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RESPONSE OF WINTER RYE TO LIMESTONE, NITROGEN, AND POTASSIUM

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Background. Livestock production during the cool season can be limited by lack of adequate amounts of high-quality pasture. Cool-season forage legumes and grasses are planted for winter grazing to limit dependency on hay for maintenance of livestock. Rye (*Secale* spp.) competes favorably with ryegrass and winter wheat by providing earlier growth and earlier maturity. We established this experiment in 1992 to evaluate the acidity tolerance and nitrogen (N) and potassium (K) requirements of winter rye.

Research Findings. Elemental sulfur was applied to acidify a Bowie fine sandy loam during the winter of 1989. In mid-spring, we established the experimental area in a central-composite, rotatable design to evaluate limestone, N, and K variables at 5 rates each. Limestone (ECCE 62%) rates applied to selected plots were 0, 811, 2000, 3189, and 4000 lb/ac. These treatments were reapplied in September, 1992 and incorporated by disking. Previous N treatments of 0, 30, 60, 90, and 120 lb/ac were increased 50% for rye in 1993, split into three applications, and surface-applied as urea. Potassium (KCl) was applied at rates of 0, 50, 100, 150, and 200 lb K_2O/ac. Plots measuring 13.33 ft by 20 ft were fertilized with adequate rates of phosphorus for rye production. Two cuttings of rye were made in 1993.

In plots treated with 120 and 100 lb/ac rates of N and K_2O, respectively and sampled in May 1993, limestone increased soil pH from 5.2 in the no lime plots to 6.9 in plots treated with 1.5 t/ac (Fig. 1). First harvest dry matter response of rye to N and limestone rates is shown in Figure 2. Rye yield was linear to the 120 lb/ac rate of N. Application of limestone to decrease soil acidity had a negligible effect on rye production at the low N rates. Increasing the limestone rate produced a negative rye response as higher N rates were applied.

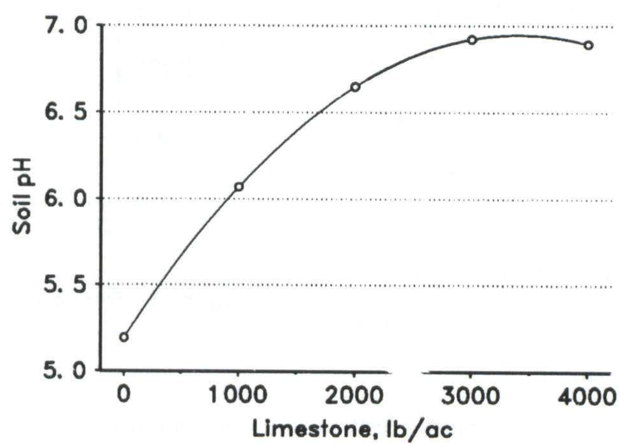

Figure 1. Effect of ECCE 62 limestone treatment on on 0–6 inch depth pH in Bowie soil (1993 data).

Three possibilities may have caused this reduction in yield at the higher N and limestone treatments. The first, but least likely is that the limestone may not have fully reacted to decrease soil acidity by Feb. 25, the date of the first harvest. Second, the additional acidity caused by the increasing N rates could have partially overcome the neutralizing effect of the limestone. The third possibility is that increasing amounts of surface-applied urea N could have been volatilized as the limestone rate was raised, even during this cool season.

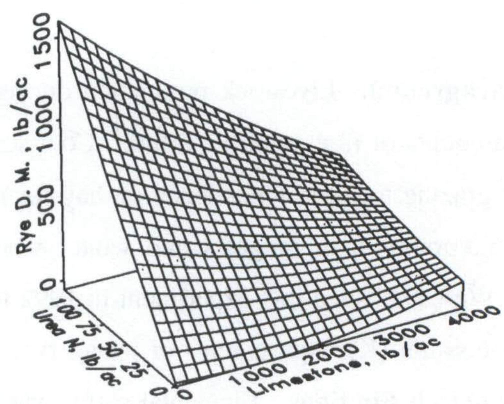

Figure 2. First harvest response of rye to nitrogen and limestone treatments (1993 data).

The second harvest of rye forage was made Mar. 31. The combined yields show a linear response to N as the rate was increased from zero to 180 lb/ac. The effect of limestone with the resultant increased pH had no significant effect on total dry matter yield.

After four years of treatments and growth of crops that included sweet potatoes, wheat, sorghum sudan, and watermelons in multiple cropping systems, rye growing on this Bowie soil did not respond to potassium fertilization.

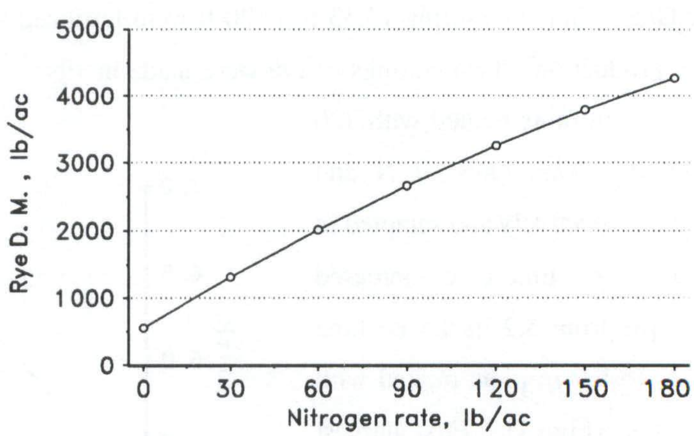

Figure 3. Response of rye to fertilizer nitrogen (1993 data).

Application. Winter rye for forage responded favorably to fertilizer N. Response to limestone applied to decrease soil acidity and raise pH was negative in the first harvest for the possible reasons explained above. There was no significant effect of limestone treatment at the second cutting. The rye plant roots grew past the zone of acidified soil and were no longer affected by acidity in the surface 6-inch depth.