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Filling the Niche: Looking at Alternative Uses and Species of Forage Crops

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The forage breeding program at Tifton, Georgia has a long, notable history that began with the release of ‘Coastal’ Bermudagrass (*Cynodon* spp.) in 1943, which is now planted on 10 million acres, nation wide. Forage releases have continued with ‘Tifton 85’ bermudagrass, ‘Tifton 9’ bahiagrass (*Paspalum notatum* Flüggé) and ‘Tifleaf 3’ pearl millet (*Pennisetum glaucum* L.), by Drs. Glenn Burton and Wayne Hanna. This program has often looked at species or uses that were not immediately viewed as the most appropriate use of resources, but ultimately proved invaluable to the agricultural economy of the southeastern United States. While work in the traditional program areas of forage and turf improvement of bermudagrass, bahiagrass, and pearl millet for the southeast continues, new application such as efforts to develop bio-energy feedstocks as well as the study of new species is also underway.

Numerous studies of biomass production, nutritive value, and harvest frequency response to nitrogen in Bermudagrass were done starting as early as 1956 (Taliaferro et al. 2004). The majority of this work focused on maximizing production, rather than for optimization through increasing nitrogen use efficiency by the plant. Nitrogen use efficiency for turf grass applications has been defined in two ways: the first is the percentage of nitrogen per dry weight of plant matter (Jiang et al. 2002), and the second defines it as percent of applied nitrogen recovered by plant roots (Bowman et al. 2002). Bowen et al. (2002) reported nitrogen recovery ranging from 63% to 84% for six warm season grasses. Significant species and cultivar differences have been reported for the amount of nitrogen recovered by each of three different cool-season grass species (Liu and Hull, 2006). While differences among warm-season grass species for nitrogen use-efficiency have been reported detailed cultivar studies such as those for cool-season grass species have not been reported. The goal of this research work is to do a large scale survey of available bermudagrass to determine availability of genotypes which allow for the development of plant types with increased nitrogen use efficiency.

Pearl millet as a forage is an annual of note in the southeast with dry matter yields of 11,000 kg ha⁻¹ and digestibility of 500-600 g kg⁻¹ (Hanna et al. 2004). Developments of brown midrib (bmr) types with reduced lignin for increased digestibility are a major focus of the current program. To date, six elite cytoplasmic male sterile females and eleven restorer lines expressing the gene reported by Cherney et al. 1988, have been developed and are utilized in seven elite hybrids currently under field performance testing. Traits under evaluation are digestibility, yield, disease/insect resistance, and drought tolerance. Additionally more than 3000 early generation bmr inbreds expressing a gene identified at Tifton in germplasm from Burkina Faso that also include a trait for stay-green are also being tested.

Bio-energy feedstock improvement of Napiergrass (*Pennisetum purpureum* Schumach.) is also currently underway. ‘Merkeron’ napiergrass has yielded 28,748 kg ha⁻¹ versus 15,570 kg ha⁻¹ for ‘Tifton 85’ bermudagrass and 13,254 kg ha⁻¹ for ‘Alamo’ switchgrass in Georgia suggesting it would be a good bio-energy feed stock for the southeast (Bouton, 2002). One of the draw backs to this species, however, is lower lignocellulose digestibility. Personal

communication with Wayne Hanna has further indicated that the A' genome of Napiergrass may be masked by the B genome of Napiergrass. Study of gene expression is set to determine the validity of this hypothesis as well as attempt to improve the quality of napiergrass. Fritz et al. (1981) was able to successfully move the recessive bmr trait from diploid sorghum to tetraploid sudangrass. If the A' genome is not masked, bmr napiergrass could be developed as a bio-energy feed stock. Currently, approximately 1000 pearl millet X napiergrass F₁ crosses are being grown out in the greenhouse. These hybrids include pearl millet females expressing the recessive bmr gene and a dominant red leaf trait to determine the viability of A genome genes moved from pearl millet to napiergrass. The digestibility of the hybrids could be improved if the A genome proves not to be masked.

Rhizoma peanut (*Arachis glabrata* Benth.) is a tropical legume that combines both high nutritive value and long-term persistence under a wide range of grazing and harvested hay systems. Rhizoma peanut is planted in the Gulf Coast region with the majority of acreage occurring in Florida and Georgia in USDA winter hardiness growing zones 8b and higher (Williams et al. 2002). Forage production for the horse (*Equus caballus* L.) hay market is currently providing some growers with economic returns approaching seven hundred dollars an acre once the field reaches maturity, which occurs at approximately three years (Lacy 2006). Winter survivability of Florigrass has been reported as far north as Fort Valley, GA (32°33'N, 83°54'W) and two plant introductions have shown promise as far north as Stephenville, TX (32°N, 98°W) (Terrill et al. 1996; T.J. Butler, personal communication). The northern limits of this species have not been determined as yet and it is the goal of this research to test multiple germplasm lines to determine if there is potential to expand production of Rhizoma peanut to USDA winter hardiness growing zones 8a and 7b.

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