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Fertilizing Grasses with Nitrogen


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Introduction

Forage research the past five years has resulted in breakthroughs in hay yields, protein production, and longevity of stands. Hay yields of 8 to 10 tons, or more, per acre have been obtained. Yields of this magnitude will result in a protein yield of 2,000 to 3,000 pounds per acre. With proper management and liberal fertilization, highly productive stands have been maintained for more than five years.

With the advent of lower cost commercial nitrogen fertilizer and the threat of the alfalfa weevil, an experiment was initiated on the Purdue University Agronomy Farm at Lafayette to investigate the yield potential of several cool-season grasses under intensive management. On April 8, 1966, Potomac orchardgrass, Kentucky 31 tall fescue, Lincoln smooth bromegrass, and reed canarygrass were seeded individually with oats as a companion crop. Currently herbicides are available for use with forage seedings which make it possible to obtain three to five tons of forage the seeding year. The soil type was Chalmers silty clay loam. At seeding, 305 pounds of 25-25-0 was applied per acre. The oat crop was harvested for grain on July 22 and the straw removed.

Research Plots Established

In April, 1967, research plots were established on the four grasses and ammonium nitrate was broadcast at rates of 0, 12.5, 25, 50, 100, 200 and 400 pounds of actual nitrogen per acre per harvest. The initial application of nitrogen was in early April with the following applications being applied immediately after each hay harvest. The last cutting received no nitrogen after harvest.

Cutting Management

Cutting management depended upon the morphological characteristics of the individual grasses. Five cuttings were obtained annually from orchardgrass and tall fescue since these grasses head out in early May and the regrowth does not joint. This permits orchardgrass and tall fescue to be harvested at approximately five-week intervals. Smooth bromegrass and reed canarygrass head out about the middle to the latter part of May and the stems of the regrowth joint. Approximately six to seven weeks are required for stem elongation of these two grasses to ensure rapid regrowth and maintenance of stand. Therefore, only four cuttings of smooth bromegrass and reed canarygrass were obtained.
Effect of nitrogen fertilization on hay yields (12 per cent moisture) expressed as tons/acre of smooth bromegrass, orchardgrass, tall fescue and reed canarygrass (Purdue University Agronomy Farm, Lafayette, Indiana).

| Species             | Year | Number of Cuttings | Pounds of N applied per harvest |
|---------------------|------|--------------------|---------------------------------
|                     |      |                    | 0  | 12.5 | 25  | 50  | 100 | 200 | 400 |
|                     |      |                    | tons/acre                       |
| Orchardgrass        | 1967 | 5                  | 2.1 | 3.2  | 4.0 | 5.1 | 5.6 | 5.3 | 5.1 |
|                     | 1968 | 5                  | 1.9 | 3.6  | 5.9 | 7.2 | 7.8 | 7.5 | 6.7 |
| Tall fescue         | 1967 | 5                  | 2.5 | 3.3  | 4.3 | 5.4 | 6.4 | 6.7 | 6.1 |
|                     | 1968 | 5                  | 2.6 | 4.1  | 6.6 | 7.9 | 8.5 | 7.3 | 6.3 |
| Bromegrass          | 1967 | 4                  | 3.2 | 3.9  | 4.4 | 4.8 | 5.5 | 5.4 | 5.4 |
|                     | 1968 | 4                  | 2.6 | 3.5  | 5.1 | 5.9 | 6.5 | 6.2 | 5.2 |
| Reed canarygrass    | 1967 | 4                  | 2.4 | 3.2  | 3.5 | 4.7 | 6.1 | 5.6 | 5.9 |
|                     | 1968 | 4                  | 2.5 | 3.4  | 5.2 | 7.2 | 8.5 | 8.1 | 7.5 |

Fertilization

In 1967, 100 pounds per acre of phosphorus (229 pounds P₂O₅) and 300 pounds per acre of potassium (360 pounds K₂O) were broadcast on the 9th of August. Because of the high yields obtained in 1967, the rates of phosphorus and potassium were doubled in 1968 to replace the large amounts of plant food, especially potassium, removed by the high-yielding forages. Thus, 100 pounds of phosphorus and 300 pounds of potassium were applied on April 6 followed by an identical application on the 23rd of July.

Hay Yields

The hay yields of the four grasses at the various levels of nitrogen are presented in the accompanying table. Higher yields were achieved in 1968 due to a more favorable moisture supply. This experiment demonstrates that these grasses are capable of yielding from 6.5 to 8.5 tons of hay per acre with good management and adequate fertilization. The data indicate that smooth bromegrass may not have the yield potential of the other three grasses at high levels of nitrogen. In addition, under optimum management conditions, it appears that 200 to 250 pounds of nitrogen are required annually to obtain high yields (7+ tons/acre under good growing conditions) of these grasses and possibly even higher rates for maximum yield and quality.

Animal Trials

Animal trials are being conducted at the Miller-Purdue Farm in Grant County and Normandy Farm near Indianapolis to determine the response of animals consuming smooth bromegrass and orchardgrass fertilized with high rates of nitrogen fertilizer. Also, in vitro digestibility trials are planned using the plant material produced by the four grasses in this experiment during 1967 and 1968 to obtain an estimate of the effect of nitrogen fertilization on quality of forage.

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