

**Project Title:** Nitrogen fertilization strategies for annual ryegrass pasture

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**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 in autumn (0, 50, 100, and 150 lb. per acre of N at planting) followed by the either 0, 50, 100, or 150 lb. per acre of N in early spring. The table below describes the rate and date of N applications for treatments.

| Treatment | N in autumn                | N in early spring |
|-----------|----------------------------|-------------------|
|           | ----- lb. N per 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               |

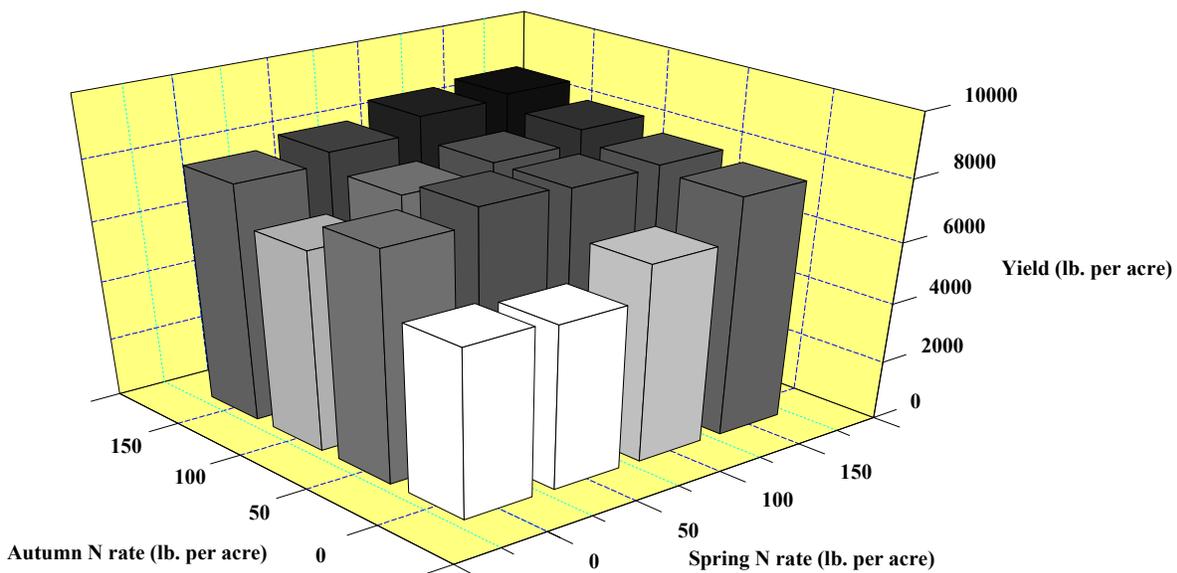
- We established the annual ryegrass into a conventionally tilled seedbed at the Southwest Research and Education Center near Mt. Vernon, MO in late August of 2002, 2003 and 2004 (Fig. 1). The seeding rate was 30 lb. per acre of pure live seed. After seeding, the autumn fertilizer treatments were applied.



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, 2003 and 2004. In 2002, the stand established well but dry weather conditions in autumn limited fall growth. Growth in the autumn of 2003 and 2004 was excellent.

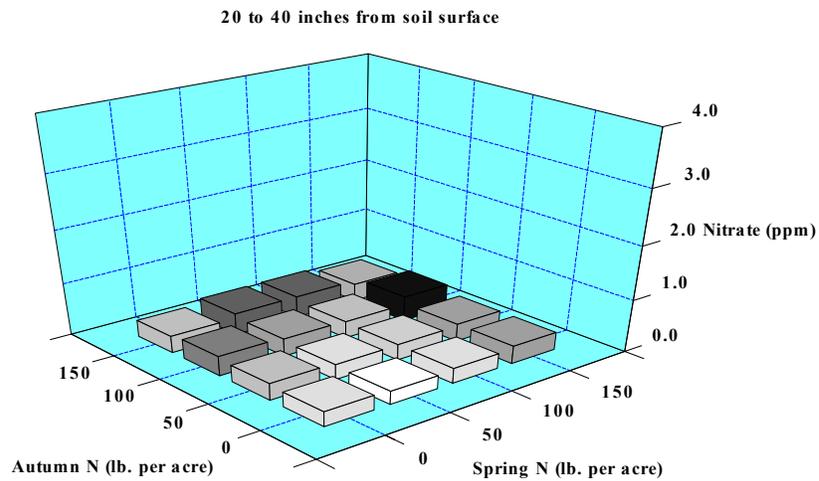
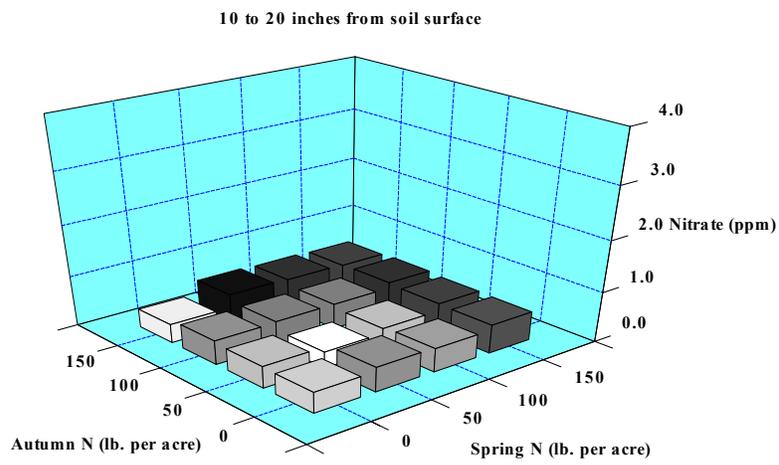
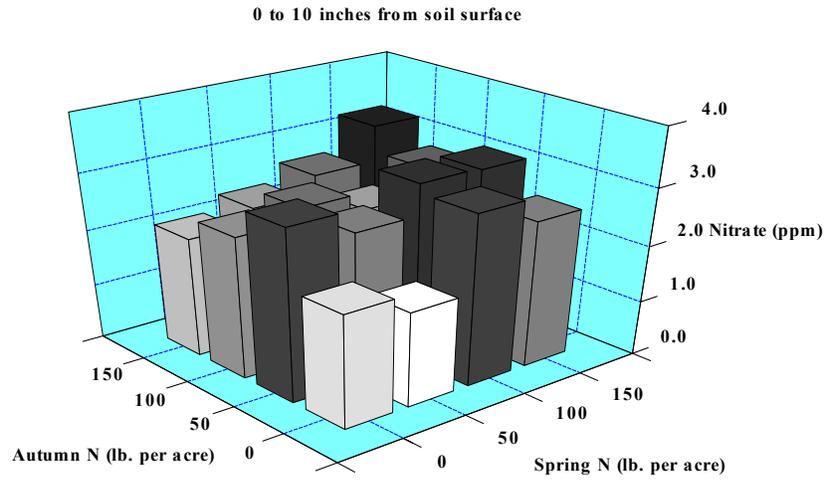
- This past year (2003-2004), two harvests were possible in autumn for all treatments, although autumn yields were greatest for plots receiving 50 or more lb. per acre of N at planting. When an additional 50 or more lb. per acre of N was applied in spring, earlier and more frequent harvests were possible. This suggests that plots not receiving any N in autumn use residual soil N for a while, but that this supply runs out in about 60 days.
- Season long (total) yields were in excess of 8,000 lb. per acre for the best treatments (Fig. 2). While the highest N rates provided the greatest yields, it appears that 50 lb. per acre of N in autumn followed by 50 lb. per acre in early spring provides an even distribution of forage yield and gives the best economic response.

Fig. 2. Season-long (August 2003 to June 2004) annual ryegrass yields in response to fall and spring applied N at Mt. Vernon, MO.



- Forage quality samples show that annual ryegrass is excellent forage. Samples for the last two years have showed that annual ryegrass averaged 24% crude protein and had acid detergent fiber values less than 22%. In short, few other forages can produce such excellent quality feed for winter and early spring grazing.
- Soil samples were taken to a 40-inch depth prior to applying fertilizer treatments each year and again after the annual ryegrass ended its spring growth in June. Samples were split into three depth classes (0-10, 10-20, and 20-40 inches) and then analyzed for  $\text{NH}_4$  and  $\text{NO}_3$  content. Initial results showed that plots had equal ( $P>0.05$ ) levels of pre-experiment  $\text{NH}_4$  and  $\text{NO}_3$ . Samples collected in June 2004 showed that soil nitrate levels, 0 to 10 inches from the soil surface, were 3 ppm when 150 lb. per acre of N was applied in both autumn and spring, while the all the other treatments had 3 ppm of nitrate or less (Fig. 3). At deeper depths, (10 to 20 and 20 to 40 inches from the surface) soil nitrate levels were less than 1 ppm for all treatments. This suggests that little N is lost due to leaching from annual ryegrass pastures at the rates of N we examined.

Fig. 3. Soil nitrate levels June of 2004 when fertilized with 0, 50, 100, 150 lb. per acre of N in autumn and 0, 50, 100, 150 lb. per acre of N in early spring.



More than 1,000 individuals had the opportunity to view this 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 year, we will be able to extend our results even further.

**Objectives left to finish:**

- 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 third year of data collection. As outlined in our original proposal, the tasks in the table below will be conducted over the next year. Note that no additional funding is requested.

|  |   |
|--|---|
| 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 early spring fertilizer                               | 3/1/05  |
| Take five, 3 inch diameter cores from each plot & count the number of tillers    | 4/15/05   |
| Take soil cores from each plot to determine residual soil N                      | 6/1/05  |
| Analyze samples taken to date for forage quality                                 | 7/31/05   |
| Prepare final report to Missouri Fertilizer and Lime Council                     | 12/15/05  |
| Prepare a guidesheet on N fertilization of annual ryegrass                       | 12/15/05  |
| Work with publications office on articles for the popular press                  | 12/15/05  |

- In addition, we will be fully analyzing our field data 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 of N applied at relatively high rates to annual ryegrass. Our preliminary data as well as that 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 large amounts of 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:        \$0**

No additional budget is requested for this year. Since this project starts in August and continues through July of each year, we still have about six more months of data to collect before the project is completed. We only request that we be allowed to carry over the funding already allocated for this project so that we can complete it.