

## **THE HISTORY OF THE DEVELOPMENT OF FORAGE BERMUDAGRASS: III. A FOCUS ON DIGESTIBILITY AND YIELD**

September 2011 Georgia Cattleman

Wayne Hanna, Bill Anderson, and Dennis Hancock

USDA-Agricultural Research Service and The University of Georgia

Over the last couple months, we have celebrated the Georgia Cattleman's Association's 50<sup>th</sup> year by recounting the story of the development of bermudagrass in a three-part series. It is no accident that improved bermudagrasses are the most widely grown warm season perennial forages in the Southeastern US. It is the ultimate story of making lemons into lemonade, and many in the state of Georgia have played an important role in many steps along the way. In this third and final installment in the series, attention is turned to how bermudagrass breeding in the USDA-ARS and UGA program began to focus more on forage quality and digestibility and how this ended up setting a precedent for how forage breeders would develop new varieties thereafter.

### **Improvements in Forage Yield and Quality**

'Coastal' helped transform bermudagrass from the South's worst weed in cultivated crops to a cultivar that is planted on over 10 million acres today. It produced twice the forage yield that common bermudagrass produced. It is not an overstatement to say that it revolutionized cattle and hay production in the South. In fact, this cultivar has been a major factor in keeping beef and milk production profitable in the warm, sandy Coastal Plain region of the US for more than 50 years and substantially contributed to the forage systems in other regions (e.g., the Southern Piedmont, etc.).

Building on the success of 'Coastal,' (Glenn Burton, the USDA-ARS geneticist who developed 'Coastal') and others worked on developing new and improved forage hybrids. 'Midland,' a hybrid of Coastal and a winter-hardy common from Indiana, was developed by Burton and colleagues from Oklahoma State University and released in 1953. It was released as a more winter-hardy cultivar than 'Coastal.' Though it soon was recognized that 'Midland' failed to yield or persist as well as 'Coastal' in Georgia, it is more widely adapted to the Mid-South. As such, 'Midland' is thought to have been planted on over 1 million acres north of the Coastal Plain region.

Breeding for improved digestibility in warm-season grasses was a new concept in the 1960s. Animal scientist R.S. Lowery (UGA), agronomist W.G. Monson (USDA-ARS), and Burton were the first to evaluate the nutritional quality of experimental bermudagrass forage hybrids. They used a technique that actually measures the breakdown of fiber when the forage was incubated in rumen fluid, which is a technique now known as "*in vitro* dry matter digestibility." Now, most forage breeding programs around the world use some type of forage quality–digestibility measure in cultivar development. But, at that time, it was quite revolutionary.

This initial work led to the development and the 1967 release of 'Coastcross-1,' which was 12% more digestible and gave 30 to 40% better average daily gains (ADG) and liveweight gains per acre than 'Coastal.' 'Coastcross-1' was the first forage cultivar released based on improved digestibility. Though it was not winterhardy enough for most of the United States, it

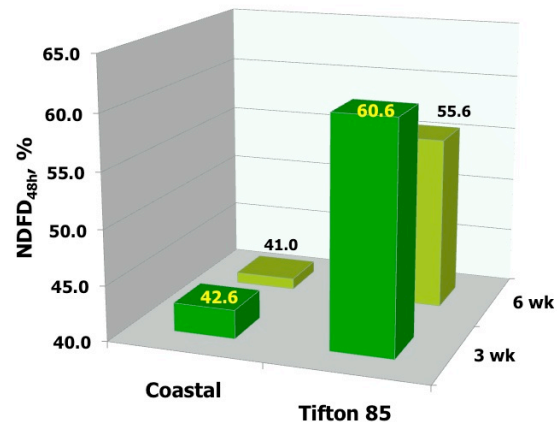
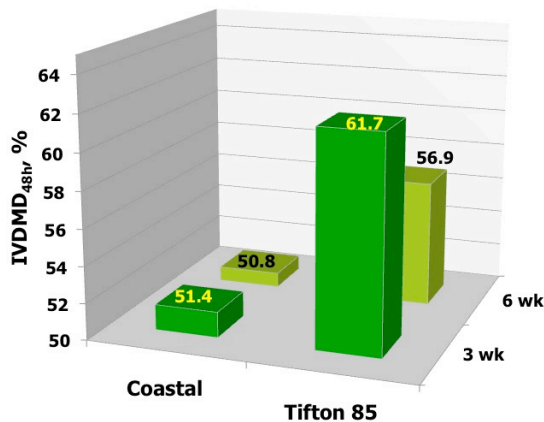
was planted on about a half million acres in Cuba, where it produced more milk without supplement than any other grass tested. Other, highly digestible but more winter-hardy varieties were developed and released later (e.g., Tifton 44 in 1978).

The focus on forage quality in the development of new bermudagrass cultivars was not limited to the laboratory. These lab studies were followed with numerous grazing and feeding trials, led by UGA animal scientists Phil Utley and Gary Hill, to evaluate the actual animal performance on the experimental hybrids. The information and performance data obtained from these animal studies were key to the success in “selling” the new hybrids to farmers and ranchers.

The most recent cultivar to be released from the CPES breeding program, ‘Tifton 85’ is the best bermudagrass cultivar since ‘Coastal.’ ‘Tifton 85’ is a sterile hybrid between a winter-hardy bermudagrass introduction and a highly digestible cultivar, ‘Tifton 68,’ that had been developed from two different lines of stargrass (a different species within the same family as bermudagrass). When grown as a hay crop, ‘Tifton 85’ produces up to two-thirds more forage per acre than ‘Coastal.’ Interestingly, when they analyzed the forage quality in their lab, they noticed that ‘Tifton 85’ had higher levels of fiber (NDF and ADF) than ‘Coastal.’ However, the digestibility of the fiber was much higher in the ‘Tifton 85’ than the ‘Coastal’ and, consequently, the ‘Tifton 85’ was actually found to be much more digestible than ‘Coastal.’



Stocker calves in a ‘Tifton 85’ grazing experiment at the CPES in Tifton, GA.



The *in vitro* dry matter digestibility (IVDMD) of ‘Tifton 85’ was substantially greater than ‘Coastal’ at the 3 and 6 week cutting intervals. Researchers at UGA CPES discovered that the type of lignin in ‘Tifton 85’ allows its neutral detergent fiber (NDF) to be more digestible (NDFD) than the NDF of ‘Coastal’ bermudagrass.

Table 1. Stocker performance on ‘Pensacola’ bahiagrass and preferred bermudagrass varieties in selected research trials in the Coastal Plain.

	State	ADG (lbs/hd/d)	Gain (lb/acre)	Stocking Rate (hd/acre)	Grazing Period (days)
Coastal	GA <sup>1</sup>	1.1	331	2.5	131
Coastal	TX <sup>2</sup>	1.0	279	3.0	92
Coastal	GA <sup>3</sup>	1.5	641	2.5	168
Tifton 44	GA <sup>3</sup>	1.6	681	2.5	168
Tifton 78	GA <sup>4</sup>	1.4	704	3.2	169
Tifton 85	GA <sup>4</sup>	1.5	1032	4.4	169
Tifton 85	TX <sup>2</sup>	1.7	465	3.0	92

<sup>1</sup> Utley et al., 1974. J. Anim. Sci. 38:490-495.

<sup>2</sup> Rouquette et al., 2003. Beef Cattle Research in Tx. pp. 62-66.

<sup>3</sup> Utley et al., 1981. J. Anim. Sci. 52:725-728.

<sup>4</sup> Hill et al., 1993. J. Anim. Sci. 71:3219-3225.

Those lab results were re-enforced when these comparisons were scaled-up to grazing trials. In those trials, Hill and others demonstrated that steers grazing ‘Tifton 85’ from mid-April to mid-October had an average daily gain of 1.5 lbs/hd/d. Those pastures also could support 1 ½ to 2 times the stocking rate that ‘Coastal’ could sustain (Table 1). Consequently, it was shown that ‘Tifton 85’ has the greatest potential for beef production, on a gain per acre basis, of any of the bermudagrass varieties.

Of course, forage bermudagrass breeding programs in other states (e.g., Oklahoma, Florida, and Texas) have also contributed a number of other varieties to the market, as well. Examples of these include ‘Russell’ (Auburn Univ.), ‘Guymon’ (Oklahoma St. Univ.), ‘Grazer’ (Louisiana), and ‘Midland 99’ (Oklahoma St. Univ.), as well as stargrass varieties like ‘Florona’ and ‘Florakirk’ (Univ. of Florida). Many of these resulted from collaborative efforts with UGA and CPES USDA-ARS personnel.

## Perspective

The story behind the development of bermudagrass is an interesting tale to many of us in the cattle industry in the Southeast. After all, it is a story about taking the bane of every South Georgia cotton farm and developing it into the most important forage species in the South. It is a story of how, when given the resources, a publicly-funded research team can develop innovations that revolutionize an industry. It is a story of how a public-private partnership can spread that innovation throughout the region and even to the far-flung corners of the earth. Ultimately, it is a story about courage, vision, leadership, and an unabating desire to make agricultural production more productive and efficient.

To learn more about the development of forage bermudagrass and the number of different bermudagrass varieties that are available, check out the bermudagrass-related Extension publications on our website at [www.georgiaforages.com](http://www.georgiaforages.com) or contact your local University of Georgia Cooperative Extension office.

### got questions?

Have a question or topic that you want Dr. Hancock to address? Email him at: [questions@georgiaforages.com](mailto:questions@georgiaforages.com).