

## Fall versus Spring Nitrogen Fertilization on Pasture

### A.S. Leaflet R1780

S. K. Barnhart, professor of agronomy

L. J. Secor, Superintendent, McNay, Research and  
Demonstration Farm

B. J. Havlovic, Superintendent, Armstrong Research and  
Demonstration Farm

#### Summary

**Iowa livestock producers managing drought-stressed pastures wanted to know if grass-based pastures would recover more quickly or produce more forage by applying nitrogen to pastures in the fall versus their traditional spring application management. A pasture fertilization study was conducted on cool-season grass-based pastures at the Iowa State University Armstrong, Neely-Kinyon, and McNay Research and Demonstration Farms. Urea was hand applied at rates of 0, 22.5, 45, 66.7, and 90 lbs/acre to small plots at each site in October 2000. Some plots received 22.5 and 45 lbs/acre of N at the fall application date as the first half of a split application to total 45 and 90 lb/acre of N. The same N rates were applied to different plots and the remainder of the split application treatments was applied in March 2001. Dry matter yield was determined in mid-May 2001. Yields at the Neely-Kinyon and McNay farms were similar, and slightly higher than those at the Armstrong farm. Yield response to nitrogen application rates was positive and linear for each additional unit of nitrogen applied. The average total increase was about 38% for the first 45 lbsN/acre and about 81% for the 90 lbN/acre rates. There was no statistically significant or consistent relation between pasture yield increase and timing of nitrogen application across the three sites, but there were minor differences among sites. The trend, however, indicated that greater yields frequently were obtained from the early spring application treatments.**

**Data was not collected to assess forage nutritive quality or stand density, however, both could be of value and importance to the long-term sustainability of a forage-livestock enterprise. These results indicate that for the period studied, there was no consistent advantage in applying nitrogen fertilizer to grass-based pastures in late fall or splitting the total application between fall and spring as compared to making traditional spring nitrogen applications.**

#### Introduction

Southern and southwestern Iowa experienced a period of lower than normal precipitation from fall 1999 through fall 2000. During extended moisture deficit periods such as this, pasture use generally continues at normal levels until

diminished pasture regrowth limits livestock intake and supplemental forage or grain feeding is implemented. The physiological vigor of pasture plants often is affected into the subsequent growing season.

This was the situation in much of southern and southwestern Iowa in fall 2000, and Iowa producers whose livestock production enterprises depend on pasture as a major annual feed source were inquiring whether fall applications of nitrogen (N) fertilizer would be a better management alternative on drought-affected pastures than traditional early spring nitrogen application management. There was limited data available to answer that question, so a pilot study was undertaken to compare affects of fall versus spring nitrogen application on spring pasture production.

#### Materials and Methods

Sites reflecting the condition of many perennial, cool-season grass-based pastures in the area were identified on the Armstrong, Neely-Kinyon, and McNay Research and Demonstration Farms in southern and southwestern Iowa. The vegetative composition at all sites was mixed grasses with less than 15% forage legumes.

The Armstrong Farm site had a general mixture of Kentucky bluegrass, tall fescue, smooth brome grass, and orchardgrass. The Neely-Kinyon site was primarily smooth brome grass, Kentucky bluegrass, and Orchardgrass and had the greatest legume content. The McNay pasture area contained predominantly Kentucky bluegrass and orchardgrass, with minor amounts of smooth brome grass, tall fescue and reed canarygrass. All pasture sites had been grazed prior to nitrogen application; residual forage heights averaged 1—2 ½ in, with patches of taller vegetation in the vicinity of dung pats.

Nitrogen (N) treatments were applied October 27, 2000, at the Armstrong and Neely-Kinyon sites, and October 30, 2000, at the McNay site. Urea was hand applied at rates of 0, 22.5, 45, 66.7, and 90 lbs/acre to 10-ft x 20-ft plots, with 3 replicates at each site. Some plots received 22.5 and 45 lbs/acre of N at the fall application date as the first half of a split application totaling 45 and 90 lb/acre of N. The same N rates were applied to different plots on March 14 as spring treatments at all locations. The remainder of the split application treatments was applied to the appropriate plot areas on the same dates.

Plots were harvested May 16, 2000, at the Armstrong and Neely-Kinyon sites and May 18, 2000, at the McNay site. A 20-ft by 19-in swath was cut from each plot at a 2-in height with a rotary mower. Cut forage was collected in the catch basket of the mower then weighed and sub-sampled for dry matter determination. Dry matter yield was calculated for each plot and data were analyzed using analysis of variance.

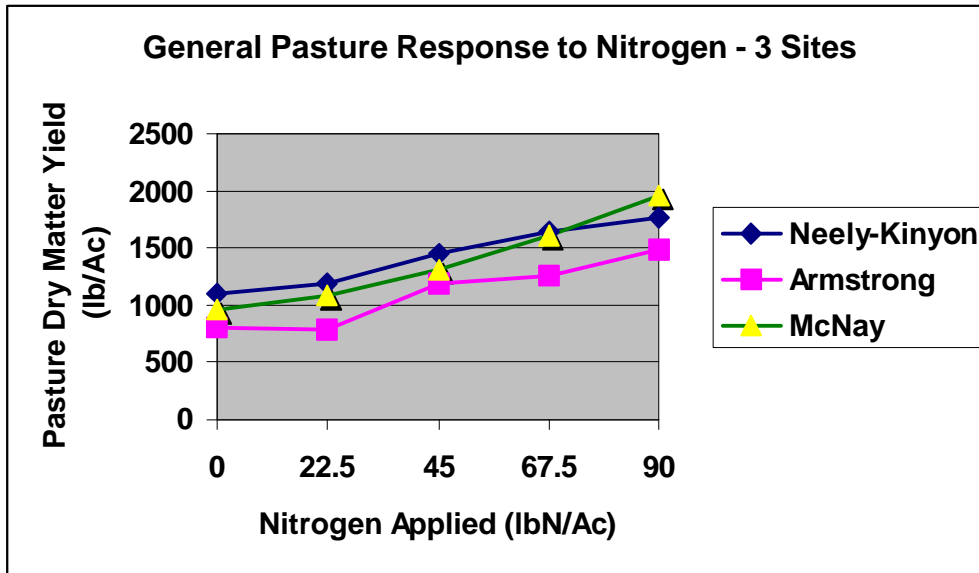
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### Results and Discussion

Pasture yields varied for locations (Figure 1). This type of variability is expected, due to differences in soil productivity and forage types. Yields at the Neely-Kinyon and McNay farms were similar, and slightly higher than those at the Armstrong farm. Yield response to nitrogen application rates was positive and linear; this meant that at the nitrogen levels used, the forage yield response increased at a uniform rate for each additional unit of nitrogen applied.

The increase in pasture dry matter (DM) production, across all application levels, was at a rate of about 8.2, 9, and 11.3 lb/DM per lb of N applied for the Armstrong, Neely-Kinyon, and McNay locations, respectively. The average total increase was about 38% for the first 45 lbsN/acre and about 81% for the 90 lbsN/acre rates. These increases varied somewhat from farm to farm, with the greatest at the McNay farm and the least increase at the Armstrong farm.

Figure 1. General pasture response to nitrogen at the three sites



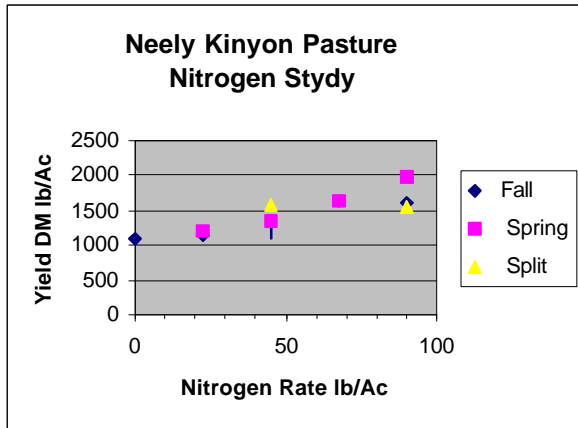
There was no statistically significant or consistent relation between pasture yield increase and timing of nitrogen application across the three sites, but there were minor differences among sites. The trend, however, indicated that greater yields frequently were obtained from the early spring application treatments. (Figures 2, 3, 4.)

There was a statistically significant interaction between N application rates and timing of application. This likely

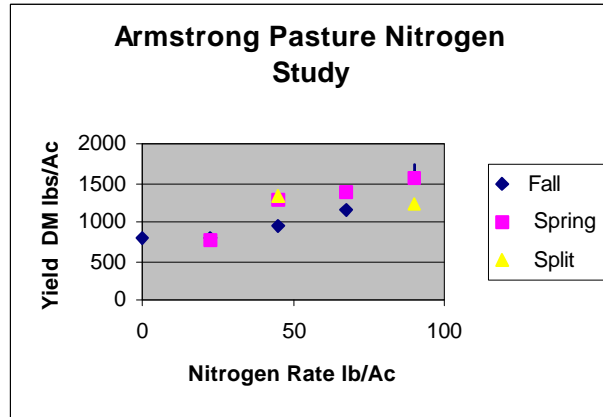
was due to the inconsistent response to the split application treatment at the Neely-Kinyon and Armstrong locations. Data was not collected to assess forage nutritive quality or stand density benefits from fall versus spring nitrogen application managements, both of which also could be of value and importance to the long-term sustainability of a forage-livestock enterprise.

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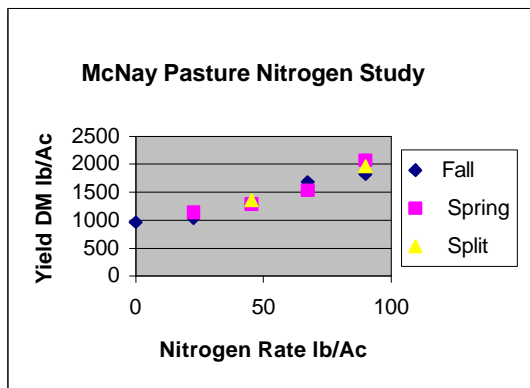
**Figure 2. Neely-Kinyon Farm Pasture Fertilization Study: Nitrogen Rates and Timing. 2001-1002**



**Figure 3. Armstrong Farm Pasture Fertilization Study: Nitrogen Rates and timing. 2000-2001**



**Figure 4. McNay Farm Pasture Fertilization Study: Nitrogen Rates and Timing. 2000-2001**



### Implications

This series of pasture fertilization studies verifies a forage production response to added nitrogen. The yield responses indicate that, at the rates used, forage yield still was increasing at a uniform rate, with greater returns likely at higher application rates before the return per unit of added nitrogen diminished. The data from these studies showed that, in an attempt to increase spring pasture growth, there was no consistent advantage in applying nitrogen fertilizer in late fall or splitting the total application between fall and spring instead of making traditional spring nitrogen applications.

From a grazing management perspective, producers should consider that normal, unfertilized spring production of cool-season grass-based pastures often exceed quantities that grazing livestock effectively can use. So, when considering nitrogen fertilization for pasture, producers should plan for effective use of additional nitrogen-stimulated forage produced from fall or spring fertilization management.