Seedling Survival and Establishment Costs: Crimson and White Clover in Bermudagrass Pastures

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ABSTRACT

Improving existing pastures with legumes has the potential to reduce N fertilizer costs, enhance forage quality for cow–calf operations, and to distribute forage production more evenly throughout the grazing season. West and Mallarino (1996) reported that between 100 and 250 kg N ha–1 yr–1 may be fixed by legumes, and 10 to 40% of that amount may be available for use by other grasses in the forage mixture. Under ideal conditions, white clover can add 224 kg of N ha–1 yr–1 to the soil (Jennings, 2005); this is the N equivalent of 672 kg ha–1 yr–1 of NH4NO3 or 448 kg ha–1 yr–1 of urea and represents a value of nearly US$350 ha–1 at N prices for 2012 (University of Arkansas Cooperative Extension Services, 2012). Thus, increased N2 fixation has the ability to reduce pasture maintenance costs because typically inorganic N accounts for 40% of the annual cost to maintain bermudagrass pastures (Biermacher et al., 2010). While adding legumes to pastures may not improve the quantity of the forage produced, the nutritional quality has been shown to increase because legumes are higher in crude protein and are more digestible for cattle than other forages (West and Waller, 2007). Clover also has the benefit of providing forage growth from March to June when warm-season forage species are not as productive (West and Waller, 2007).

Increased utilization of legumes appears to be a promising, cost-effective approach to significantly improve pastures for small- to medium-sized cow–calf producers, defined as operations with <100 head. This producer segment represents approximately 90% of cow–calf operations, accounting for nearly half the inventory of beef cows in the United States (USDA, 2008).

A switch to grass–legume mixtures as a forage base is not easily achieved, however. Among issues restricting greater use of legumes is the selection of appropriate legume species to meet the site-specific conditions of each region (Van Keuren and Hoveland, 1985; Han et al., 2012). Common legumes used to improve pastures in the transition zone of the southeastern United States (western boundary approximately 96° longitude, centered roughly at 37° latitude) include alfalfa (Medicago sativa L.), lespedeza (Lespedeza bicolor Turcz.), birdfoot trefoil (Lotus corniculatus L.), and clovers including white, crimson, red (Trifolium pratense L.), or arrowleaf (Trifolium vesiculosum Savi) (University of Arkansas Cooperative Extension Services, 2006). High summer temperatures, sporadic rainfall, pest and disease pressure, poor soil fertility, and poor seed–soil contact as well as competition from established grasses in the pasture can make legume establishment difficult for cow–calf producers (Han et al., 2012; Taylor, 2008; Jennings, 2005). Nonetheless, the use of legumes in forage mixtures in existing stands of either tall fescue (Festuca arundinacea Schreb.) or bermudagrass may be economically desirable because establishment costs are mainly comprised of seed with a nominal annual cost for planting equipment or custom application. In clover–grass mixtures, clovers typically constitute <30% of the aboveground biomass (West and Waller, 2007) to avoid potential bloat in cattle and to enhance seasonal forage quality and availability.

For this analysis, crimson and white clovers were selected as legumes to be seeded into existing bermudagrass pastures in the U.S. Southeast transition zone. Crimson clover is an annual cool-season legume that is cold tolerant and has good seedling vigor with rapid seedling survival, early growth, and improved pasture establishment costs.

Abbreviations: CCP, cost per established plant; CDF, cumulative distribution function; ROS, rates of survival.