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LEAF, SHOOT, AND ROOT FRACTIONS OF ANNUAL RYEGRASS INFLUENCED BY NITROGEN RATE AND SEASON

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Background. There are about 1 million acres of annual ryegrass grown in Texas each year. It is a popular forage because it is easy to establish, adapted across all soil types, and is later maturing than other cool-season annual grasses. Because nitrogen (N) is the most limiting of the three major nutrients, it is critical that we understand how N impacts plant growth. Information is needed to understand N utilization by ryegrass and provide economical and environmentally sound guidelines for producers. Annual ryegrass was planted at 25 lb/acre on a prepared seedbed in October 2001 and 2002 at the TAMU Agricultural Research and Extension Center at Overton. Plots were 4 x 16 ft. arranged in a complete randomized block design with 4 replications. Fall growth was measured on plots fertilized with 0, 50, 100, or 150 lb N/acre at ryegrass emergence. Winter growth was measured on plots fertilized with 50 lb N/acre at emergence to provide moderate fall growth and then mowed to a 2-in. height in late December and fertilized with 0, 50, 100, or 150 lb N/acre. Spring growth plots were treated the same as the winter plots until late December when they were fertilized with 50 lb N/acre, mowed to a 2-in. height in late February, and fertilized with 0, 50, 100, and 150 lb N/acre. The 4 x 16 plots were subdivided into four 4 x 4 ft. plots and sampled at 2, 4, 6, and 8 weeks after the N fertilizer treatments were applied. Plants were excavated from a 14 x 12 in area in the center of each 4 x 4 ft plot and divided into leaves, stems, and roots.

Research Findings. Leaves are the most digestible portion of the plant and are where most of the photosynthesis occurs to support plant growth. In the fall, leaf weight accounted for the largest plant fraction because of the immature stage of the plants and was the most responsive plant fraction to N fertilizer (Table 1). Leaf weight increased up to 150 lb N/acre the first year and 100 lb N/acre the second year. Stem weight was the second largest plant fraction in the fall and had the same response to N rate as leaf weight. Roots accounted for the smallest plant fraction and did not increase with N rate the first year and only responded to 50 lb N/acre the second year. Except for leaf weight the first year plant components increased substantially from fall to winter. During the winter growing period the stem component exceeded the leaf weight the first year and was slightly lower the second year. Leaf and stem weights responded up to 100 lb N/acre the first year. In the second year leaf weight was the only plant component that responded to N. In the spring, leaf and stem weights only responded to 50 lb N/acre and root weights were not affected by N rate both years. The spring plots were fertilized with 50 lb N/acre at emergence

and late December. The earlier N applications supported moderate plant growth in fall and winter but probably had little residual effect on spring growth. Stem weight was the largest plant fraction and represented about 50% of the total weight the first year and about 60% the second year. Stem and root weights increased with each succeeding season.

Application. This study showed the importance of N fertilizer in the fall on annual ryegrass planted on a prepared seedbed. Under favorable fall weather conditions, N increased growth and the leaf portion which is highly digestible and responsible for photosynthesis. Ryegrass was the least responsive to N fertilizer in the spring with maximum growth at 50 lb N/acre. Nitrogen fertilizer had little influence on root growth.

Table 1. Influence of nitrogen fertilizer on leaf, stem, and root weights in fall, winter, and spring when averaged across 2, 4, 6, and 8 week sampling dates.

| | 2001-2002 | | | 2002-2003 | | |
|---------------|-----------|---------|--------|-----------|--------|--------|
| <i>FALL</i> | | | | | | |
| N rate | Leaf | Stem | Root | Leaf | Stem | Root |
| lb/ac | lb/acre | | | lb/acre | | |
| 0 | 648 d† | 410 d | 418 ab | 156 c | 82 c | 74 b |
| 50 | 902 c | 533 c | 451 a | 344 b | 189 b | 131 a |
| 100 | 1140 b | 623 b | 320 b | 361 ab | 205 ab | 123 a |
| 150 | 1328 a | 730 a | 295 b | 443 a | 262 a | 131 a |
| <i>WINTER</i> | | | | | | |
| 0 | 508 c | 918 c | 804 a | 1025 b | 1033 a | 681 a |
| 50 | 672 b | 959 bc | 951 a | 1238 ab | 1131 a | 664 a |
| 100 | 836 a | 1099 ab | 869 a | 1328 a | 1107 a | 623 ab |
| 150 | 820 a | 1115 a | 894 a | 1394 a | 1107 a | 558 b |
| <i>SPRING</i> | | | | | | |
| 0 | 820 b | 2050 b | 1435 a | 1189 b | 3100 b | 1181 a |
| 50 | 1058 a | 2567 a | 1394 a | 1501 a | 4034 a | 1058 a |
| 100 | 1091 a | 2599 a | 1664 a | 1632 a | 3944 a | 1025 a |
| 150 | 1222 a | 2501 a | 1525 a | 1648 a | 4075 a | 1066 a |

†Values in a column within season are not significantly different at the 0.05 level, Fisher's Protected LSD.