Fescue Response to Variable Rates of Nitrogen Fertilization
Project Description

Nitrogen fertilization is essential for intensively managed swords of grass. Meadows where the predominate forage species is grass are often most limited by availability of nitrogen. The current economic and environmental cost of nitrogen fertilization are major factors influencing farm profitability and water quality. The objectives of every forage producer is to apply nutrients efficiently to maximize forage production while minimizing risks to the environment. Producers are interested in learning the point of diminishing returns when it comes to nitrogen application. A study conducted in 1998 at EORDC suggested fescue yield and nitrogen application per pound of dry matter produced may be more economically applied than suggested by current soil test reports. In the demonstration plots receiving 75 lb. of actual nitrogen per acre returned 13.56 lb. of dry matter per pound of nitrogen applied. Plots receiving 125 lb. of actual nitrogen yielded 12.48 lb. of dry matter per pound of nitrogen applied. A follow up study in 1999 revealed no significant difference between zero pounds of nitrogen applied with recommended levels of P_2O_5 (25 lbs/A) and K_20 (300 lbs/A) when compared to 125 lbs. of nitrogen plus recommended levels of P & K in a single application in the spring. Furthermore, 75 lbs. of nitrogen plus recommended levels of P & K in a single application in the spring was the only plot replication which differed significantly from the control. This study indicated that when these levels of N, P, and K are recommended, we should limit nitrogen application to no more than 75 lbs. of actual N per acre when applying all nutrients in a single application in the spring. Further research is needed to investigate forage response to reduced nitrogen application.

Producers are interested in applying commercial fertilizers at the lowest possible levels and to a point where forage quality and yield are not negatively impacted.

Problem:

Agronomists do not know to what level nitrogen application can be reduced on fescue swords and still maintain acceptable forage yields and quality.

Objectives:

To determine if nitrogen application can be reduced from 125 lb. of available N to 75 lb. of available N while maintaining acceptable forage quality and yield on fescue swords.

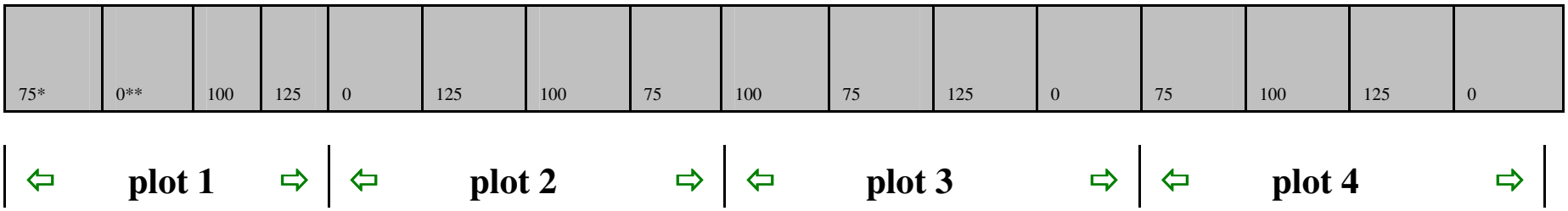
Methods:

A random block design will be developed and replicated four times. Individual plot size will be 20 feet x 20 feet. Recommended levels of P and K will be applied according to soil test. Nitrogen will be applied at recommended levels according to soil test, 125 lb N, 100 lb N, 75 lb N and a control with no additional nitrogen. Recommended levels of P and K will be applied in two applications, spring and fall. Nitrogen application will be applied in the spring and fall, half after first cutting and the remainder in August. Plots will be managed for three cuttings and 200 hundred square feet of forage would be harvested with a plot harvester, a sub-sample taken, dried, and analyzed for dry matter yield after each cutting. Dry matter yield would then be calculated for each experimental treatment.

Outcome and Measures:

Standard statistical analysis calculations would be utilized to detect variation in treatments measuring response in total dry matter production, and forage nutrients.

Fescue Fertilization Plots



***** Denotes lbs. of Nitrogen applied per acre

****** Control plots have received recommended levels of P & K applied with no Nitrogen.

1st hay harvest 5/23/00.

Fertilizer applied after 1st cutting 5/24/00

2nd cutting 7/14/00, 2nd fertilizer application 8/2/00

3rd cutting 9/8/00

Plot size: 20 x 20 feet. Plot treatment replicated 4 times and randomly selected. All plots will receive split application of nutrients N, P, & K. Half in the spring and the remainder in the fall. The only variable is Nitrogen amount.

Data Analysis
Fescue Fertilization Trial

General Linear Models Procedure

T tests (LSD) for variable: DM

NOTE: this test controls the type I comparison-wise error rate not the experiment-wise error rate.

Alpha = 0.05 df = 9 MSE = 37846.32
Critical Value of T= 2.26
Least Significant Difference = 220.04

Means with the same letter are not significantly different.

T Grouping	Mean	N	Nitrogen
A A	3636.63	8	125
A A	3553.50	8	100
A A	3517.25	8	75
B	3108.38	8	0

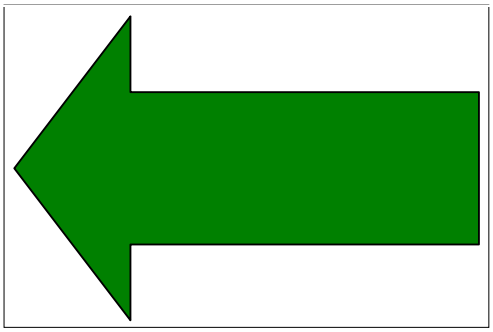
Co-efficient of variation = 13.6%
An acceptable level of experimental error for field studies.

Data Analysis
Fescue Fertilization Trial

General Linear Models Procedure

	Nitrogen Level	N	pounds of DM/acre	
			Mean	SD
	0	8	3108.38	825.03
	75	8	3517.25	757.56
	100	8	3553.50	720.83
	125	8	3636.63	725.42
	Level of CUT	N	---------DM Mean	---------- SD
	2	16	4133.69	268.62
	3	16	2774.19	323.33
Level of Nitrogen	Level of CUT	N	---------DM Mean	---------- SD
0	2	4	3840.75	193.13
0	3	4	2376.00	347.28
75	2	4	4190.00	253.07
75	3	4	2844.50	261.02
100	2	4	4203.75	213.65
100	3	4	2903.25	197.98
125	2	4	4300.25	227.18
125	3	4	2973.00	43.24

Conclusion:



Cost to fertilize at various nitrogen levels: Calculations are based on ammonium nitrate @ $230/ton compared to control. Costs do not include spreading. Costs are assessed to additional forage generated by nitrogen fertilization.

Example:

Total Mean yield of Control = 3108
Total Mean yield @ 75 lb. N/A = 3517

Difference = 409 lb of DM

Cost = 220.5 lb. N x .115¢/lb. = $25.35/A

Cost/ton of forage = $\frac{\$25.35}{.205 \text{ tons}}$ = $123.96/ton

@ 100 lbs N/A = $\frac{\$33.82}{.223 \text{ tons}}$ = $151.66/ton

@ 125 lbs N/A = $\frac{\$42.28}{.265 \text{ tons}}$ = $159.85/ton

Discussion:

On these plots, in year 2000, the results indicate we would have maximized our profit per acre by applying only 75 units of nitrogen. Treatments did not vary significantly between nitrogen amounts. The questions becomes, how much nitrogen do we actually need on these fescue plots? Over the past three years of nitrogen research on these plots the following trends have been indicated.

1.) 1998 - Nitrogen source did not significantly affect yield when applied at the same level and used properly.

- Significant differences do exist in the cost of fertilizers. As cost increases so does the cost per ton of forage produced. The current value of fescue hay prices make it difficult to recoup fertilization costs. 75 units of actual N applied either as a single application or split applied has been the most economical level of nitrogen demonstrated in these studies.

- Fertilization has affected forage quality, yield and micronutrient absorption.

2.) 1999 - 75 lbs. of nitrogen was as effective as higher rates of nitrogen (when applied in a single application in the spring).

3.) 2000 - 75 lbs of nitrogen split applied with P & K split applied was as effective as higher rates of nitrogen applied in the same manner.

4.) The annual yield response for cool-season grass to nitrogen application will vary based on weather conditions, forage species, timing of nitrogen application, soil organic matter content, etc.

5.) Applications of nitrogen fertilizer should be based on the value of additional forage produced from this fertilization and the cost to the forage stand if applying no nitrogen.

FESCUE RESPONSE TO VARIABLE RATES OF NITROGEN FERTILIZATION

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Nitrogen fertilization is essential to maximize production of intensively managed grass swords. The current economic and environmental cost of nitrogen fertilization are major factors influencing farm profitability and water quality. The objectives of every forage producer are to apply nutrients efficiently to maximize forage production while minimizing risks to the environment. Our objective in this study was to evaluate three levels of nitrogen fertilization on fescue: 125, 100, and 75 pounds of actual nitrogen per acre and control plots. Nitrogen was split applied, half after first cutting and the remainder in August. All plots received recommended levels of phosphorus and potassium, according to soil tests. The results indicated that on these plots in year 2000 we would have maximized our profits per acre by applying only 75 units of nitrogen per acre.

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