea cultivar (technically a variety mix) that remains vegetative during most of the summer and flowers in early September. Iron & Clay is the recommended cowpea cultivar for East Texas. Current cultivars of forage cowpeas are best adapted in Texas to the Piney Woods and Post Oak Savannah ecoregions.

Lablab (Lablab purpureus)

This tropical legume is tolerant of drought, heat and a variety of soil conditions, but not including wet, poorly drained soils or heavy clay soils. Forage nutritive value is high, similar to cowpea, with leaf protein ranging from 24 to 28%. Lablab is more tolerant of defoliation than cowpea or soybean. Generally, lablab is more palatable to cattle compared to cowpeas. Rio Verde lablab was developed through selection for tolerance to defoliation, forage production potential and Texas seed production. This new lablab cultivar was developed at Overton, Texas and released by the Texas Agricultural Experiment Station (TAES) in 2006. Rio Verde is the first lablab cultivar developed in the US and also has the value-added trait of Texas seed production.

Rio Verde lablab is adapted to sandy, sandy loam, clay loam and clay upland soils of the US southern region, including the following regions of Texas: Pineywoods; Gulf Prairies and Marshes; Post Oak Savannah; Blackland Prairies; Cross Timbers and Prairies and South Texas Plains. In the lower rainfall areas of the Cross Timbers and the South Texas Plains, irrigation may be required for establishment. In northeast Texas the primary growing season for Rio Verde lablab is June through October.

Soybean (Glycine max)

This temperate grain legume can be used as a grazing and hay crop. Soybean is not as tolerant of heat and drought as cowpea and lablab and does not regrow well after defoliation. Soybean is better adapted to heavy clay soils and wet soils relative to cowpea and lablab. Late maturing types are best suited for grazing or hay crops.

Warm-Season Perennial Legumes

Bundleflower (Desmanthus)

There are several species of bundleflower that are native to Texas and surrounding states. Two species have been commercialized for use in Texas. Sabine Illinois bundleflower (*Desmanthus illinoensis*) is adapted to North and Central Texas from about Austin northward. BeeWild bundleflower (*D. bicornutus*) was developed by the Texas Agricultural Research Station at Beeville and released by the Texas Agricultural Experiment Station in 2003. BeeWild consists of four (4) different cultivars that are produced as monocultures for seed production purposes, and then blended to produce BeeWild. The four different cultivars have a 100% range in seed size, and a broad range in flowering and seed maturation time. BeeWild is best adapted south of Waco, TX . All bundleflowers are poorly adapted to acid sandy soils, so their use is restricted to soils that are sandy clay loams and heavier with a pH near neutral and above. All bundleflowers contain tannin which reduces palatability and essentially eliminates the potential for bloat. Recommended seeding rates for bundleflower is 3 to 5 lbs per acre. Seeding into prepared seedbed is the preferred method of establishment, but successful seedings can be made following glyphosate treatment of the associated grass. Bundleflower is very sensitive to seeding depth, and should be seeded no more than ¼ inch deep. On prepared seedbed, broadcast seeding followed with dragging or cultipacking has been very successful. Bundleflower likes warm temperatures so April and May seedings are preferred.

Figure 1. Gould Texas Ecoregions.

