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Abstract

Ten cultivars of tall fescue (*Festuca arundinacea*, Schreb.) and one cultivar of orchardgrass (*Dactylis glomerata* L.) were part of a study to determine changes in endophyte levels of fescue under two different styles of forage management: intensive and extensive. Included in the study were two endophyte infected-cultivars of tall fescue to compare interactions with endophyte free and infected cultivars. After three years, the results demonstrate that under high levels of management and non-endophyte infected crops prior to seeding, introduction of the endophyte can be reduced or delayed. Under lower levels of management and a smother crop into endophyte infected fescue prior to seeding, high yielding endophyte free cultivars maintain the lowest percent of re-infection (25.0-32.1% infected).

Keywords: Tall fescue, orchardgrass, endophyte, extensive, intensive

Introduction

Tall fescue for grazing livestock is commonly considered a versatile and persistent perennial forage. Tall fescue was first planted on a wide-spread basis in the USA in the 1940's, and now occupies some 14 million hectares. Most of the tall fescue stands in Southern Ohio are Kentucky 31 fescue with a 70-85 percent infection level of an endophyte (*Acremonium coenophialum*) which can have associated adverse affects on livestock performance. An endophyte is a plant which grows within another plant, in this case a fungus growing within the fescue. The term fescue toxicosis is often used to describe the adverse symptoms caused by the toxin (ergovaline) produced by the endophyte.

Grazing studies by Dr. Blaser (1986), dating back to 1956 reported usual beef steer gains of usually 0.45 kg per day while grazing tall fescue. Studies by Hoveland et al. (1983) note that steer gains are reduced from 0.83 kg per day on low-endophyte infected pastures to 0.45 kg per day on high-endophyte infected pastures. Studies from Putnam et al. (1990) reported that many mares grazing infected tall fescue exhibited reproductive abnormalities.

Farmers are reluctant to attempt eradication of endophyte-infected fescue and reseed with new cultivars of tall fescue. Seeding failures and poor stand durability are the most cited reasons for not trying new cultivars of tall fescue. It is also difficult to eradicate endophyte-infected tall fescue from pastures and prevent reintroduction from surviving rhizomes and seed in the soil.

The purpose of this study is to compare endophyte levels from various fescue cultivars on intensive and extensive management systems after three years.

Material and Methods

The field trial was established in 1995 at the Ohio Agricultural Research and Development

Center's Jackson Branch in southeast Ohio. The soil is a Rarden silt loam. Eleven grass cultivars that were currently on the market in the U.S. were included: eight were low or endophyte-free tall fescue, two were endophyte-infected tall fescue, and one was orchardgrass. Both sets of plots were seeded on 5 September 1995 with a no-till drill following suppression of the existing vegetation with paraquat dichloride (1,1'-dimethyl-4,4'-bipyridinium). At planting, 50 kg/ha of P was applied through the drill. Seeding rate was 11.2 kg/ha. On 1 October 1995, 67 kg/ha of N was applied and an additional 45 kg/ha was applied on 26 April, 1996. A randomized complete block design with two replications were used on each set of plots. ANOVA and LSD was accomplished using AGSTATS (Oregon State University, 1990).

Intensive Plots- Prior to seeding the plots existing vegetation was orchardgrass and perennial ryegrass (*Lolium perenne* L.) Soil pH was 6.0, available P was 23 ppm, and exchangeable K was 118 ppm. Plot size was 1.8 x 6.0 m. Broadleaf weeds were controlled in the plot area with 2,4-D amine (2,4-dichlorophenoxyacetic acid, dimethylamine salt) and dimethylamine salt of dicamba (3,6-dichloro-o-anisic acid) on 2 May 1996. Plots were mechanically harvested three times per year (May, July, August) from 1996-1998 and fertilized according to recommendations. On 20 October 1998, five samples from each plot (eleven plots, replicated twice) was obtained and each sample tested for endophyte levels.

Extensive Plots- Prior to seeding the plots existing vegetation was Kentucky 31 infected fescue. On 20 June 1995, plots were clipped prior to seed maturation, and on 26 June, existing vegetation was suppressed with paraquat dichloride. On 7 July, 56 kg/ha of Foxtail Millet was planted to suppress fescue regrowth (Jung, 1995). Plot size was 1.8 x 36.9 m. Plots were mechanically harvested in June, grazed in August (beef cows), and stockpiled for winter grazing from for three years (1996-1998). On 29 October 1998 ten samples from each plot (eleven plots replicated twice) was obtained and each sample tested for endophyte levels. Twice as many samples were taken from the extensive plots due to the much larger size to allow for grazing.

Results and Discussion

After three years, no endophyte was detected in the intensive plots that had endophyte free seed planted. Endophye levels were at 80% in the Kentucky 31 infected fescue and 100% in the Jessup infected fescue. No endophyte was detected in the endophyte free fescue or orchardgrass cultivars (Table1).

The endophyte was detected in all but one plot in the extensive trial. Even the orchardgrass displayed 62.5% and 87.5% infection rate (table 2). There were no significant differences in the infection rates, but the levels averaged 25.0% to 92.85 %.

Several factors could have contributed to the high endophyte levels in the extensive plots. Taylor et al. (1979) suggests that volunteering and spreading are enhanced by seed production of unclipped plants, through undergrazed pastures and over-mature hayfields. Although these plots were clipped for hay prior to initial seed maturation in late May, some plants did produce seed heads prior to grazing in August and during stockpiling for winter grazing in December. Cattle were also on infected pastures prior to grazing the plots allowing the possibility of infected seed to be in the manure. Although the plots had a smother crop prior to seeding and no viable seed had been produced for a year, re-infection occurred.

The intensively managed plots had no endophyte fescue in the endophyte free and orchardgrass plots. Under this management system, adequate fertility, no livestock on infected pastures prior to grazing and non endophyte infected perennial forages can reduce or eliminate the presence of endophyte infected fescue for three years.

Endophyte infected fescue has the advantages of stockpiling well for winter grazing, maintaining a sod cover in high traffic areas and holding the soil. Its problems include animal health problems, poor animal performance. Newer endophyte free fescue cultivars such as Au Triumph and Fawn have the advantages of infected fescue without many of the problems. These cultivars can be aggressive enough to reduce re-introduction of infected fescue in extensively managed fields (table 2). To reduce the levels of endophyte further, plant new cultivars of endophyte free fescue into endophyte free fields. If that is not an option, increased levels of management (ie. managed grazing, adequate fertility and timely harvests or clipping) will further reduce the chances of reinfection.

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Table 1 - Endophyte Levels of Intensive Managed Plots

		Percent Endophyte Infection		
Cultivar	Type	Replication 1	Replication 2	Average
Au Triumph EF[1]	Fescue	0.00	0.00	0.00a[3]
Kentucky 31 EI[2]	Fescue	80.00	80.00	80.00b
Stargrazer EF	Fescue	0.00	0.00	0.00a
Kentucky 31 EF	Fescue	0.00	0.00	0.00a
Festorina EF	Fescue	0.00	0.00	0.00a
Jessup EF	Fescue	0.00	0.00	0.00a
Barcel EF	Fescue	0.00	0.00	0.00a
Fawn EF	Fescue	0.00	0.00	0.00a
Martin EF	Fescue	0.00	0.00	0.00a
Jessup EI	Fescue	100.00	100.00	100.00c
Benchmark	Orchardgrass	0.00	0.00	0.00a
LSD (0.05%) CV=0.00%		0.01	0.01	0.01

[1]EF - Endophyte Free
[2]EI - Endophyte Infected

Table 2 - Endeophyte Levels of Extensive Managed Plots

Cultivar	Type	Percent Endophyte Infection		
		Replication 1	Replication 2	Average
Au Triumph EF[1]	Fescue	0.00	50.00	25.00
Kentucky 31 EI[2]	Fescue	80.00	57.10	68.55
Stargrazer EF	Fescue	70.00	66.60	68.30
Kentucky 31 EF	Fescue	66.60	66.60	66.60
Festorina EF	Fescue	22.20	37.50	29.85
Jessup EF	Fescue	62.50	22.20	42.35
Barcel EF	Fescue	37.50	87.50	62.50
Fawn EF	Fescue	28.50	30.00	29.25
Martin EF	Fescue	50.00	14.20	32.10
Jessup EI	Fescue	85.70	100.00	92.85
Benchmark	Orchardgrass	62.50	87.50	75.00
LSD (0.05%) CV=0.00%		NS	NS	NS

[1]EF - Endophyte Free
[2]EI - Endophyte Infected