# RESPONSES OF MERION KENTUCKY BLUEGRASS SOD TO NITROGEN FERTILIZATION

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In determination of optimum nitrogen fertilization for sod production one must consider the objectives in the sod production enterprise as well as a number of other factors. Questions which might be asked are: Is the operation geared to rapid maturing of the crop, or is it necessary to hold the crop for a period of time until markets develop? Are clippings to be utilized? What is the type of soil on which the sod is being grown? Is irrigation available? What is the potential for leaching of nitrates? What species and variety of grass is being grown?

The effects of varying of levels of nitrogen, phosphorus, and potassium on Merion Kentucky bluegrass sod was studied by Satari (2). More recently, English (1) has completed a study on the effects of nitrogen on sod development. He was particularly interested in measurements of nitrogen responses which might be used in predicting nitrogen needs in sod production. In this study Merion Kentucky bluegrass was seeded at 40 pounds per acre in August, 1969 on Houghton Muck at the Michigan State University Muck Experimental farm. The nitrogen treatments which were applied are given in Table 1.

The check treatment (no. 1) received no nitrogen at any times during the study. The 60 and 120 pounds nitrogen per acre per month treatments (3 and 4, respectively) are in excess of normal recommendations but it was felt these treatments were needed to determine the maximum nitrogen application that could be used on sod. Treatments 2 and 5 represent 30 and 15 pounds nitrogen monthly applications of nitrogen, respectively.

Soil nitrate levels were measured every two weeks throughout the 1970 growing season. This measurement was not effective in determining differences due to the nitrogen treatments described in Table 1, except two weeks after each nitrogen application for the 120 pound nitrogen treatments and for the 60 pound nitrogen treatment later in the summer. Since these two treatments were higher than would normally be applied this test did not prove sensitive enough to justify its use for predicting nitrogen fertilizer needs for sod.

The nitrate content of the soil in the check plot rose gradually during the summer, reaching a peak of 36.6 parts per million in October. The total nitrogen content of the soil, sampled periodically during the summer, ranged from 2.7 to 3.0 percent nitrogen and did not vary due to treatment throughout the season. This high nitrogen content in the soil and the tendency for nitrates to increase in the check plot during the summer points out the large reservoir of nitrogen which organic soils possess and emphasizes the importance of careful nitrogen fertilization for sod on organic soils, especially in late summer.

Table 1. Pounds of nitrogen (as ammonium nitrate) per acre and application dates.

| Treatment | 1969 | May 1 | June 5 | June 30 | Aug 4 | Sept 30 | Total for 1970 |
|---|---|---|---|---|---|---|---|
| 1 | 0* | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 30* | 30 | 30 | 30 | 30 | 30 | 150 |
| 3 | 60* | 60 | 60 | 60 | 60 | 60 | 300 |
| 4 | 120* | 120 | 120 | 120 | 120 | 120 | 600 |
| 5 | 0* | 15 | 15 | 15 | 15 | 15 | 75 |
| 6 | 30* | 15 | 15 | 15 | 15 | 15 | 75 |
| 7 | 60* | 15 | 15 | 15 | 15 | 15 | 75 |
| 8 | 120* | 15 | 15 | 15 | 15 | 15 | 75 |
| 9 | 0** | 30 | 30 | 30 | 0 | 0 | 90 |
| 10 | 30** | 30 | 30 | 30 | 30 | 30 | 150 |
| 11 | 60** | 30 | 30 | 30 | 60 | 60 | 210 |
| 12 | 120** | 30 | 30 | 30 | 120 | 120 | 330 |
| 13 | 30* | 30 | 30 | 0 | 0 | 0 | 60 |
| 14 | 30* | 30 | 30 | 30 | 30 | 30 | 150 |
| 15 | 30* | 30 | 30 | 60 | 60 | 60 | 240 |
| 16 | 30* | 30 | 30 | 120 | 120 | 120 | 420 |

* Applied in seedbed August 29, 1969.

** Topdress application October 6, 1969.

This is the time of year when soil temperatures are warm and microbial activity is causing decomposition of some of the organic matter and release of available nitrogen during this period of the growing season.

In clipping response there is a wide range in production due to nitrogen treatment as would be expected (Table 2). The check plot produced 1400 pounds of fresh clippings per acre during the growing season while the 160 pound nitrogen monthly treatment produced over 35,000 pounds of clippings. The amount of clippings harvested per week varied widely for each treatment. The clippings from the higher nitrogen treatments were higher in percent moisture (76% water for the 160 pound treatment compared to 67% water in the clippings from the check plot). Other treatments ranged between these values.

The nitrogen content of the clippings (Table 2) increased with nitrogen additions ranging from 3.0% nitrogen (season average) for the check compared to 5.4% nitrogen in clippings from the highest nitrogen treatment. Nitrogen content varied throughout the season, however, as the clippings from the check plot ranged from as low as 1.8% to as high as 4.4%. Clippings from the 160 pound nitrogen treatment ranged from 4.3 to 6.1% nitrogen. Utilization of clippings from a sod farm would necessitate consideration of these variations in nitrogen content as well as in total clipping weights.

Table 2. Effect of nitrogen treatments on clippings, sod strengths, and rhizome weights. (Taken from thesis by English (1) ).

| Treatment # | Total Fresh Clipping wt. Pounds/Acre | Nitrogen in Clippings % | Sod Strength 7/22/70 Pounds to Tear | Sod Strength 10/15/70 Pounds to Tear | Rhizome Wt. 7/22/70 mg |
|---|---|---|---|---|---|
| 1 | 1400 | 3.0 | 109 | 146 | 99.0 |
| 2 | 9395 | 3.6 | 123 | 130 | 119.8 |
| 3 | 22480 | 4.5 | 105 | 97 | 42.7 |
| 4 | 35276 | 5.4 | 68 | 67 | 13.6 |
| 5 | 6373 | 3.3 | 148 | 188 | 89.4 |
| 6 | 7429 | - | 155 | 182 | 112.9 |
| 7 | 7046 | - | 135 | 180 | 160.0 |
| 8 | 6963 | - | 130 | 171 | 189.9 |
| 9 | 8329 | - | 157 | 143 | 126.4 |
| 10 | 11834 | - | 128 | 173 | 142.9 |
| 11 | 14204 | - | 137 | 105 | 82.2 |
| 12 | 20473 | - | 119 | 130 | 39.3 |
| 13 | 7554 | - | 137 | 192 | 271.7 |
| 14 | 12258 | - | 128 | 113 | 93.9 |
| 15 | 16706 | - | 136 | 93 | 144.2 |
| 16 | 19746 | - | 128 | 114 | 96.6 |

The sod strength data in Table 2 show the influence of higher nitrogen on weakening sod. On both the July 22 and October 15 dates the sod strengths were highest for the 15 pound monthly nitrogen treatment compared to other monthly nitrogen treatments (see treatments 1 through 5). The higher nitrogen treatments decreased sod strengths especially later in the summer as nitrogen was also released from the soil. When nitrogen application was reduced or stopped entirely during the summer, sod strengths were increased (see treatments 9 and 13). The lowest nitrogen treatments did not maintain a good color in the sod, however, so this must be considered in having an attractive, saleable sod.

Rhizome growth measured in July reflected the effects of nitrogen on the July sod strengths (Table 2). In most cases when sod strengths were greater the rhizome weights were also higher.

These results point out the influence of heavy nitrogen treatments on sod strength and that some nitrogen is released from the organic soil during the growing season. Late summer nitrogen fertilization should be reduced to account for this nitrogen release from the soil. Summer nitrogen fertilization should be applied only as needed to maintain color. If the crop is mature enough to harvest but must be held until a market is available minimum nitrogen rates should be used - just enough to keep out weeds.

## Conclusions

These results suggest that the variables studied here did not provide a useful means of predicting nitrogen needs for sod production. The clipping information is helpful in assessing the potential for clipping utilization. The heavier nitrogen treatments decreased sod strengths and rhizome growth. Timing of nitrogen application is important in encouraging rapid sod development. Nitrogen is released from the organic soil during the growing season, especially in late summer. As a result summer nitrogen fertilization should be reduced accordingly. This is particularly important if the sod is already mature but cannot be harvested until it can be sold at a later date.

Current nitrogen recommendations for Merion Kentucky bluegrass grown for sod on organic soils are in the range of 90 to 150 pounds nitrogen per acre annually. Most of this nitrogen should normally be applied during the spring and fall months with enough during the summer to maintain color and growth. These rates will have to be adjusted to each particular situation.

## Bibliography


1. English, Kendall, R. 1971. Effects of nitrogen fertilization on the sod development of Kentucky bluegrass (*Poa pratensis* L. Merion) on Houghton muck as measured by several nitrogen responses. M.S. Thesis. Michigan State University.

2. Satari, Achmad, M. 1967. Effects of various rates and combinations of nitrogen, phosphorus,potassium and cutting heights on the development of rhizome, root, total available carbohydrate and foliate composition of *Poa pratensis* L. Merion grown on Houghton muck. Ph.D. thesis. Michigan State University.