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Introduced Forages for South and South Central Texas

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Introduction

Soil texture, pH, rainfall, temperature and expected use of the forage are variables that determine forage adaption, variety selection and production potential. The weather pattern in South Texas are humorously described as being in a constant drought, broken only by occasional rainy periods. Spring and fall are the most consistent rainfall periods with occasional tropical storms in the summer and rainy periods along the coast in the winter. Weather and soil pH generally define South Texas as the area from San Antonio southeast to Victoria, south to the Rio Grande Valley northwest to Del Rio and back to San Antonio. Annual rainfall ranges from above 35 inches along the coast to as little as15 inches in the western portion of the state. Winters are very mild with few periods of extended freezing temperatures.

South Central Texas includes the area from about Luling, east of San Antonio - west to Del Rio - north east through the Hill Country to Austin - and south to Luling. Temperatures are much colder, however rainfall is similar to South Texas and ranges from 35 inches in the east to 15 inches in the western area. Droughts are common in both regions, and irrigated forage production is seldom practical due to the high cost of irrigation. When irrigation is used, forage types and species may change to higher yield potential types.

Soils in both regions range from poorly drained, cracking clays to moderately well-drained loams and silty clay loams to sands. It is also common to have as much variation in soil characteristics within a field or pasture as within a farm/ranch or county. Soil pH is generally above 7, and in caliche outcrop areas may be as high as 8, while there are some areas where the pH will be below 6. Some saline areas are prevalent and require special species selection. In western parts of South Texas and the Hill Country (west of I-35) the central part of the region is interspersed with large areas of caliche outcrops. Where rainfall is adequate or irrigation is available, the best soils are farmed with traditional crops such as sorghum, corn, cotton and small grains.

Many soils of the region contain adequate potassium (K_2O) for pasture species. Clayey soils hold nutrients better than sandy soils and may have adequate levels of both phosphorus and potassium. However, many higher rainfall and sandy areas will have inadequate levels of phosphorus (P_2O_5). Unless a soil is deficient in phosphorus, grasses often do not respond to P fertilization. Experience has shown that in areas where rainfall is sufficient for growth, additional P_2O_5 must be applied or stand density and production will be reduced.

The amount of fertilizer needed to maximize forage production will change depending on whether the field is used for grazing or hay production. Grazing removes fewer nutrients than haying. Most grasses will require a source of nitrogen in areas of high rainfall or irrigation. It may be pos-

sible to supply some, if not all, of the nitrogen with legumes in areas where they will grow.

Most grasses grow well in a wide range of soils and weather conditions, but the requirements for clover are more specific. Many species of clover require acid soils (below 7), while others require alkaline soils (above 7). On high pH soils (over 7.5), micro nutrient deficiencies such as iron chlorosis are a problem with some legume species. The only practical solution is to plant a tolerant species that has an adaptive mechanism for acquiring the micro nutrients needed for growth. Clovers need adequate moisture for establishment and growth or they will fade out during periods of drought. In regions where rainfall amounts are over 30 inches, clover will provide sufficient growth to be grazed. Areas that receive less than 25-inches of rainfall annually, or on shallow, droughty soils, clover stands or production will be disappointing. These requirements generally limit the use of clovers to areas east of I-35 north of San Antonio and east of Highway 281 south of San Antonio.

Adapted Improved Forages

Selecting and establishing forages can be risky. Many forages are somewhat difficult to establish from seed, sprigs or tops and stands can be lost in a single season if mismanaged or if growing conditions are poor. Environmental factors must be considered and matched as closely as possible to the requirements of the forage. Some forages have very specific soils restrictions. Some have fairly definitive rainfall requirements for both establishment, production and stand persistence. Many species have some restriction on how much cold temperature they might withstand before they freeze and are killed. Likewise, there are many non-adapted species that will not tolerate the duration of our high temperatures. A forage advertised as an excellent cultivar in one southern region may be totally unsuited for South and South Central Texas.

In South and South Central Texas, introduced forages include perennial and annual grasses and legumes, but most common are perennial warm-season grasses. One or more varieties of buffelgrass, bermudagrass, kleingrass, Old World bluestem, and Wilman lovegrass will make up the majority of the land area planted to introduced species. The most commonly planted winter annual grasses are oats, ryegrass, wheat and annual forage sorghum during the warm season.

Legumes are not extensively used because of their expense and poor seed production, but there are annual and perennial legumes that are used by some producers who are willing to impose the extra management necessary to be successful. Legumes require in excess of 30 inches of rainfall for their survival and production and are generally limited to the area east of I-35 in Central Texas. There are a small number of producers growing warm-season legumes such as lablab and shrub-like legumes such as leucaena and bundleflower for wildlife food plots. Winter annual legumes have a longer history of use.

There is a group of annual legumes that are common enough in the southern region that many people think they are native to the state. These are the annual medics . . . annual relatives of alfalfa. One of the most common of these annual medics is burr medic (commonly called burr clover). This persistent group of legumes is not native to Texas, but it has adapted well enough that it has become naturalized and can be found along roadsides, in lawns, and in pastures in spite of the poor management imposed. Extensive testing at the TAMU Beeville Research Station and testing in regional plots have shown that annual medics are widely adapted to the region where rainfall is adequate. The annual medics should enjoy widespread acceptance as we learn more about each species and develop the data needed to release one or more varieties of each species.

Species Adaptation

Buffelgrass (*Cenchrus ciliaris*) is the most widely grown introduced warm-season perennial grass in the South Texas region due to its excellent drought tolerance, forage production, and proven adaptability to the semiarid areas. Because of its lack of cold tolerance, Highway 90 is generally considered the northern boundary of 'Common.' Common buffelgrass dominates about 2 million acres or 99% of the acreage planted to this grass in the region. Hybrid varieties ('Nueces' and 'Llano') have produced 30% more forage than Common. Unfortunately, low seed production and seed quality of these hybrids has discouraged seed companies to the point that currently there is no certified Nueces or Llano buffelgrass seed produced. Another recently named cold tolerant variety from Texas A&M is 'Frio' (cold in Spanish) and is still being evaluated.

In 2000, G.E. Pogue Seed Co. Inc., released two new varieties of buffelgrass that are presently resistant to the Buffelgrass Blight. These two new varieties are actually mixtures of several lines and are named "Laredo" and Pecos" . "Pecos" is reported as a more cold hardy release than "Laredo". There has not been sufficient cold weather the past several years to test their lower limits, but "Pecos" has survived well in areas near Ft. Stockton and Abilene.

The advantage buffelgrass in the semiarid region cannot be capitalized on if one cannot get a good stand. Buffelgrass is difficult to plant due to the nature of the seed; it is lightweight, fluffy with long awns or bristles, and bridges over in standard seed metering devices. These seed traits have also been responsible for some of the negative characteristics of this grass in relation to bird habitat and food. Recently, a dehulling process has been perfected that removes the fluffy awns from the seed ("Pogue Process", G. E. Pogue Seed Co. Inc., Kenedy, TX). This process allows for a more precise metering of seed, including aerial application, and more precise planting using standard seed drills. Dehulled seed usually results in much improved stands compared to awned seed. Dehulled seed can result in 800 to 1000 lb/acre advantage in forage because of earlier establishment, increased vigor, and higher stand densities. For all the desirable attributes of dehulled seed, there is one potential negative attribute. All seeds germinate rapidly, which leads to a higher percentage of seed to germinate at once. If conditions are unfavorable for continued growth after germination, the entire planting may be lost and must be replanted.

A disease was observed in Mexico and South Texas as early as 1990, that caused reduced forage production, low viable seed and even death when severe. *Pyricularia grisea* is a highly variable pathogen and differential responses to infection have been found among different plants. Preliminary molecular fingerprint analysis has revealed up to 15% variation within locations sampled and 50% variation between locations and years in this pathogen. The widespread use of a monoculture of Common buffelgrass and the alternate cycles of Buffelgrass Blight epidemics and severe drought conditions are devastating to pastures. Cattle producers have reported severe stand losses of buffelgrass in South Texas. As a result of this problem, public and private research efforts are underway; and in the near future, blends of several disease resistant strains and hybrids will be released to better manage Buffelgrass Blight.

Bermudagrass (*Cynodon dactylon*) is the most widely grown introduced warm-season grass in the Southeastern U.S. including Texas, but it occupies a small total acreage in South and South Central Texas. Bermudagrass is a favorite of many cattlemen for hay and should be considered as and managed like a "crop." Consistently, most wildlife managers would prefer some other species since bermudagrass lacks seed production and produces a dense mat of grass. Bermudagrass is well adapted to the wetter part of the region, but requires large amounts of nitrogen fertilizer to be productive. This problem can often be alleviated by growing winter annual legumes with bermudagrass where adequate rainfall or irrigation is available. Bermudagrass can take abuse through heavier grazing pressure and survive than most other grass grown in the region. Often, overglaze bermudagrass becomes very weedy, and different levels of renovation is required to restore the pasture to its productive potential. Bermudagrass does not tolerate shade, so productivity is severely depressed when weeds are allowed to dominate.

There is a long list of available varieties, but for South Texas, 'Coastal' is the most widely used. In evaluation trials including most varieties available to producers, 'Tifton 85' has been shown to be an improvement over Coastal. It was selected for improved quality and yield, and once established, it has been found to be extremely drought tolerant. The disadvantage to Tifton 85 has been the price of the sprigs (released in 1991), and it is somewhat more difficult to establish. The latest approach to overcoming the problem with establishment has been to firm the soil with multiple passes of a good roller after sprigging. Tifton 85 tends to have larger stems and is coarser than Coastal which makes it objectionable to some horse producers when used for hay.

'Jiggs', a private release in 1989, seems to have some advantage in the heavy clay soils in the Victoria area. It is easier to establish than Tifton 85 and spreads rapidly by runners. However, it is also susceptible to some leaf diseases during rainy periods or in the more humid regions. This problem could get worse as more acres of Jiggs are planted. Tests and producer experience in the Uvalde area have shown it is an excellent choice under center pivots for hay or grazing. Jiggs is presently being grown successfully in the Rio Grande Valley and should be considered for irrigated, intensively managed pastures along the Rio Grande.

'NK-37' or 'Giant' has the advantage that it is seed propagated; however, the seed is expensive and some seed sold as NK-37 is contaminated with common bermudagrass. It is generally less productive than other bermudagrasses. The publication B-6035 Forage Bermudagrass: Selection, Establishment, and Management describes bermudagrass production in greater detail.

Kleingrass (*Panicum coloratum*) is well adapted to the region. Two varieties are available, with the main difference being seed size. 'Selection 75' was formally released in 1969, but was available for at least 10 years before it was released. 'Verde,' released in 1982, was selected for its larger seed to aid in improved establishment and to be more useful as a game bird food. The advantage of a larger seed in establishment has not been great. Kleingrass is more productive than bermudagrass in South Texas when the two are not fertilized, or when low rates of nitrogen fertilizer are utilized. Kleingrass seems to grow in slightly cooler temperatures in the spring and autumn. Being a bunch grass, it is compatible with winter annual legumes like annual medics which grow between the clumps. Kleingrass responds to drought by phasing into a dormant state. Under irrigation, kleingrass may require more water than bermudagrass to be productive in mid-summer. A thin stand of kleingrass can be encouraged to thicken by light-to-moderate cultivation.

Currently, there are several kleingrass lines being tested for potential release; each has been selected for one or more traits that are lacking in current varieties. Kleingrass has some antiquality compounds that makes it a potential problem for horses as well as sheep and goats (big head disease). The plant can contain compounds in new growth after a drought that cause a condition known as photosensitivity. No similar problems have been documented with cattle or wildlife.

Old World Bluestem is the common name of a number of species and even genera of plants that were introduced from the Middle East, southern Asia, and Africa. The majority of the varieties that perform well in South Texas belong to *Dichanthium annulatum* ('Kleberg', 'PMT-587', and 'Pretoria 90') and *D. aristatum* ('Gordo' and 'Medio'). Gordo and Medio prefer higher rainfall areas. Other varieties that are also called Old World Bluestem belong to the genus *Bothriochloa*. The new variety 'WW-BDahl', released in 1994, is *B. bladhii* and is adapted in all South and South Central regions of Texas and looks promising. It has looked good in producer fields in the Uvalde and Hill Country region. WW-BDahl is an aggressive, rapidly spreading grass.

Those varieties belonging to *Bothricochoa caucasia* (Caucasian bluestem) and *B. ischaemum* ('King Ranch', 'Plains', 'WW-Iron Master', and 'WW-Spar') do not perform well in South Texas. These plants are very stemy and do not produce the quantity or quality of forage when grown in the southern and central regions of Texas.

Seed harvest is generally difficult with many of these varieties because of the indeterminate or continual flowering which results in only a small portion of viable seed at a given time. Because of this problem, commercial seed of Pretoria 90 is no longer available in Texas. Pretoria 90 is less winter hardy than other *Dichanthium* varieties and its use should be restricted to the lower third of South Texas. Gordo and Medio are best adapted to heavy soils which may experience periodic flooding. They produce well in the blackland soils from San Marcos southward. Kleberg and PMT-587 perform well on sandy clay loam and clay loam sites in the 25 plus inch rainfall areas of South Texas. Kleberg also performs well in the dryer western areas of these regions including the Uvalde area.

Wilman Lovegrass (*Eragrostis superba*) is a perennial warm-season grass that has excellent establishment characteristics. It is well adapted to most soils, including sandy soils in the area receiving less than 30 inches of annual rainfall. 'Polar', released in 1972, is the only variety available. It is often planted in mixtures with kleingrass to enhance early stand establishment. Unlike many of the other lovegrasses, Wilman lovegrass is quite palatable. If it is allowed to be grazed too close without producing seed, it will not persist in pastures.

Blue Panic (*Panicum antidotale*) is a robust warm-season perennial grass that is sometimes used in planting mixtures with other grasses. With adequate water, it can grow to a height of 7 feet with hard cane-like stems up to ½ inch thick. Blue panic has a large seed and establishes easily, but do not expect it to persist under heavy grazing. Common seed is available for those interested in including it in a mixture.

Rhodesgrass (*Chloris gayana***)** is a seed-propagated warm-season perennial grass with limited winter hardiness. Hence, it is used only in South Texas. The plant spreads by seed and stolens to fill in open spaces. 'Bell', released in 1966, is used to vegetate saline sites in South Texas. Rhodesgrass is somewhat unpalatable, so it is not well suited to mixtures; but if livestock are not given a choice,

they will consume it and perform well.

Forage sorghum, sudangrass and sorghum sudan hybrids (*Sorghum bicolor*) are summer annual grasses often planted for hay and sometimes for grazing. They can produce a modest amount of forage quickly with a limited amount of water. Forage sorghums are best used as a hay crop and are not a good substitute for perennial grass pastures for grazing. (See L-5219, Managing for High Quality Hay) Because of land preparation and fertility requirements, they are expensive to produce every year.

It is difficult to make even moderate quality hay unless it is cut at the proper time and adequately fertilized. In high rainfall areas, it does not store well outside in round bales. Sorghums are subject to both nitrate or prussic acid poisoning problems under certain circumstances (See L-5231, Nitrate and Prussic Acid Poisoning) . Much forage sorghum is cut when it is too mature and nutritive value is lost due to poor management or to weather complications. There are other varieties too numerous to list .

There is one relatively new innovation in forage sorghums, and that is the development of varieties that will not flower if planted after a certain date in the spring. This prevents flowering, but does not prevent maturation of the tissue. So even though the plant does not flower, it can still be of poor nutritive value if it is grown too long before it is utilized for hay or grazing. These plant types are well adapted to intensive grazing programs, because unlike most varieties they will regrow better after defoliation, providing that you do not let the plant reach maturity.

Sorghum Almum (*S. almum*) is a natural perennial hybrid between *S. bicolor* and *S. halepense* (Johnsongrass) that has rhizomones like Johnsongrass, but does not have sufficient winter hardiness to perennate in most of the region. The seed shatters readily, making it a good food source for game birds. Many pounds of sorghum almum seed is sold each year for use by livestock and wild game managers. It is also used as a "filler" when planting grass seed for quick establishment to hold water and provide for erosion control. When grazed, it will slowly decline over a period of several years.

Pearl millet (*Pennistum americanum*) is another summer annual grass that resembles forage sorghum in growth habit, but has not proven to have any real yield or quality advantage over dryland forage sorghums in this region. Pearl millet is more sensitive to cold stress during germination and early seedling growth than are the sorghums. Temperatures in the 40 to 50^{8}F range can kill pearl millet seedlings. Pearl millet is smaller than sorghum seed and is preferred by birds. Since pearl millet is not a member of the sorghum family, it does not have problems with prussic acid poisoning. However, pearl millet can still accumulate nitrates to toxic levels under certain conditions. Like forage sorghums, the trait which prevents flowering has recently been added to at least one pearl millet variety.

Oat (*Avena sativa*) is the most widely used winter annual grass in the southern region. Oat is well adapted to this environment, and seed will emerge from deep planting. Another advantage of oat, the husk prevents the seed from trying to germinate when there is inadequate moisture in the soil. There is a long list of available varieties, but leaf and stem rust attacks most varieties and limits the productivity. Rust is most prevalent in wet years when the potential for production is the greatest. 'Coronado' is the one variety that has lasted longer than most in the region; but it has become susceptible to a new race of rust. 'TAMO 397' is a new release from Texas A&M which has performed well in plantings throughout the region. It is also highly resistant to the present races of rust.

Oat can be planted in September or October to provide early winter grazing. It is more productive than wheat in the early part of the season. It is generally recommended that producers overseed oat plantings with 10 to 15 lbs/acre of a good ryegrass variety to extend the spring grazing period and to provide forage when oat is winter-killed in those periodic cold winters. Oat should be planted 1.5 to 3 inches deep depending on the soil texture, soil moisture, and time of the year. Because of the small seed size, ryegrass should not be planted more than 3/4 to 1 inch deep, so you **cannot mix** the seed in the planter. Plant the oats first, then make a second trip over the field and plant the ryegrass since it is planted more shallow. Oat is widely used in dryland plantings, but is more productive in irrigated sites, especially if mixed with ryegrass.

Ryegrass (*Lolium multiflorum*), or more correctly annual ryegrass, is one of the most widely used winter annual grasses in the USA. It has only been in the last decade or so that the value of ryegrass in South Texas has been realized. Our experience at the Research Station at Beeville has been that ryegrass will out yield oat or wheat in 8 out of 10 years. Ryegrass must be irrigated and closely managed in western areas that receive less than 30 inches of annual rainfall. The advantage to ryegrass over oat

comes later in the growth cycle. Oat will usually outfield ryegrass when compared in the first harvest because oats come up and grow quicker than ryegrass. Oat also head out sooner in the spring, while ryegrass continues to grow often for another month longer. Ryegrass is best used on cultivated land. Its potential as an overseed crop on perennial warm-season grasses is limited to the higher rainfall areas. Some cultivation of the perennial grass is needed at planting time to get good soil contact of the ryegrass seed.

Another reason overseeding ryegrass on perennial grasses does not work here without cultivation is direct competition with the warm-season perennial grass for water, light, and nutrients. With warm weather in the fall, if enough nitrogen is applied preplant to stimulate the ryegrass, the perennial grass will try to grow and become even more competitive. Fertilization should be delayed until the ryegrass has germinated and warm season grass growth has diminished. There are subtle differences among varieties, and most are limited in yield by lack of rainfall and nitrogen fertilizer. In South and South Central Texas, there are differences among varieties for disease resistance and for winter growth. Disease resistance is a must.

Varieties that are advertised as having good winter hardiness will yield less in mid-winter, because the winter hardiness is associated with reduced winter growth. We recommend that you use a variety that has been tested and evaluated under your conditions. 'Gulf' ryegrass will grow here, but one of our concerns is that very little of the ryegrass seed sold is certified; hence, there is little quality control with seed differences from year to year. If ryegrass is used in an intensively managed (and particularly in irrigated) grazing systems, the extra money for a named cultivar with known characteristics is usually a better buy.

Wheat (*Triticum aestivum*) is a winter annual grain crop that is also used for forage. In South Texas there is little advantage to wheat as a forage crop. The potential to graze wheat in the winter and harvest grain in the spring has not proven to be reliable in South Texas. However, in the northern areas of the Hill Country, wheat has the cold tolerance to survive cold winters when oats often freeze out. Winters in most years north of Highway 90 are cold enough to cause most wheat varieties to initiate heading (vernalize), so it will produce grain if not grazed out. However, it will produce less forage than oats and ryegrass.

Triticale (*Triticum secale*) is a hybrid between wheat and rye (*Secale cereale*) and was developed to provide an improvement in forage characteristics over either of the parents. The current varieties have shown little merit in South and South Central Texas as they were developed for the central USA. Another weakness of triticale is that the seeds will try to germinate when there is insufficient soil moisture to support seedling growth and development. Hence, seeds can germinate and die unless the field is irrigated or you wait to plant until after a good rain.

Legumes

Alfalfa (*Medicago sativa*) is a perennial cool-season legume that is planted on limited acreage in the Rio Grande Valley area under irrigation. It uses up to 72 acre inches of water under irrigation, depending on the growing season and number of cuttings. Since adequate water is available only along the Rio Grande Valley, it is seldom planted in South Texas. The high irrigation amounts can be used more efficiently on grasses. Non-dormant alfalfa varieties developed for use in southern California and other similar locations will work equally well in the area. Cotton root rot is one of the limiting factors for longevity of stands. Expect 2 to 3 years of production before significant stand loss from cotton root rot damage.

Sweetclover (*Melilotus alba*) is a legume with a long history of use in South Texas. The variety 'Hubam' is produced and sold by a number of farmers and seed producers in Texas. This plant grows best with oats and other winter annual grasses, as it does not produce a good natural reseeded stand without cultivation. Hubam is a tall growing, stemy plant that often produces more dry matter than is utilized by the grazing animal. Hubam is **not** highly palatable, and the forage is not fully utilized by grazing animals. It does not make good hay if allowed to become mature.

Clovers (*Trifolium* sp.), (and true clovers) have a very limited use in South and Central Texas. None reseed well and many are susceptible to iron-deficiency chlorosis. Red clover (*T. pratense*) is used to a limited degree near Victoria for hay. Red clover is resistant to iron-deficiency chlorosis. The variety 'Cherokee' was developed in Florida for winter growth and has shown the greatest promise.

Berseem clover (*T. alexandrum*) has the greatest growth potential of any clover we can grow in the southern regions, but also has the least drought tolerance. Berseem

is recommended for irrigated, high rainfall or flood prone areas of South Texas. Varieties that perform well include 'Bigbee', 'Multicut', and 'Burton'.

Subterranean clover or subclover (*T. subterraneum*) has a long list of varieties, but only a short list of varieties that are resistant to iron-deficiency chlorosis. The recommended varieties with resistance include 'Clare' and 'Koala'. These subclovers are well adapted to the areas that receive at least 28 inches of rainfall and usually produce sufficient seed to regenerate naturally, even under grazing; but the seed usually does not persist until the next growing season.

Crimson clover (*T. incarnatum*) has great seedling vigor; and even though it is only moderately resistant to iron-deficiency chlorosis, it usually grows quite well in South Texas. One area crimson clover may be used is blends. Seed prices of crimson clover have historically been lower than competing legumes, but may be the most expensive clover due to seeding rate. A number of varieties of crimson clover, including 'Dixie', 'Tibbee', and 'Flame', have worked well at the Research Station at Beeville.

Ball clover (*T. nigrescens*) is relatively new to the testing program at Beeville. Only common seed (unnamed variety) is available. The seed size is very small. At this point, producers are encouraged to try ball clover only on a small scale in South Texas.

Annual Medics (*Medicago* sp.) are annual relatives of alfalfa and that are resistant to iron-deficiency chlorosis. This genus has a large number of species, several of which have a potential for use in South Texas. With over 15 years experience with some of these species, they have been found to grow well in mixtures with perennial warm-season grasses and with winter annuals like oats and ryegrass.

Barrel medic (*M. truncatula*) has a couple of varieties developed in Australia that performed well in the region for several years. 'Jemalong' barrel medic is an old variety, which is currently recommended for areas south of Austin. 'Parabinga' barrel medic is a newer variety that has excellent winter growth; however, this excellent winter growth also makes it susceptible to frost/freeze damage. Parabinga barrel medic should be planted in areas south of Bee and Goliad counties. Most other varieties do not have sufficient frost tolerance to be reliable in the northern part of the region. Additional barrel medic varieties are being evaluated for use in South Texas.

Burr medic (*M. polymopha*) is also known as burr clover. This plant was introduced into Texas over 100 years ago and has become naturalized. It can be found from the Rio Grande to nearly Dallas. In 1998, the Texas Agricultural Experiment Station released 'Armadillo' burr medic which was selected by Dr. Ocumpaugh. Armadillo was developed from a naturalized stand of burr medic collected at the Research Station at Beeville. Armadillo is readily consumed by domestic livestock and several wildlife species, including deer. Armadillo burr medic has consistently produced 4,000 lbs/acre of dry matter in the 30-inch rainfall zone, reseeds extremely well, and spreads to adjacent areas. Armadillo has a very high level of hard seed (most of the seed will not germinate in a single year, which will enable Armadillo seed to survive in the soil for years). Evaluations are continuing to determine the limits of adaptation of this variety. It prefers more than 30 inches of annual rainfall, high pH soils, including the sandy clay loams and clay soils of Central and South Texas. Its southern and western region of adaptation is still unknown. The present adaptation zone is believed to be south of I-20, which is the northern limit. Certified Armadillo is being sold by a number of seed vendors.

A button medic (*M. obicularis*) variety released by the Texas Research Foundation at Renner, TX in the mid-1950's was lost and then re-discovered a few years ago. The re-discovered button medic was harvested from a wheat field in Fisher County northwest of Abilene, TX, and is being marketed by Turner Seed Company as 'Estes' button medic. In South Texas, it is extremely susceptible to powdery mildew and flowers too late to be a good reseeder. However, it seems to have a place on heavier soils of the northern half of Texas. Evaluations are underway with some elite lines of button medic from Australia, and some look promising.

Black medic (*M. lupilina*) is also adapted to some parts of the region. There is one commercial variety, 'George', released from Montana, but it is not adapted to South Texas. Several naturalized selections are currently being evaluated throughout Texas and Oklahoma. Two selections of black medic, one selected at Beeville and one selected at Dallas, are currently under first stages of seed increase. Black medic will extend the northern limit of annual medic adaptation. Naturalized stands are present in much of the region from south of Beeville to well north of the Red River. Black medic bares its fruit in a smooth pod

with one or sometimes two seeds per pod; hence, it can easily be consumed by birds. A variety for Texas is a few years away yet.

In 1998, seed from a naturalized stand of *M. minima*, or small burr medic, was harvested from a pasture near Devine, Texas. Like the black medics, research is continuing as seed is increased and plants are evaluated from this naturalized species at several locations in Texas and Oklahoma. This plant seems to be better adapted to the sandier, better drained sites than the other medics that have been evaluated. It is hoped to be a legume for the drier regions. It will not produce as much forage as Armadillo burr medic, but it matures later and appears to be adapted further north and west than Armadillo. A variety of little burr medic is several years away.

Shrubby Legumes

Bundleflower (*Desmanthus* sp.) is a warm-season perennial legume native to South Texas and to a large part of the Americas. In 1993, the Research Station at Beeville started an evaluation program of the USA and Australian Plant Introduction collections. Australia had also released three varieties of prostrate bundleflower (*D. virgatus*, 'Uman', 'Bayamo', and 'Marc') in that same year. These varieties and part of the Plant Introduction collection were evaluated and resulted in the identification of **four** lines (BEDES-06, BEDES-08, BEDES-37, and BEDES-57) which are currently under testing throughout South Texas. Of the released Australian prostrate bundleflower varieties, Bayamo looked best at Beeville, but is not as good as the four lines selected in South Texas. Uman will likely be useful in the Rio Grande Valley, as it flowers late and has limited winter hardiness. The Beeville Experiment Station lines produce an abundance of large seed and the seedlings have excellent vigor. They also have sufficient winter hardiness to grow and produce seed throughout the region and have adequate hard seed content to persist in the soil and regenerate a stand. All bundleflower lines are tolerant to iron-deficiency chlorosis. It is believed that this species will prove to be an excellent legume for both wildlife (for food and cover for birds and deer) and domestic livestock grazing. Two of the four lines were evaluated in deer forage experiments this summer. Observations confirm that at least one of the two is readily consumed by white-tailed deer. Plans are to evaluate all four lines for deer during the summer of 2000. There was sufficient seed produced in 1999 for multi location evaluations for wildlife and domestic livestock throughout the region in 2000. A release containing some combination of selections as a blend will be made as soon as adequate testing is completed.

'Sabine' Illinois bundleflower (*D. illinoensis*) is **not** adapted to South Texas.

Leucaena (*Leucaena* sp.) is another warm-season perennial legume that is native to South Texas and the Americas. The best variety seems to be 'K-636'. The biggest weakness of this group of plants appears to be poor seedling vigor. A number of producer fields have been established by transplanting seedlings. The plant has its greatest potential for use as wildlife forage . This plant is very drought tolerant and is resistant to iron-deficiency chlorosis.

Other Legumes

Lablab (*Lablab purpueus*) is a warm-season annual legume that is being sold and used for wildlife forage. Careful attention must be given to proper planting procedures or its performance will be very disappointing in the lower rainfall areas. The high cost of annual establishment limits its use to small wildlife use plantings. The plant is so palatable that wildlife managers find that they have to fence the deer out each year during the establishment phase. It must be planted each year. A very old variety, 'Rongai', from Australia is being sold as 'Tecomate' and is currently the only variety available in Texas. This legume is susceptible to iron-deficiency chlorosis.

Cowpeas (*Vigna unguiculata*) are summer annual legumes that are best known as a vegetable crop. They are large seeded and are adapted to much of Texas. There are several varieties, but 'Iron and Clay' has proven to be most versatile as a forage producer. Cowpeas are susceptible to iron-deficiency chlorosis. These legumes require annual planting in a prepared seedbed.

Other Forage Publications

L-5219	Managing for High Quality Hay
L-5238	Managing Annual Winter Grasses in South and Southwest Texas
L-5218	Managing Warm-season Improved Pastures
B-6035	Forage Bermudagrass: Selection, Establishment and Management