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**EVALUATING VARIETIES OF ALFALFA AND TALL FESCUE FOR TOLERANCE
TO OVER-GRAZING BY CATTLE**

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Abstract

Cultivars of alfalfa (*Medicago sativa* L.) and tall fescue (*Festuca arundinacea* Schreb.) were seeded in small (1.5 m x 4.6 m) plots and harvested for estimating yield the following spring. Plots were then grazed by cattle continuously for the remainder of the season so as to keep stand heights at 7.5 cm or less. This procedure was repeated for one or two more grazing seasons, depending on stand survival. Stands were visually rated for stand in the fall and spring. Marked differences in grazing tolerance were observed among alfalfa cultivars, following closely the commercial designations as grazing-type or hay-type alfalfa. Some cultivars of endophyte-free tall fescue were as grazing tolerant as endophyte-infected Kentucky 31 tall fescue.

Keywords: Alfalfa, tall fescue, grazing tolerance, endophyte.

Introduction

In the past, farmers made variety choices about alfalfa and tall fescue based on 'clip and carry' yield trials. These data are certainly useful for establishing yield potential, resistance to significant diseases of the region, and adaptation. However, yield trials reveal little about persistence under grazing.

Alfalfa is the highest yielding, highest quality forage crop grown in Kentucky. It is produced mainly for hay, but its use as a pasture crop is increasing. Research at the University of Georgia found that persistence among alfalfa cultivars varied when subjected to mowing versus continuous grazing (Counce et al. 1984). Smith et al. (1989) demonstrated that selecting for grazing tolerance during the breeding process could result in significantly more grazing tolerance compared to hay type alfalfas. This selection resulted in the release of 'Alfagraze.' Since this release, many varieties of alfalfa have been released with claims of grazing tolerance. However, farmers are concerned that these new varieties (including Alfagraze) may not persist under less than perfect pasture management, especially continuous grazing. It is unclear if all claims of grazing tolerance among varieties are equally valid.

Tall fescue is the pre-dominant pasture species in Kentucky. Most tall fescue in Kentucky is infected with a fungal endophyte (*Neotyphodium coenophialum* Morgan-Jones and Gams). Stand establishment and persistence of initial endophyte-free cultivars of tall fescue in Kentucky was disappointing. As a result, later releases of new endophyte-free tall fescue varieties have been poorly adopted. The prevailing farmer attitude is that, to be truly better, a new endophyte-free variety would have to demonstrate the 'toughness' of endophyte-infected Kentucky 31 (the predominant variety). It is unclear if new endophyte-free varieties of tall fescue are as tolerant to close, continuous grazing as endophyte-infected Kentucky 31.

Identifying truly grazing tolerant varieties of alfalfa and endophyte-free tall fescue would

greatly encourage their use and would therefore result in higher pasture productivity and quality in Kentucky.

The purpose of these studies was to evaluate current varieties of alfalfa and tall fescue under heavy, continuous grazing pressure by cattle.

Material and Methods

Cultivars of alfalfa, tall fescue, and orchardgrass were fall-seeded in small (1.5 m x 4.6 m) plots in 1994 and 1996 and harvested for estimating yield the following spring. After this first cutting, plots were allowed to regrow to approximately 2.4 to 3.2 cm in height and then grazed by cattle continuously for the remainder of the season so as to keep stand heights at 1.2 cm or less. This procedure was repeated for one or two more grazing seasons, depending on stand survival. Stands were visually rated for stand in the fall and spring.

Alfalfa stands were fertilized with lime, phosphorus, potassium, and boron as if the stands were to be managed for hay production. Winter weed control measures were used as needed. Grazing terminated on alfalfa plots by mid-September. Studies were considered completed when stand ratings of the grazing tolerant check (Alfagraze) and the grazing susceptible check (Apollo) fell within the ranges described by the NAAIC Standard Tests to Characterize Alfalfa Cultivars (Bouton and Smith, 1998). Tall fescue plots were fertilized with 67 kg N ha⁻¹ in the spring of each grazing season and other nutrients were applied as needed. Plots were grazed until all fall growth had been removed and no more growth was expected. These trials were grazed for 2 or 3 seasons until differences emerge among varieties. Tall fescue plots were grazed for the entire season in 1999 (first cutting not taken as hay).

Results and Discussion

Alfalfa varieties differed significantly in tolerance to overgrazing (Tables 1). There was a fairly clear separation between the grazing type and hay-type alfalfas (denoted with an H') in both the 1994 and 1996 seedings. Alfagraze was numerically the most grazing tolerant cultivar in Study 1, but was significantly different than the top variety (Feast) in Study 2.

Several endophyte-free varieties of tall fescue proved to be as tolerant of overgrazing as endophyte-infected Ky31 (Ky31+), considered the grazing tolerant check (Tables 2). Cattle Club and Richmond in Study 1 and Festorina and Dovey in Study 2 were as tolerant to overgrazing as Ky31+.

In both studies, endophyte-infected varieties were more tolerant of their genetic equal without the endophyte (Ky31+ vs. Ky 31-; Ga Jesup+ vs Ga Jesup-). This confirms earlier work by Bouton et al. (1993) and West et al. (1989) that the presence of the endophyte aids in stand persistence under high levels of stress.

Endophyte infection is not a pre-requisite for stand survival under grazing stress, at least in the Central Kentucky, USA environment (Table 2). Bouton et al. (1993) found a geographic interaction in the endophyte's effect on tall fescue survival. They found that only endophyte-infected cultivars persisted in a clipping study in the Southeastern Coastal Plain region of the USA in Georgia. The same treatments in studies in the Piedmont region of Georgia found no difference in persistence due to endophyte. It is logical to assume that temperatures and rainfall in Central Kentucky would be more suitable for tall fescue than those in either region of Georgia. However, both 1998 and 1999 could be characterized as drought years in Kentucky (data not shown). The latter half of the growing season in 1998 was dry, as was all of 1999. In fact, 1999 was the driest year in Kentucky since rainfall records have been kept. Therefore, these data are especially indicative of the stress tolerance of some

of the newer, endophyte-free tall fescue varieties, especially Study 2 (Table 2).

Plant breeders have successfully selected for grazing tolerance in alfalfa (Table 1). Considering the severity of the grazing pressure, farmers should feel confident that varieties surviving this treatment should well tolerate occasional lapses in proper pasture rotation

It is very encouraging that at least a few varieties of endophyte-free tall fescue have proven to be as tolerant of close, continuous as Ky31+ (Table 2). Considering the severity of the drought in 1999 and the closeness of grazing of these plots, farmers can expect the top performing cultivars in these studies to withstand even extreme stress for short periods of time.

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Table 1 - Percent stand ratings for alfalfa varieties sown 3 September 1994 (Study 1) and 23 August 1996 (Study 2) at Lexington, Kentucky and continuously grazed for two growing seasons.

Study 1 Grazed 1995-96		Study 2 Grazed 1997-98	
Variety	Jun 1997 Rating	Variety	Jul 1999 Rating
Alfagraze	63 *	Feast	73 *
Wintergreen	60 *	Amerigraze 401+Z	66 *
ABT205	58 *	WL326GZ	63 *
ABT405	45 *	ABT405	59 *
Spredor-3	45 *	Spredor 3	53
Quantum	45 *	Grazeking	46
Cut-n-Graze	43 *	Alfagraze	45
Pasture-Plus	38	Stampede	35
Magnagraze	35	Saranac-AR (H)	34
Apollo (H)	30	Haygrazer	33
Fortress (H)	25	Fortress (H)	28
Rushmore (H)	20	Apollo (H)	23
Legacy (H)	20	Arc (H)	9
5373 (H)	13		
Mean	39	Mean	44
CV, %	36	CV, %	28
LSD 0.05	21	LSD 0.05	15

* Not significantly different from the highest numerical value in the column based on the 0.05 LSD.

(H) = Hay Type Alfalfa

Table 2 - Percent stand of tall fescue varieties sown September 3, 1994 (Study 1, grazed two seasons) and 23 August 1996 (Study 2, grazed three seasons) in Lexington, Kentucky and continuously grazed.

Study 1 Grazed 1995-96		Study 2 Grazed 1997-99	
Variety	Jun 1997 Rating	Variety	Mar 2000 Rating
Cattle-Club	84*	Festorina	62*
Richmond	73*	Dovey	57*
Ky31+ ¹	73*	Ky31+	53*
Ga Jesup +	61	Ky31-	47
Johnstone	56	Barcel	45
Ky31-	56	Stargrazer	38
DLF-5	48		
Ga Jesup -	48		
Stargrazer-	35		
Mean	59	Mean	50
LSD,0.05	22	LSD,0.05	13
CV,%	32	CV,%	23

* Not significantly different from the highest numerical value in the column based on the 0.05 LSD.

¹ '+' indicates variety is endophyte infected; '-' indicates variety is endophyte free. All others are endophyte free.