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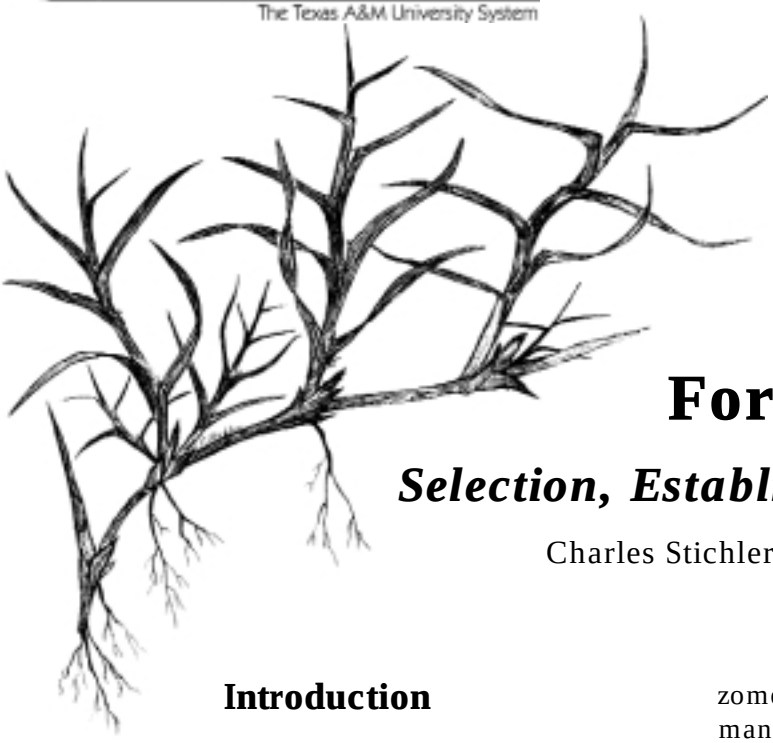

Forage Bermudagrass:

Selection, Establishment and Management

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Introduction

In April of 1943, with the introduction of Coastal bermudagrass (an F_1 hybrid between selections from Georgia and South Africa), forage production with perennial grasses changed dramatically and permanently. Hybrid bermudagrass is sterile and will not produce viable seed, so it must be vegetatively propagated and is usually planted by using "sprigs." Sprigs are made up of either root pieces or rooted stolons or runners.

Immediately after its introduction, extensive research began in many states to evaluate the forage potential of this hybrid grass under various management schemes. Experiments with nitrogen rates as high as 1,800 pounds of actual nitrogen per acre and other nutrients were conducted under dryland and irrigated conditions to determine just how much forage this new "miracle" grass could produce. Countless feeding trials were also conducted to determine the digestibility and nutritive value under various management practices. Since then, Coastal bermudagrass has become the standard by which other grasses are compared.

These trials have shown that Coastal bermudagrass is more drought- and grazing (defoliation)-tolerant than many grasses. These tolerance levels are due to its spreading growth by stolons and rhizomes and its ability to reestablish itself if mismanaged or partially killed out. It responds well to adequate fertility and rainfall or irrigation and can grow under a variety of soils and climatic conditions in the South. However, Coastal bermudagrass is susceptible to freeze injury and will be killed in areas where the soil freezes. It is truly a "miracle grass" in many ways.

Since the introduction of Coastal bermudagrass, there have been many introductions of similar hybrid grasses: Coastcross-1, African Star, Alecia, Callie,Tifton 44, Tifton 78, Brazos, and recently, Grazer, Tifton 85, World Feeder, Russell and Jiggs. These newer selections are rapidly becoming very popular. Research is being conducted to evaluate their adaptability and forage production as compared to Coastal bermudagrass.

In addition to hybrid bermudagrass, selections were made from common bermudagrass and two varieties are most prevalent, Giant and NK-37. Although these two grasses generally produce less forage than the hybrids, they are seeded varieties and offer an advantage to owners of small acreages. These grasses do not spread as rapidly as the hybrids but have a more upright growth habit than common bermudagrass.

The following yield test results are from Bryan (sandy loam soil), Overton (sandy soil, East Texas), and Jackson (clay soil) Counties.

Table 1. Yield as a Percentage of Coastal Bermudagrass.

Variety*	Bryan (3 Years)	Overton (3 Years)	Jackson Co. (2 Years)	Average
Coastal	100	100	100	100
Tifton 85	146	134	146	142
Jiggs	125	144	120	130
Tifton 78	102	105	112	106
World Feeder	96	86	47	76

David Bade, Gerald Evers, S. Simecek and M. Hussey.

Establishment

Establishment is a critical step. Considering the time, effort and expense involved in establishing any forage, attention to details is important to success. The ideal seed bed is smooth, firm, weed-free, moist and fertile; it is free of excess residue or "trash," compaction zones, and harmful insects and plant diseases; it also has good soil structure.

Land Preparation

For many people, grass is not a crop, it is just grass. But in order to get the full potential from any intensively managed crop, the crop should be planted on productive soils. Producers of hybrid bermudagrass should think of their "crop" as any other crop. Grass planted on low-potential, marginal soils will have a low yield potential.

Adequate seedbed preparation is important. It creates the proper environment in which to plant. Obviously, limiting factors such as stumps, pot holes or salt problems due to poor drainage should be eliminated before planting. Initial tillage may include moldboard plowing, heavy disking with an offset disk, chiseling or subsoiling. The soil should be worked with a disk to eliminate trash and reduce clod size. The seed bed should be as good as for any other crop. The seedbed should be free of clods, firm, and not "fluffy." A fluffy seed bed will not allow water to move upward through capillaries in the soil. A weighted roller or "cultipacker" will do an adequate job. It is generally best to wait for a rain to settle the soil after initial preparation.

Producers who irrigate should prepare their land as they want it prior to planting. It should be uniform and set up in borders if flood irrigated. Flood irrigation is accomplished best when the soil is not level, but uniformly sloping. Once established, it is difficult to "push" water through a stand of grass.

The land should be uniformly smooth to facilitate haying operations. Borders should be established under flood irrigation to match swathers and mower widths.

Preplant fertilizer should be incorporated as recommended by a soil test. In the absence of a soil test, incorporate about 100 to 200 pounds per acre of a product such as 18-46-0, 11-53-0 (dry fertilizer), or 10-34-0 (liquid), before planting, on soils that are generally medium to high in phosphorus. In soils low in phosphorus, incorporate 200 to 400 pounds of the same fertilizers. Soils in areas of Texas that are generally medium to high in potassium do not need additional fertilizer for planting. However, on soils that are low in potassium, apply 100 to 200 pounds per acre of 0-0-60. (Additional information on fertility follows in the management section.) During the establishment stage, grasses need only small amounts of nitrogen. However, once the grass is rooted and begins to grow, the demand for nitrogen increases rapidly in order for the plant to produce proteins for continued growth.

Planting

Bermudagrass is commonly propagated by planting plant parts such as rhizomes or sprigs (underground storage roots), stolons (above-ground runners), or tops (mature stems). Only non-hybrids such as Giant and NK37 can be planted by seed. Sprigs or rhizomes are planted in late winter to early spring. Stolons and tops are planted in the late spring through early fall as moisture for "rooting" is critical. Stolons and tops are subject to desiccation or rapid drying in dry soils.

Sprigging

The entire rhizome or "sprig" is planted in a furrow immediately behind an opening device, covered, and rolled in a single operation. The depth of planting is determined by the availability of moisture and the texture of the soil. Placed too deep, the new growth may die. Placed too shallow, the sprig may dry out without irrigation. Under dryland conditions, 2 to 2 1/2 inches deep is generally adequate. Under irrigation, plant at a depth of 1 1/2 to 2 inches with occasional sprigs showing

above ground. The "ideal" sprig is 5 to 6 inches long, planted with one end 2 inches deep and the other end at the soil surface.

Tifton 85 is sensitive to deep planting. A portion of the sprig should be left above the soil.

If the soil is dry before planting, water should be applied **immediately** after planting to prevent desiccation. If planted in moist soil, irrigation may not be necessary or may be applied as needed.

Use fresh sprigs from a vigorous coastal field or a certified grower. Sprigs should be thick, tan to amber-colored, and crisp. After digging, it is important to keep sprigs moist and cool and to plant as soon as possible. Exposure of sprigs to the sun and wind after digging will increase desiccation and rapidly reduce their viability. If sprigs have been dug for more than 24 hours, they should be soaked in water for 12 to 15 hours before planting.

Table 2. Relationship of Exposre Time to Percentage of Sprigs Alive at Planting.

Exposure time	% Sprigs alive at planting
No exposure	100
2 Hours, 9 a.m. - 11 a.m.	94
4 Hours, 9 a.m. - 1 p.m.	72
2 Hours, 12 noon - 2 p.m.	30
4 Hours, 12 noon - 4 p.m.	3
8 Hours, 9 a.m. - 5 p.m. (shaded and moist)	100

Bermudagrass can be sprigged at many different rates. The faster a stand is desired, the more sprigs should be planted. The closer the spacing, the faster the sprigs will completely cover the area. The following table can help determine sprigging rates to use:

Table 3. Sprigging Rates.

Bushels/Acre	Square feet for one sprig
5	8.7
10	4.3
20	2.1
30	1.5
40	1.1
50	0.9

Controlling weeds is important because weeds compete for moisture, plant nutrients and light. Weeds can be controlled either by mowing or with herbicides. See B-5038, "Suggestions for Weed Control in Pastures and Forages" (Texas Cooperative Extension). Refer to the label for complete rate and timing instructions before using any pesticide.

Under dryland conditions, plant during the period when rainfall is most likely to occur, or shortly after a rain while the soil moisture is adequate.

Most failures in establishing hybrid bermudagrass are due to:

1. Poorly prepared seed bed.
2. Inadequate moisture at planting.
3. Using desiccated or dried sprigs.
4. Planting too few sprigs.
5. Planting sprigs too deep.
6. Not firming the soil around sprigs.
7. Severe weed competition.
8. Severe grazing before plants are established.

Planting Tops Rather than Sprigs

Planting tops is somewhat different from planting sprigs in establishing bermudagrass. Sprigs are underground roots that are dug and planted. Tops are above-ground, green, mature stems. Tops, unlike sprigs, must develop roots at the nodes to become plants. For a top (stem or runner) to root, it must be about 6 weeks old, 18 to 24 inches long, and have six or more nodes.

Planting tops allows producers to plant throughout the growing season as long as soil moisture is sufficient. Tops have been planted from late April through September. Fall-planted tops must have enough time to form roots and become well established before frost, or they will die during the winter. Tops planted in the late spring or early summer have the best chance to survive.

Planting tops has also allowed producers to establish a nursery and transplant runners to larger fields as they mature. This practice can decrease the cost of paying for complete sprigging and can be done by the producer.

The new Tifton 85 and Jiggs varieties are easier to root by tops than other hybrid grasses.

The following suggestions will increase the chances of success:

1. Plant 5 to 7 bales per acre.
2. Cut the tops with a sickle mower, bale **immediately**, and plant as soon as possible before the bale becomes hot enough to kill the grass. With small plantings, "pitching" the newly cut grass on a trailer and spreading is adequate.
3. Scatter and disk tops into moist soil before they wilt. Tops can die within minutes.
4. Pack the soil immediately (using a roller) around new runners to prevent excessive moisture loss and ensure good soil contact.

Renovation of Hybrid Bermudagrass

Renovation is a practice or series of management practices for improving or restoring the vigor of a field. Pasture renovation implies almost making the field new again. It may involve testing the soil and fertilizing according to the nutrients needed, or destroying the sod and replanting, or anything in between. The level of renovation required depends on the reason for decreased grass vigor and the management goals and pasture usage of the producer. Table 4 summarizes renovation practices.

Although there are many reasons for pasture decline, the following symptoms would indicate that some kind of renovation should be considered:

- Reduced forage production.
- Thin stands with bare ground showing and a decrease in the number and vigor of rhizomes.
- Invasion of broadleaf weeds and undesirable grasses.
- Rough soil surfaces.
- Poor drainage.
- Poor water infiltration or penetration; soil compaction.
- Accumulation of nutrients such as phosphorus in the top 1 inch of soil.

Table 4. Renovation Practices and Requirements.

Minimum Renovation	Extensive Renovation
Soil testing	Subsoiling or chiseling
Fertilization	Disking or plowing
Weed control	Replanting
Prescribed burning	Heavy fertilization

Soil testing and fertilizing should be the first practice in any renovation. High forage production will remove many soil nutrients, not just nitrogen alone. Hay production removes all the nutrients when the forage is harvested. For each 6 tons of hay removed, the soil must provide approximately 300 pounds of nitrogen, 60 pounds of phosphorus, and 240 pounds of potassium, plus sulfur, calcium, magnesium, and all the other nutrients needed for plant growth. Continued hay removal will "mine" the soil until it is unproductive.

Nitrogen, sulfur, calcium and phosphorus are the primary nutrients removed by grazing, but animal manure returns only a part of the minerals to the soil. With both commercial fertilizer and manure applications, non-mobile nutrients (such as phosphorus) tend to accumulate in the top 6 inches of soil. Since nutrients need to be dissolved in water for best uptake, during droughty periods root uptake is minimal from the soil surface.

Weed control will be part of any renovation program. Weeds compete with bermudagrass for water, nutrients and sunlight. Weeds present during bermudagrass establishment prevent good stands and often result in plantings that take years to cover or never cover completely. Thin, weak bermudagrass stands resulting from low fertility, drought or heavy harvesting pressure cannot compete with weeds. Field experiments in Victoria County have shown that from 3 to 7 pounds of Coastal bermudagrass will be produced for every 1 pound of weeds controlled. (See B-5038, "Suggestions for Weed Control in Pastures and Forages," Texas Cooperative Extension.)

Prescribed burning during the dormant period before spring growth will remove excess dead forage; warm the soil; destroy some insects, winter weeds and weedy grasses; and promote faster greenup. Disadvantages include fire hazards, the need for a burning permit, baring the soil for possible erosion, and removing protection from late freezes. Timing is critical; burning must be done

after weeds have emerged but before bermudagrass greenup. Waiting too long delays bermudagrass regrowth and allows emerging weeds to outgrow the grass. A suggested time for burning is about 1 week before the last average frost date. In Falls County, burning increased grass production by 143 percent while decreasing weed competition by 96 percent. The grass had a 4 percent increase in protein and 2 percent increase in mineral content (Ca, P, K, Mg) over non-burned areas.

Subsoiling chiseling, disking and plowing are operations that will partially destroy the sod, but are used to manage bermudagrass pastures needing complete renovation. Subsoiling and chiseling will eliminate compaction layers, loosen the soil, increase air movement and water penetration, and decrease water runoff for increased root development. Intensive disking or plowing will incorporate organic matter, fertilizer and lime (if needed in low pH soils); destroy grassy weeds; and replant bermudagrass. Often cultivation of hay pastures is desirable to smooth the soil surface, making haying easier. Any soil renovation work should be done in the early spring just before greenup and spring rains or irrigations. During droughty periods, major soil renovations should be delayed until there is adequate soil moisture to prevent killing bermudagrass rhizomes.

Replanting should be considered when there is an inadequate number of live rhizomes to rejuvenate the stand.

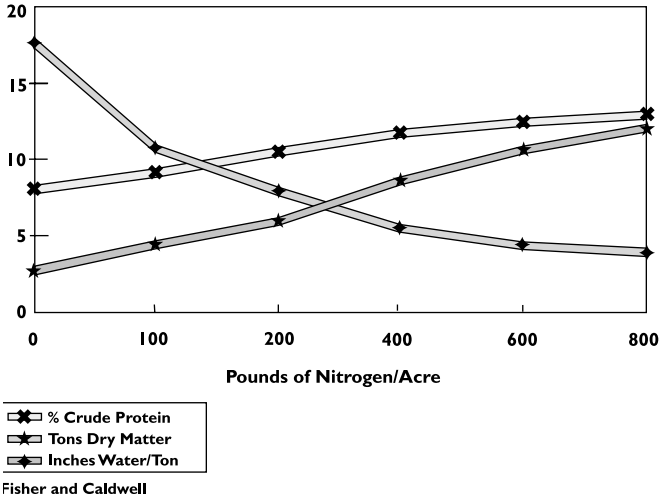
Management of Hybrid Bermudagrass

Of the factors that limit forage production, water is the most important. Without water, plants will not grow, no matter how much fertility is available. Fertility, particularly nitrogen, is the second-most-important limiting factor to production. From a practical viewpoint, water and fertility and their interaction cannot be separated.

In comparison to other plants, hybrid bermudagrass is very water-efficient. Figure 1 shows the amount of water needed to produce a pound of dry matter.

The water efficiency of hybrid bermudagrass can be improved even more by adding plant fertilizer. Since plants use nitrogen to build amino acids and proteins, the number of new cells that a plant can produce is directly related to the amount of nitrogen it is able to absorb. Up to a point, the more nitrogen and water available, the more the plant will grow. The following research was conducted in Crystal City, Texas.

Figure 1. Effects of Nitrogen Rates on Percent Protein, Yield, and Inches of Water/Ton.



Fisher and Caldwell

This graph shows three very important points that have been repeated in research throughout the South. Although the results will vary depending upon many factors, the general outcome will be similar. **As the rate of nitrogen increases, the percent crude protein and yield increase dramatically, while the amount of water used to produce a ton of forage goes down.** With low nitrogen rates, a high of 17.6 inches of water is needed to produce a ton of dry matter. With adequate nitrogen, only 3.9 inches of water is needed to produce a ton of dry matter. Adequate nitrogen fertility is necessary to fully utilize the amount of water received by a crop. Water without fertility will not produce new plant tissue.

Warm-season perennial grasses use nitrogen, phosphorus and potassium at a ratio of approximately 4-1-3. To produce 1 ton of dry forage, bermudagrass must absorb approximately 50 pounds of nitrogen per acre, 15 pounds of phosphorus and 42 pounds of potassium. If these numbers are multiplied by the number of tons of forage desired, the product will equal approximately the pounds of nutrients needed. For example, for 4 tons of production, it will take about 30 inches of water during the growing season, 200 pounds of nitrogen, 60 pounds of phosphorus, and 168 pounds of potassium.

Splitting the applications of fertilizer throughout the growing season improves efficiency, which means that a greater percentage of the nutrients, particularly nitrogen, is used by the plants.

It is important to test soil every 2 to 3 years to determine if the natural mineral content of the soil is changing. Many soils can provide some nutrients almost indefinitely. Fertilizer rates should be adjusted to maintain soil nutrients without excessive buildup.

In summary, the advantages for fertilization include:

- Increased forage production.
- Improved forage quality, especially protein.
- Improved root system and sod density.
- Reduced weed competition.
- Reduced soil erosion.
- Improved water-to-yield ratio.

Stage of Harvest

Whether the grass is grazed by livestock or harvested mechanically, the stage or level of maturity of the plant tissue will also determine its quality. Without proper harvest timing, high-quality forage will rapidly turn into "cardboard." Research conducted in Georgia on Coastal bermudagrass produced the results shown in Table 5.

Although the yield was higher for an individual cutting at 6 weeks, the amount of protein produced per acre was almost the same as the amount of protein produced after 3 weeks. In these tests, cutting twice at 3-week intervals would produce twice as much protein and almost twice as much forage per acre as cutting at 6-week intervals.

Summary

Hybrid bermudagrass can produce high-quality forage. As with any other crop, proper variety selection, adequate soil prepration for planting, correct planting, adequate fertility, wise irrigation management, and proper timing of harvest are required for best results.

Table 5. Effects of Cutting Intervals on Quality of Yield.

Cutting interval (Weeks)	Yield (Tons per acre)	Percent protein	Lb. dry matter per acre	Percent leaf	Percent stem	Precent fiber	IV DVD
3	7.9	18.5	2442	83	17	27	65.2
4	8.4	16.4	2317	79	21	29.1	61.9
5	9.2	15.4	2329	70	30	30.6	59.3
6	10.3	13.3	2292	62	38	31.6	58
8	10.2	10.7	1898	56	44	32.9	54.1
12	10.4	9	1612	51	49	33.4	51

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