

Project Title: Nitrogen fertilization strategies for annual ryegrass pasture

Investigators: Robert L. Kallenbach and Richard J. Crawford, Jr.
Plant Sciences Unit and the Southwest Research and Education Center
University of Missouri

Accomplishments for Year 1:

- A three-year field trial studying the effects of nitrogen rate and date of application on the yield and quality of annual ryegrass began in August, 2002. This replicated (4x) experiment has 16 treatments; four N rates at planting (0, 50, 100, and 150 lb/acre of N) followed by either 0, 50, 100, or 150 lb/acre of N in late winter. The table below describes the rate and date of N applications for treatments.

Treatment	N at planting	N in Late winter
	----- lb N /acre -----	
1	0	0
2	0	50
3	0	100
4	0	150
5	50	0
6	50	50
7	50	100
8	50	150
9	100	0
10	100	50
11	100	100
12	100	150
13	150	0
14	150	50
15	150	100
16	150	150

- We established the annual ryegrass in to a conventionally tilled seedbed at the Southwest Research and Education Center near Mt. Vernon, MO in late August of 2002 (Fig. 1). The seeding rate was 30 lb/acre of pure live seed. After seeding, the autumn fertilizer treatments were applied.



Fig. 1. Planting annual ryegrass at the Southwest Research and Education Center near Mt. Vernon, MO. The annual ryegrass was planted into a conventional seedbed in late August of 2002. The stand established well but dry weather conditions in autumn have limited growth so far.

- Soil samples to a 40-inch depth were taken prior to seeding using a hydraulically operated soil probe. The probe diameter was 1.5 inches. Samples were split into three depth classes (0-10, 10-20, and 20-40 inches) and then analyzed for NH_4 and NO_3 content. Initial results showed that plots had equal ($P>0.05$) levels of pre-experiment NH_4 and NO_3 .
- As planned, we started collecting forage growth data in the autumn of 2002 and this will continue through May of 2003 for the first year. Dry autumn weather at this location has limited forage growth to date. So far, all treatments have produced approximately 1500 lb/acre of dry matter which is less than 30% of what we would normally expect by this time. The lack of a response to N fertilizer is also abnormal as studies conducted in other states show that annual ryegrass responds quite favorably to N. Likely, the dry weather this autumn is responsible for this response. However, we expect that once the entire season's data has been collected (usually complete by late May), we will see a substantial response to N fertilization.
- Forage quality samples show that annual ryegrass is excellent forage. Samples collected to date show that annual ryegrass has a crude protein content of 28% and acid detergent fiber values less than 17%. In short, few other forages can produce such excellent quality feed for winter grazing.
- More than 1,000 individuals had the opportunity to view this new research project as part of various extension education programs and field days conducted at the Southwest

Research and Education Center. As we develop more comprehensive data over the next three years, we will be able to extend our results even further.

Objectives for Year 2:

- Over the next year we will continue our research on N fertilization of annual ryegrass. Because annual ryegrass is planted in August and harvested through winter and early spring, we are only partway through the first year of data collection. As outlined in our original proposal, the tasks in the table below will be conducted over the next year.

Harvest plots for forage yield and retain subsamples for forage quality analysis	Ongoing as forage growth dictates. Anticipate 5 to 7 harvests per year.
Apply N to plots receiving late winter fertilizer	3/1/03
Take five, 3 inch diameter cores from each plot & count the number of tillers	4/15/03
Take soil cores from each plot to determine residual soil N	6/1/03
Analyze samples taken to date for forage quality	7/31/03
Prepare seedbed for annual ryegrass planting (Year 2 of study begins)	8/20/03
Take soil core samples to a 40-inch depth for initial soil nitrogen determinations (Year 2)	8/31/03
Plant annual ryegrass at 30 lb/acre (Year 2)	9/1/03
Apply N fertilizer to plots receiving an autumn application (Year 2)	9/1/03
Take five, 3 inch diameter cores from each plot & count the number of tillers (Year 2)	10/10/03
Harvest plots for forage yield and retain subsamples for forage quality analysis (Year 2)	Ongoing as forage growth dictates. Anticipate 5 to 7 harvests per year.

- In addition, we will be fully analyzing our field data from the first year next summer. We are most interested in refining N recommendations for annual ryegrass so that maximum economic productivity can be obtained by forage-livestock producers. In addition, we would like to understand more about the fate N applied at relatively high rates to annual ryegrass. Work from other regions suggests that annual ryegrass can capture nearly all of the N applied to the surface. This may make it an ideal crop for operations with a large amount livestock manure.
- We will continue to integrate our findings into the curriculum of the Missouri Grazing Schools, grazing workshops statewide, and at the Southwest Research and Education Center Field day. These outreach efforts can be expected to reach more than 1,000 producers, agency staff, and agri-business personnel. Additionally, as more comprehensive data are collected, we will start work on a new guidesheet about annual ryegrass fertilization. In addition we will prepare articles to be published in statewide and national

magazines such as Missouri Ruralist, Graze, Stockman Grass Farmer and scientific journals.

Budget:

As requested last year, our budget for the second year of studies is as follows.

Year 2

Salary and Benefits

Research Specialist (25% of \$31,500)	\$ 7,875
Benefits for Research Specialist	\$ 1,969
<hr/>	
Total Salary and Benefits	\$ 9,844

Operating Expenses

Seed, fertilizer, bags, repair parts for harvester and other field supplies	\$ 1,850
NIR charges for forage quality analysis (approx. 300 samples @ \$1 each)	\$ 300
Forage quality wet chemistry for NIR calibration (60 samples @ \$11 each)	\$ 666
Soil N analysis (66 samples @ \$8 each)	\$ 528
Travel to SWC (mileage, lodging, and meals for six trips per year)	\$ 1,464
<hr/>	
Total Operating Expenses	\$ 4,808

Equipment

None requested	\$ 0
<hr/>	
Total Equipment	\$ 0

Total Proposal Request for Year #2

\$14,652