Forage Sorghum Production in the Southern Plains Region

With the influx of dairies into the southern Plains region of Kansas, New Mexico, Texas and Oklahoma, the demand for quality silage has increased dramatically over the last few years. Currently, about 465,000 milking cows are located in this region (Southwest Plains Dairy Directory, 2007) with numbers projected to double within the next four years. The feed and water required to meet the needs of this expanding industry are now a major influence in the region. These changes within the region coupled with the emerging bio-energy sector have strengthened grain prices, thus, providing an added incentive to producers to consider cropping alternatives to more traditional crop patterns in the region.

While the dairy industry is the major consumer of corn silage, the region’s beef-finishing feedyard industry, representing about 25% of the nation’s total, is also a consumer of corn silage. With a large proportion of the diets of milking cows currently based on corn silage, demands for irrigation water are increasing relative to more traditional cotton production systems. However, more and more dairies as well as feedyards, are considering forage sorghum silage as an alternative to corn silage.

Research in the northern Texas Panhandle has demonstrated that selected varieties of sorghums approach corn in both yield and quality while requiring less water (Bean & McCollum, 2006). Information emerging from the producer-led Texas Alliance for Water Conservation’s (TAWC) monitoring of 26 sites within Hale and Floyd Counties is validating this on a landscape scale and demonstrates that profitability to the producer of sorghum silage was almost twice that of corn silage while requiring about one half the irrigation water reflecting the irrigation-use efficiency for sorghum that is about 2.5 times that of corn (Figure 1; TAWC, 2007).

Forage sorghums may be particularly useful in the southern Plains region with high concentrations of beef and dairy. They fit well into dryland and limited irrigation situations because of their tolerance to drought. It is in these systems that the grasses may have the greatest potential to produce large amounts of nutritious forage during the summer months and that their inherent versatility allows them to fit into many different types of cropping or livestock operations (Marsalis, 2006). Kochenower and Hicks (2006) stated that

*In the coming years with natural gas prices rising and the possibility of water supplies diminishing, sorghum silage may replace corn silage in the Panhandle region. Sorghum being more drought tolerant than corn requires less water, therefore less irrigation is required.*

Recent efforts by seed companies to develop high quality forage sorghums has increased the potential of sorghum as a viable silage alternative. Milking
and feeding trials have been conducted showing that forage sorghum can be equal to corn in milk and cattle gain and have the potential to replace corn silage in rations both nutritionally and economically (Alberts, 1999; Aydin, Grant, & O’Rear, 1999). In addition, brown midrib (BMR) forage sorghums have exhibited nutritive values similar to corn silage while using less water to produce comparable yields (Marsalis, 2006). With this potential for increased net returns while saving precious water resources, it is worth the time of producers to investigate the potential of this crop in their individual operations.

Development of Forage Sorghum

Sorghum can be traced back to 8,000 BC and may have been introduced into the United States by Benjamin Franklin in the late 1700s (Smith & Frederickson, 2000). By the early 1900s, grain sorghum was recognized as a drought tolerant crop that would outperform corn in the arid regions of the southern Great Plains. Scientists with agricultural experiment stations and USDA personnel in Texas, Oklahoma, and Kansas took note of sorghums’ drought tolerance and, along with farmer-seedsmen, began to select improved phenotypes (Smith & Frederickson, 2000). By 1957, 15% of the U.S. grain sorghum crop was from hybrid seed.

While grain sorghums were the focus of early hybrid research, more recent work has increased the advances in forage sorghums. Research conducted in the U.S. during the past century, including the discovery of the brown midrib genetic mutation at the University of Minnesota in the 1920s, has helped to develop hybrids with improved yields and less stalk lodging (Alberts, 1999). While there were few hybrids until the late 1950s, today’s researchers are testing several varieties of forage sorghum. Trials conducted from 1999 to 2005 at the Texas Agricultural Experiment Station at Bushland, TX, with sorghum and sorghum-sudangrass hybrids, including brown midrib (BMR) and photoperiod-sensitive (PS) hybrids, were compared for their agronomic, yield, and nutrient composition characteristics. BMR forage sorghums were shown to have yield, irrigation water use efficiency, and energy values equal to that of corn. Photoperiod-sensitive hybrids without BMR had the highest yield and irrigation water use efficiency, but had the lowest percent energy value (Bean 2007). Today’s varieties have the potential to grow very tall (6 to 15 feet) and can produce large amounts of vegetative growth (Marsalis, 2006).

The use of forage sorghum for silage appears to be increasing in the region with the USDA (2005) reporting that 188,000 acres of sorghum were grown for silage in the four-state region of Kansas, New Mexico, Oklahoma, and Texas. While this is about half of the number of acres planted for corn silage, the number of forage sorghum acres are increasing with a nearly equal number of acres (130,000 corn silage vs. 100,000 for sorghum silage) being grown in Texas.

Choosing a Sorghum Hybrid

Quality and yield will vary more between varieties than what is typically observed in corn. This makes the choice of hybrid a very important consideration. There are three types of forage sorghums that are currently being marketed: conventional, brown midrib (BMR), and photoperiod sensitive (PS).

The conventional forage sorghums have been grown for years. Some of the newer varieties of forage sorghum are capable of producing very high grain yields that are comparable to grain yields produced by some of the best grain sorghum varieties on the market (Bean, et al., 2006). These can truly be considered dual-purpose in that they can be harvested
Table 1. Agronomic and forage quality comparison of forage sorghums.

<table>
<thead>
<tr>
<th>Sorghum Type</th>
<th>Height, ft.</th>
<th>Plant Moist. @ Harvest</th>
<th>% Lodging</th>
<th>Silage, Ton/Ac @ 65% Moist.</th>
<th>Grain Yield, lbs/Ac</th>
<th>Crude Protein, %</th>
<th>ADF, %</th>
<th>NDF, %</th>
<th>IVTD, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional</td>
<td>7.2</td>
<td>64.7</td>
<td>14.7</td>
<td>24.1</td>
<td>5,110</td>
<td>7.2</td>
<td>28.6</td>
<td>47.7</td>
<td>75.9</td>
</tr>
<tr>
<td>Average</td>
<td>5.2-</td>
<td>57.0-</td>
<td>0.0-</td>
<td>18.1-</td>
<td>1,155-</td>
<td>5.5-</td>
<td>24.5-</td>
<td>39.8-</td>
<td>67.7-</td>
</tr>
<tr>
<td>Range</td>
<td>0.6</td>
<td>71.2</td>
<td>54.3</td>
<td>33.3</td>
<td>7,424</td>
<td>8.6</td>
<td>36.5</td>
<td>59.6</td>
<td>82.1</td>
</tr>
<tr>
<td>BMR</td>
<td>7.4</td>
<td>67.5</td>
<td>10.4</td>
<td>20.7</td>
<td>3,527</td>
<td>7.8</td>
<td>26.9</td>
<td>45.4</td>
<td>81.0</td>
</tr>
<tr>
<td>Average</td>
<td>6.6-</td>
<td>63.1-</td>
<td>0.7-</td>
<td>16.5-</td>
<td>1,966-</td>
<td>5.8-</td>
<td>24.7-</td>
<td>42.3-</td>
<td>76.3-</td>
</tr>
<tr>
<td>Range</td>
<td>9.2</td>
<td>70.4</td>
<td>42.5</td>
<td>24.0</td>
<td>5,119</td>
<td>8.5</td>
<td>33.4</td>
<td>56.2</td>
<td>84.0</td>
</tr>
<tr>
<td>PS</td>
<td>10.0</td>
<td>72.8</td>
<td>5.2</td>
<td>29.0</td>
<td>0</td>
<td>6.1</td>
<td>38.6</td>
<td>63.4</td>
<td>69.0</td>
</tr>
<tr>
<td>Average</td>
<td>9.0-</td>
<td>70.8-</td>
<td>2.2-</td>
<td>27.9-</td>
<td>5.9-</td>
<td>37.8-</td>
<td>62.4-</td>
<td>68.2-</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>10.0</td>
<td>74.9</td>
<td>8.1</td>
<td>29.8</td>
<td>0-0</td>
<td>6.3</td>
<td>39.3</td>
<td>64.6</td>
<td>69.8</td>
</tr>
</tbody>
</table>

for either grain or forage. Typically, these sorghums are taller and leafier than sorghums sold for grain production. Quality can be variable, but there are some conventional varieties with excellent quality. (Table 1).

BMRs get their name from their expression of a brown midrib trait. What is also important about these varieties is that they have less lignin content than conventional sorghums (McCollum, et al., 2005). Lowering the lignin content in the plant increases the overall digestibility of the fiber component of the forage, and thus improving overall quality. One potential negative associated with less lignin content is increased lodging potential. This potential problem, however, can be compensated for with appropriate management practices (Bean, 2007). There is also a wide range in lodging potential among BMR varieties, again making hybrid choice an important consideration.

PS varieties will stay in the vegetative stage of growth until day length is less than 12 hour and 20 minutes (McCollum, 2005). For the Texas High Plains, this occurs on or about October 12, depending on your location. From a practical standpoint, these varieties are very unlikely to produce a head before the region experiences a hard freeze. These varieties are capable of producing high yields and can reach heights of 12 ft or more. These varieties should be used primarily for grazing or wilted for hay production, or possibly used as green chop. The problem for using these as silage is their quality is not up to par with other sorghum types, and they are normally too wet at harvest to use as silage.

When choosing forage for quality, three forage analyses are often examined by nutritionists. These are neutral detergent fiber (NDF), acid detergent fiber (ADF), and in vitro true digestibility (IVTD). NDF measures all the fiber found in forage. This NDF fiber is partially digestible and is positively correlated with bulk density making it useful for predicting feed intake. ADF measures the least digestible fraction of the fiber (lignin and cellulose). The lower the NDF and ADF the higher the digestibility of a particular forage, and thus the higher the quality or energy value (Figure 2).

Although BMRs on average are of higher quality than conventional, yield is often reduced. In most years, research has shown BMRs to yield about 10% less than conventional (Table 1). However, because of the range in yield and quality of both sorghum types, it is important that the characteristics of each individual hybrid be considered, regardless of type. It is often assumed that a high grain yield is necessary for forage sorghum to produce high quality forage. While this tends to be true with conventional forage sorghums, it is not true with BMRs. (McCollum, 2005)


In Table 1, conventional varieties on average yielded over 1,500 pounds more of grain than BMRs. However, BMRs on average had a higher % IVTD than the conventional. Research has shown that BMRs can have a very low percentage of grain in the silage, yet be very high in quality.

**Planting Guidelines**

*Planting Dates & Soil Temperature*

Forage sorghum planting date should be similar
Figure 2. Acid detergent fiber (ADF) and in vitro true digestibility (IVTD) relationships for in pre-ensiled normal (non-BMR), brown midrib (BMR), and photoperiod-sensitive (PS)
to the planting date used for grain sorghum. Sorghum needs warm soils to germinate. Planting in cooler soils will reduce germination and delay emergence which leaves the plant subject to attack by microorganisms. However, planting too late might not allow the crop to reach the optimum cutting stage before frost.

A report by Bolsen and Kuhl (n.d.) with the Kansas State University Extension recommends an early to mid-June planting for Kansas producers with a soil temperature in the 70 to 75°F range. Preferably, the average 10-day six inch soil temperature should be 60°F or higher before forage sorghum is planted. Producers can risk moving up the planting dates when the 10-day six inch soil temperature is 55°F but should expect delayed emergence. Marsalis (2006) stated that a minimum soil temperature of 60°F (3-5 days) is required for proper germination, and sorghums are less tolerant of cool temperatures than corn.

**Planting Depth & Row Spacing**

Planting depth of ¾ to 1½ inches is generally recommended for sorghum but this will vary with soil type and moisture conditions (Bolsen & Kuhl, n.d.; Marsalis, 2006).

There is likely some advantage in planting forage sorghum in narrow rows. However, this is only true if seeding rate and placement can be accurately controlled. Excellent yields can be obtained when planted in 30-inch and even 40-inch rows. Research conducted in Stephenville, Texas in 2001 and 2002 (Butler & Muir, 2003) examined row spacing (12, 18, and 36-in.) and plant maturity at harvest (boot, early head, early dough, mid-dough, late dough, and hard seed) of forage sorghum varieties (Brown midrib and conventional) to determine the effect on silage production. Based on the results of this study, forage sorghum silage should be planted on 12 in. rows and harvested at the late dough stage to realize greater production and higher silage nutritive value.

**Seeding Rate**

Bolsen and Kuhl (n.d.) stated seeding rates are relatively high as typically 65-70% of the seeds actually emerge. Seeding rate will depend on sorghum type and anticipated irrigation amount. Marsalis (2006) stated that if irrigation is limited, seeding rates should be reduced with dryland seeding rates ranging from one-half to two-thirds of those for irrigated. Increasing seeding rates does not always result in higher yields, and excessive rates escalate the risk of potential lodging of plants.

Seed size varies greatly between varieties. For this reason it is important to plant number of seeds/acre rather than pounds/acre. Number of seed per pound can range from 12,000 to 22,000 with the most common being around 17,000 seed per pound. Bean et al. (2004) reported excellent yields in the Texas Panhandle with seeding rates as low as 30,000 seed/acre on 30-inch rows. Narrow row spacing (6-20 inches) will require higher seeding rate than wider rows.

Because of the increased concern of lodging with the BMR varieties, it is recommended that the seeding rate in fields under irrigation be reduced as compared to conventional varieties. Varieties may respond differently to seeding rate. For this reason, seed companies should be consulted concerning their specific recommendation for any given hybrid. The seeding rates recommended in Table 2 are based on studies conducted by Drs. Bean and McCollum at the Texas Agricultural Experiment Station, near Bushland, TX over several years, but only on a limited number of varieties.

Based on this research, there is very little advantage in increasing seeding rate of either sorghum types over 120,000 seed/acre for fields under full irrigation. Under most full irrigation conditions, 90,000 seed/acre will produce maximum yields. However, increasing the seeding rate of conventional varieties will tend to cause the stem diameter to be less, making the forage easier to dry down, and possibly more palatable to cattle. Because the BMR stems are more digestible, stem diameter is not as much of a concern. Under limited irrigation, consider reducing the seeding rate to 90,000 seed/acre or less with conventions and less than 75,000 with BMRs if lodging is a concern.

Many growers underestimate the ability of these forages to compensate for low seeding rates and poor establishment, and will unnecessarily increase their production costs by planting at higher rates (Marsalis,
2006). If lower rates are used, individual plants will tiller more extensively and will fill in the spaces within and between rows.

**Fertilizer Requirements**

Nitrogen and phosphorus are two nutrients that will most likely need to be added to the soil for forage sorghum silage production (Bolsen & Kuhl, n.d.; Mortvedt, Westfall, & Croissant, 1996). Mortvedt, Westfall, and Croissant (1996) reported that zinc and iron may also be limiting nutrients in some soils. Marsalis (2006) stated that forage sorghums will remove large amounts of nutrients from the soil, so it is imperative that producers test their soils frequently in order to accurately assess their fertilizer needs.

Mortvedt, Westfall, and Croissant (1996) reported that sorghum roots quickly grow into the soil between the rows. As such, sidedressing nitrogen fertilizers early in the growing season will help avoid root pruning. Dryland nitrogen requirements will be lower than those necessary for irrigated due to lower plant populations and lower expected yield. Bolsen and Kuhl (n.d.) stated that a high nitrate concentration in the sorghum is likely if excessive nitrogen is applied or if production is limited by drought. As such, a split application provides better nutrient distribution and reduces the potential for nitrate or prussic acid accumulation. Additional results from six field trials in New York suggest that BMR sorghum sudangrass needs to be fertilized as a grass rather than as a corn crop using split applications ranging from 100-150 lbs N/acre per cut in fields (Ketterings, et. al., 2005).

The general recommendation is 8 to 9 lbs of N/acre is needed for every ton/acre (65% moisture) of forage produced. The phosphorus (P2O5) recommendation is 3.25 lbs/acre for every ton of forage. Marsalis (2006) reported that while sorghums will grow on infertile, low and high pH soils, they respond well to increase fertility, and growth is optimized at pH levels of 6.0-7.0 on well-drained soils.

**Irrigation Water Requirements**

It has been documented that forage sorghums have the potential to produce as much, and in some cases more, dry matter than corn when grown with the same amount of water (Anderson & Guyer, 1986; Teutsch, 2002). Sorghums have a lower transpiration ratio than corn and require less water per unit of dry matter produced (Martin, Leonard, & Stamp, 1976). Forage sorghums have the ability to maintain high yields under water stress conditions and resume growth after drought (Sanderson, Jones, Ward, & Wolfe, 1992).

Studies have shown forage sorghum responds
well to irrigation. Average yield per inch of water used by the crop is about 1,500 lb/acre of forage corrected to 65% moisture (McCuistion, 2006). This includes soil stored water, in-season rainfall, and irrigation. A field with 4 inches of stored soil moisture prior to planting that received 8 inches of timely rainfall, along with an additional 10 inches of irrigation, could be expected to yield approximately 16.5 tons/acre of silage at 65% moisture. This might be a little lower with a BMR and a little higher with a PS hybrid.

Harvesting & Storage

Harvesting both too early and too late will reduce energy of the fed product. Stage of maturity has a much greater effect on the agronomic performance and nutritive value characteristics of forage sorghum cultivars than grain sorghum hybrids (Bolsen, 2004).

In grain producing forage sorghums, whole plant moisture content between 64 and 70% usually occurs when the grain has reached the soft dough stage. At this stage, the kernel can be mashed between the fingers. Little if any milk should be present. The BMRs tend to have slightly higher whole plant moisture (1 – 2%) at the soft dough stage compared to conventional.

Marsalis (2006) reported that if forage sorghum is harvested when the moisture level is greater than 70%, seepage is likely. Seepage will result in a loss of nutrients and lowers digestibility. Wet silage promotes the production of butyric acid (fishy odor) which results in high fermentation losses and lower intake. Excessively dry silage will not pack well and eliminating oxygen will be difficult, thereby causing high temperatures, hot damaged protein, and a more indigestible, lower energy product (Marsalis, 2006).

Storage

Berger and Bolsen (2006) stated that bunker silos and drive-over piles are economically attractive for storing both moderate and large amounts of ensiled forage, but by design, they allow large percentages of the ensiled material to be exposed to the environment. In addition to the weather influences, silage in bunkers and piles is affected by other interacting factors involving crop DM content, exposed surface area during filling, permeability of the silo walls, length of storage, and rate of silage removal during feedout (McDonald, Henderson, & Heron 1991). These factors produce a wide range of silage DM and nutrient losses on dairy farms.

Berger and Bolsen (2006) listed eight steps that producers and their employees should consider to minimize surface-spoiled silage in bunkers.

1. Achieve a high packing density (minimum of 15 lbs of DM per cubic ft) in the forage within the top 3 feet of the silage surface.
2. Shape all surfaces so water drains off the bunker or pile, and the back, front, and side slopes should not exceed 30 to 35 degrees.
3. Seal the forage surface immediately after filling is finished.
4. Two sheets of plastic or a single sheet of improved oxygen barrier film are preferred to a single sheet of plastic.
5. Overlap the sheets that cover the forage surface by a minimum of 4 to 6 feet.
6. The sheets should reach at least 4 to 6 feet off the forage surface around the entire perimeter of drive-over piles.
7. Put uniform weight on the sheets over the entire surface of a bunker or pile, and double the weight placed on the overlapping sheets. For many years, full-casing discarded tires were the norm for anchoring bunker silo covers. These waste tires are cumbersome to handle, messy, and standing water in full-casing tires can help spread the West Nile virus, which is another reason to avoid using full-casing tires on dairy farms.
   - Bias-ply truck sidewall disks, with or without a lacework of holes, are the most common alternative to full-casing tires.
   - Sandbags filled with pea gravel are another effective means of anchoring the overlapping sheets, and sandbags provide a heavy, uniform weight at the interface of the sheets and bunker walls.
   - Sidewall disks and sandbags can be stacked, and if placed on pallets, they can be moved easily and lifted to the top of a bunker wall when the silo is being sealed and lifted to the top of the feedout face when the covering materials are removed.
   - A 6- to 12-inch layer of sand or soil or sandbags are an effective way of anchoring sheets around the perimeter of drive-over piles.
8. Prevent damage to the sheets during the entire storage period.
   - Mow the area surrounding a bunker or pile and put up temporary fencing.
   - Regular inspection and repair is recommended but extensive spoilage can develop quickly when air and water penetrate...
Berger and Bolsen (2006) reported several reasons why the starch-salt matrix sealed with wax would be superior to plastic in reducing surface spoilage. Through their research, they found that the matrix forms an air-tight seal, and it does not just lay on the surface of the forage similar to plastic. It bonds to the forage particles without creating an air-layer interface. In addition, the salt diffuses into the top 10 to 15 inches of silage and acts as a preservative to prevent the growth of yeast and mold thus providing an effective protection from air and water. All the ingredients in the formulation are GRAS (general recognition of safety) and feed grade, making it totally safe to feed to livestock. The ingredients in the matrix also provide essential nutrients that would be added to the ration, and the cover will blend with the other ingredients in a normal feed mixer. When the edible cover was fed at 2.5% of the ration (DM basis), there was no reduction in DM intake (Berger & Bolsen, 2006).

Feeding

Silage

Five years of research at the University of Nebraska Institute of Agriculture and Natural Resources indicated that brown midrib sorghum is 10 percent more digestible than regular sorghum. As such, dairy cows fed brown midrib sorghum silage produce 10 more pounds of milk per day than cows fed regular sorghum silage and the same amount as those fed corn silage (Alberts, 1999). Similar results were found by Aydin, Grant, and O'Rear (1999) who found that dry matter intake and body condition score were not significantly different between cows fed BMR and standard sorghum, but cows fed BMR sorghum resulted in long-term milk production greater than cows fed standard sorghum and was similar to cows fed corn silage.

The discarding of surface-spoiled silage from bunker silos and drive-over piles is not always a common practice on dairy farms. However, Berger and Bolsen (2006) reported that surface spoilage reduces the nutritive value of corn silage-based rations far more than would be expected. The economic impact of creating and feeding surface spoiled corn silage to growing cattle could cost the producer as much as 15 to 25 dollars per ton of crop ensiled.

Grazed

Trostle (2004) stated that 1999 and 2000 results from trials conducted by Dr. Ted McCollum at
the Texas Agricultural Experiment Station, near Bushland, TX, determined a 12% increase in average daily gain for stockers in a replicated rotational grazing system when grazing BMR sorghum sudangrass vs. a non-BMR sorghum sudangrass. In addition, grazing preference for BMR forage vs. other sorghum/sudans has been observed in the field.

According to the Upper Midwest research of Undersander et al. (1990), sudangrass and sorghum-sudangrass hybrids are usually ready for grazing 5 to 6 weeks after planting. Since prussic acid is highest in the immature plant parts, new shoots may be dangerous until they reach a height of at least 18 in. Rotational grazing will provide maximum production at a nutritious, yet safe stage of growth. Allow time for 18 in. or more of regrowth before regrazing. Livestock may selectively graze and trample the crop if the plants are too tall (over 40 in.).

Toxicity Concerns

Bolsen and Kuhl (n.d.) reported that sorghums can accumulate potentially toxic nitrate levels when stressed by drought, shade, frost, or temperature extremes. Generally, forages that contain more than 6,000 ppm nitrate (DM basis) should be considered potentially toxic. Nitrates normally are highest in young plant growth; however, concentrations can remain high in mature sorghum. Raising the cutting bar 6 to 12 inches to exclude the basal part of the stalk can reduce nitrate levels. The fermentation phase in the ensiling process converts about 50% of the nitrates to a nontoxic form. Because of this, nitrate levels are seldom high enough to be a problem when feeding silage.

Bolsen and Kuhl (n.d.) stated that prussic acid, or hydrogen cyanide (HCN) poisoning, is caused by cyanide production in sorghums that grow rapidly following a stress situation. Cyanide is concentrated in young, actively growing leaves and is commonly associated with new shoot growth at the end of a summer drought or after the first autumn frost. Research in the Upper Midwest has shown that when the crop is cut and field-cured, or ensiled, the hydrocyanic acid degrades (2-3 weeks after ensiling) and the danger is greatly reduced (Undersander, Smith, Kaminski, Kelling, & Doll, 1990).

When grazing forage sorghum, there is increased danger of prussic acid poisoning when frost kills the top-growth, leaving the base of the plant from which new shoots may emerge. Cattle will frequently avoid the tall frosted growth and graze the young shoots, which may contain toxic levels of prussic acid. Harvesting the crop for silage may be the best way to handle frost injured sudangrass or sorghum-sudangrass hybrids (Undersander et al., 1990).

Summary

Research is indicating that forage sorghum silage present a viable alternative to corn silage for cattle producers and has the potential to realize water savings of up to 50%. A recent report by McCorkle et al. (2007) concluded:

There is tremendous potential for forage sorghums in the years ahead. If the 54,000 acres of irrigated corn silage in the Panhandle region were converted to sorghum silage, the amount of water saved would be an estimated 400,000 acre inches. This would lower the cost of irrigation pumping by $2.8 million annually (at a natural gas price of $7.00/mcf). With water being an increasingly important issue and with the rising demand for silage from the expanding dairy industry, sorghum silage should be an even more attractive alternative crop. (p. 4)
Web Links

Kansas State University Research and Extension (Silage) http://www.oznet.ksu.edu/pr_forage/silg.htm

Texas A&M University System Agricultural Research and Extension Center (Agronomy) http://amarillo.tamu.edu/programs/agronomy

University of Wisconsin—Extension Forage Resources http://www.uwex.edu/ces/crops/uwforage/Silage.htm

References


The TAWC project utilizes on-farm demonstration sites, including cropping and livestock systems, to identify the various production practices, technologies and systems that help maintain individual farm profitability while improving water usage efficiency. One of the main goals of this project is to extend the life of the Ogallala Aquifer, while maintaining the viability of local farms and communities.

The Texas Alliance for Water Conservation is a unique partnership of Floyd and Hale county producers, data collection technologies, and collaborating partners that include: individual industries, universities, and government agencies. The TAWC project was made possible through a grant from the Texas Water Development Board.