USE OF THE GRAZING ANIMAL IN FORAGE BREEDING

J. H. Bouton[1], C.S. Hoveland[1], and R.N. Gates[2]
[1]Dept. of Crop and Soil Sciences, University of Georgia, Athens, GA 30602, USA
[2]USDA-ARS, Coastal Plain Exp. Station, Tifton, GA 31793, USA

ABSTRACT
The objective of these studies was to determine, in the context of a forage breeding program, the effect of cattle grazing on survival of alfalfa (*Medicago sativa* L.), red clover (*Trifolium pratense* L.), and tall fescue (*Festuca arundinacea* Schreb.). Different cultivars of each species were compared in grazed and ungrazed areas. Results consistently demonstrated that grazing reduced plant stands when compared to ungrazed conditions for each species tested. In alfalfa, however, cultivars developed for grazing tolerance showed much better grazing survival. Infection with the fungal endophyte, *Acremonium coenophialum* Morgan-Jones & Gams, likewise substantially increased grazing survival in tall fescue. These experiments further demonstrate that cultivar selection and testing needs to be accomplished with the grazing animal to properly assess pasture potential. Selection from elite germplasm under these conditions should probably be practiced as early as possible in the breeding program for species with poor pasture persistence.

KEYWORDS
Beef cattle, forages, grazing, pasture persistence

INTRODUCTION

What is the effect of the forage on the animal? What is the effect of the animal on the forage? These two questions must be considered in any forage breeding program. How forage breeders approach these questions must be viewed in the context of the cultivar development process itself. The effect of the animal on the forage and vice versa can easily be addressed during the selection and breeding phase and the testing phase of any forage improvement program.

To estimate how well USA forage breeders have used animals during development of new cultivars, a survey was made by examining the forage cultivar releases (exclusive of alfalfa) registered in *Crop Science* and *Journal of the American Society of Agronomy* for 2 yr periods spaced 20 years apart (Bouton, 1994). This survey indicated that more forage cultivars representing more species were registered in recent times than in the past, but that the grazing animal is never used during the selection and breeding phase (Table 1). Grazing animals were more widely used during testing of the resultant experimental germplasm just prior its actual release. Therefore, in the USA, forage breeders have determined the effect of the animal on the forage only at the end of the process when the investment of time and resources prevents testing of an array of genetic material. Since pasture persistence is a major problem in many temperate forage species, especially legumes, the practice of not using the grazing animal during the selection and breeding phase appears questionable.

In this paper, we report the results of experiments designed to assess the effects of the grazing animal on alfalfa, red clover, and tall fescue cultivars. The forage breeding application of these results will also be discussed.

METHODS

For alfalfa and tall fescue, procedures similar to those described previously were used (Bouton, et al., 1993b). Briefly, all cultivars (Table 2) of each species were sown in pure stands in replicated sward plots (1.5 x 4.6 m plots with 6 replications) at 20 kg seed/ha in the autumn in Tifton, GA. This area was then enclosed within a grazing paddock and exposed to intensive, continuous grazing during the summer and early autumn by beef cattle (stocked to maintain a stubble height below 7 cm for an average of 140 days per yr for a 2 yr period with alfalfa and 3 yr for tall fescue) after a spring hay harvest in each year. A similar experiment was established in an adjacent ungrazed area containing the same cultivars but subjected to a standard hay harvesting schedule. Plant counts (alfalfa) or basal areas (tall fescue) were made initially and at the end of each grazing season for each area.

Another experiment was conducted to compare the stand survival of several modern cultivars of red clover planted into tall fescue sods and either subjected to grazing or infrequent mowing at Eatonton, GA. In February, 8 red clover cultivars (Table 2) were no-till seeded as replicated small plots into two adjacent areas of 'AU Triumph' tall fescue. Initial stands were determined by counting plants per unit area in May. One area was then subjected to grazing by beef cattle from May until December while the other area was harvested with a flail mower in July, August, October, and December during that same time. Final plant counts were then made in each area.

RESULTS AND DISCUSSION

In all cases where entries were compared in grazed and ungrazed areas, grazing substantially reduced plant stands when compared to infrequently mowed conditions for each species tested (Table 2). Among these non-dormant alfalfa cultivars (e.g. possessing winter active growth), it should be noted that ABT 805 and AmeriGraze 702 were selected for grazing tolerance and showed much better plant survival under grazing conditions than other entries tested. This trend is similar to previous results with fall dormant alfalfa cultivars where 'Alfagraze', developed by selection of surviving plants after intensive grazing, had excellent survival under both grazing and hay harvesting (Bouton et al., 1993b and Smith and Bouton, 1993). Red clover, another crown forming plant, may also benefit from this type of selection.

Georgia 5, the only endophyte-infected tall fescue cultivar tested, showed no depression in survival due to grazing (Table 2). These results further demonstrate the ability of the tall fescue fungal endophyte to enhance persistence during stressful conditions (Bouton et al., 1993a). Differences observed among the remaining cultivars indicate sufficient genetic variation may be present to select among surviving plants in the grazed area in order to increase grazing survival of endophyte-free tall fescue.

Hodgson (1981) felt it should be "....an article of faith that any plant material intended for use under grazing conditions should be selected and tested under such conditions, or at least by procedures which have been shown to provide a true index of performance under grazing.....". Since trampling and defoliation by the grazing animal is a main part of the inherent stress of the pasture environment, these data support the concept that direct and early use of animals during the breeding process is necessary for cultivar development programs of forage species with a history of poor pasture persistence.

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Table 1

Animal use in the selection and testing phases during the development of pasture legume and grass cultivars (does not include alfalfa) as registered in *Crop Science* and the *Journal of the American Society of Agronomy* for different time periods.

Period	Cultivars	Species	Animals Used In Selection	Animals Used In Testing
	——————no.——————-			—no. of cultivars—-
1992-93	13	10	0	8
1972-73	16	14	0	8
1952-53	4	4	0	2
1932-33	0	0	0	0

Table 2

Final stands of different cultivars of alfalfa, red clover, and tall fescue under grazed and ungrazed (e.g. infrequent mowing) conditions in Georgia.

Species: Cultivars	Grazed	Ungrazed
	————no. plants m^{-2}————	
Alfalfa:		
13R Supreme	1.1	58.1
ABI 9299	3.2	44.5
ABT 805	43.1	85.0
AmeriGraze 702	41.9	89.3
Florida 77	16.1	58.1
Nitro	0.1	49.5
Topaz GZ	0.2	48.7
LSD (5%)	12.9	30.2
Red Clover:		
Acclaim	17.2	72.1
Cinnamon	11.8	60.2
Cherokee	18.3	58.1
Kenstar	19.4	53.8
Red Baron	4.3	26.9
Redland III	13.9	46.3
Renegade	10.8	49.5
Scarlett	11.8	53.8
LSD (5%)	NS	19.4
	————% basal area————-	
Tall Fescue:		
AU Triumph (EF*)	19.4	74.2
GA-87E (EF)	40.0	81.2
GA-120L (EF)	37.8	74.2
GA-133 (EF)	22.0	75.0
Georgia 5 (EI)	91.6	92.7
Jesup (EF)	39.0	93.5
Kentucky 31 (EF)	28.4	85.7
LSD (5%)	13.5	16.7

*EF=endophyte-free; EI=endophyte-infected