Productivity and Animal Performance on Tall Fescue and Rye/Ryegrass Pastures under Conventional N Fertilization and Interseeding with Cool-Season Legumes

S.M. Interrante, T.J. Butler, C. Huo, and J.D. Stein
The Samuel Roberts Noble Foundation, Forage Improvement Division, 2510 Sam Noble Parkway, Ardmore, Oklahoma 73401 USA

THE SAMUEL ROBERTS NOBLE FOUNDATION

Introduction

• Tall fescue (*Festuca arundinacea* Schreb.) and rye (*Secale cereale* L.)/ryegrass (*Lolium multiflorum* L.) mixtures are the most commonly grown cool-season pasture grasses for cattle production in OK.

• Increasing cost of N fertilizer has resulted in interest in forage legumes as alternative and economical sources of N.

Objectives

• Determine the effects of conventional N fertilization of tall fescue and rye/ryegrass pastures compared to interseeding with cool-season annual forage legumes in south-central OK on:

➢ Forage production and

➢ Animal performance

Plant Material

• Grass Pastures
  • 'PDF 584' tall fescue and
  • 'Maton II' rye / 'Marshall' ryegrass mixture

• Cool-season grass/legume mixtures
  • Rye/Ryegrass: 'Apache' arrowleaf clover (*Trifolium vesiculosum* Savi), Austrian winter pea (*Pisum sativum* subsp. *arvense* L.), 'AU' hairy vetch (*Vicia villosa* Roth.), and 'NF' button medic (*Medicago orbicularis* [L.] Bartal.)

  • Tall Fescue: arrowleaf clover, Austrian winter pea, hairy vetch, and 'Durana' white clover (*T. repens* L.)

Experimental Site

• Noble Foundation, Ardmore, OK (34 10' N / 97 8' W)

• Soil: Heiden clay (fine, smectitic, thermic Udic Haplustert)

• Paddock size = 0.8 ha

Materials and Methods

• Paddocks receiving N fertilizer: 112 kg N ha^{-1}, and P and K according to soil test

• Tall fescue
  • Planted in 2005 and 2006
  • 17 kg PLS ha^{-1}

• Rye-ryegrass
  • Planted in Sept 2008
  • Rye: 112 kg PLS ha^{-1}
  • Ryegrass: 22 PLS kg ha^{-1}

• Cool-season legumes
  • Planted in Sept 2008
  • Austrian winter pea: 22 kg PLS ha^{-1}
  • Hairy vetch: 11 kg PLS ha^{-1}
  • Arrowleaf clover: 6 kg PLS ha^{-1}
  • Button Medic: 6 kg PLS ha^{-1}
  • White clover: 1 kg PLS ha^{-1}

• Pasture treatments arranged in 3 replications of a completely randomized design

• Grazing periods
  • Rye/ryegrass: Nov 2008 through Jan 2009

  • Tall fescue: Apr 2009 through June 2009

Rainfall and Temperature

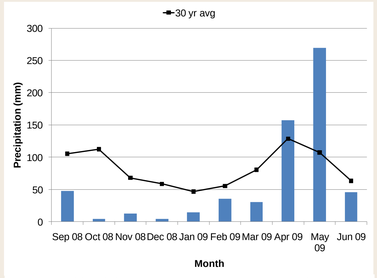

Fig. 1. Monthly rainfall data at Ardmore, OK; average of 30-yr and Sep 2008 through June 2009.

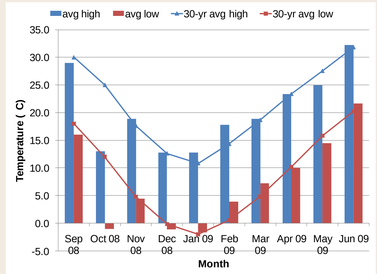

Fig. 2. Monthly temperature data at Ardmore, OK; average of 30-yr highs and lows and Sep 2008 through June 2009 highs and lows.

➢ Rainfall received from September 2008 through March 2009 was considerably lower than the 30-yr average.

➢ Early spring rainfall amounts were greater than the 30-yr average.

➢ Monthly high and low temperatures throughout the evaluation period tended to be consistent with the 30-yr average high and low temperatures, with the exception of a colder than average Oct.

Results and Discussion

• Total-season Forage Yield

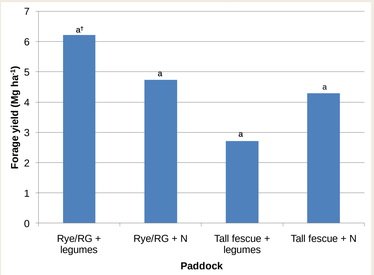

Fig. 3. Total-season forage yields of rye/ryegrass (R/RG) and tall fescue paddocks (P = 0.2, SE = 1.04).

➢ While not statistically different, rye/ryegrass paddocks tended to have greater total-season forage yield (average 5.5 Mg ha^{-1}) compared to tall fescue paddocks (average 3.5 Mg ha^{-1}).

• Seasonal Forage Yield

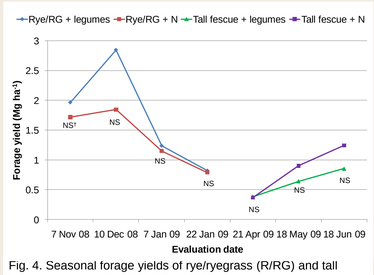

Fig. 4. Seasonal forage yields of rye/ryegrass (R/RG) and tall fescue paddocks (P = 0.2, SE = 1.04).

➢ There were no differences in forage yield between conventional N fertilizer and addition of legumes throughout the growing season for either rye/ryegrass or tall fescue paddocks.

➢ Considerably low rainfall amounts from autumn through the early spring likely contributed to the lack of treatment differences in terms of total-season and seasonal forage yields.

Rye/ryegrass + cool-season legumes paddock: January 2009

Rye/ryegrass + N paddock: January 2009

• Animal Performance

Table 1. Total gain, average daily gain (ADG), and days on pasture of rye/ryegrass (R/RG) and tall fescue paddocks.

Paddock	Total Gain	ADG	Days on Pasture
	----- kg animal^{-1} -----	--- kg animal^{-1} d^{-1} ---	---------- d ----------
Rye/RG + legumes	50.5 a†	0.9 a	62 a
Rye/RG + N	46.1 a	0.8 a	59 a
Tall fescue + legumes	35.3 a	0.7 a	51 a
Tall fescue + N	34.6 a	0.6 a	56 a
Average	41.6	0.75	57
P value	0.5	0.4	0.7
SE	8.88	0.13	6.7

† Means followed by the same letter within column do not differ by the LSMEANS test (P > 0.05)

➢ There were no differences in total gain, ADG, or days on pasture among the paddock treatments.

➢ Probably due to extremely dry weather conditions experienced during growing season

Rye/ryegrass + cool-season legumes paddock (background: tall fescue + N paddock) : January 2009

Rye/ryegrass + cool-season legumes paddock with standing Austrian winter pea hay: January 2009

Conclusions

• Lack of rainfall in the autumn and early spring likely resulted in lack of differences between N fertilizer and addition of winter legumes treatments.

• This experiment is currently being conducted again this year.

• After the second year of data is collected, economic analysis will also be conducted to determine economic feasibility of adding cool-season legumes to rye/ryegrass and tall fescue pastures compared to traditional N fertilization application.