# Kentucky Bluegrass Responses to Potassium

Shawn McBurney, Paul Rieke and John Kaufmann
Department of Crop and Soil Sciences, M.S.U.

While many of the functions of potassium regarding plant growth and regulation have been recorded, its exact roles are not well understood. Symptoms of plants deficient in potassium include browning of leaf tips, spindly shoots, and thinning of turf stands.

Studies were conducted on Kentucky bluegrass with these objectives:

1) To determine the effects of potassium on Kentucky bluegrass grown on a potassium deficient muck soil in the greenhouse;
2) To determine the effects of potassium on an existing potassium deficient Kentucky bluegrass turf established on a muck soil on a sod farm; and
3) To monitor the morphological responses of potassium on Kentucky bluegrass.

The greenhouse study was conducted during the winter of 1980-81. Varying rates of potassium and phosphorus were applied at the time of seeding of Kentucky bluegrass in 4 inch cottage cheese containers. Potash ($K_2O$) was applied at 0 and 100 pound/acre rates and phosphate ($P_2O_5$) was applied at 0, 100, 200 and 300 pound/acre rates. The soil used for the study was Houghton muck which tested very low in both P and K. Nitrogen was added to maintain growth. The plants were harvested for clipping weights and rhizome numbers two months after emergence. Phosphorous had no effect on rhizome growth in this study while potash had a limited effect (Table 1).

Table 1. Rhizome and clipping yield response of Kentucky bluegrass to phosphorous and potassium applications on a muck soil in the greenhouse. Average of 3 replications.

| Treatment | | Rhizomes | Clipping Yield (dry weight) |
|---|---|---|---|
| $P_2O_5$ | $K_2O$ | gm/pot | gm/pot |
| lbs/A | lbs/A | | |
| 0 | 0 | 0 C* | 0.08 D |
| 100 | 0 | 6 BC | 0.35 BC |
| 200 | 0 | 2 BC | 0.34 BC |
| 300 | 0 | 2 BC | 0.27 CD |
| 0 | 100 | 32 B | 0.84 A |
| 100 | 100 | 28 BC | 0.72 A |
| 200 | 100 | 42 A | 0.78 A |
| 300 | 100 | 12 BC | 0.67 A |

*Column means followed by the same letter are not significantly different at the 1% level (DMRT).

Variability in the data in this greenhouse study limited the significance of the results. A longer study may have been needed to allow potassium responses in rhizome growth to occur. Phosphorus resulted in increased clipping yields in 2 of the 3 treatments when potash was applied. Potassium was most limiting for clipping yields in that all potash treatments increased clippings, even when no phosphorous was applied.

A study was initiated in April 1981 on the sod farm where the potassium deficient soil was located. The field had been dormant seeded with a Kentucky bluegrass mixture consisting of Newport, Adelphi, Glade and Cheri. The sod was one and a half years old at the time of treatment application. Potash was applied at rates of 0, 63, 125, 250 and 500 pounds per acre with a drop spreader. Phosphate was applied at 63 and 250 pounds per acre across the potash treatments (see Table 2).

Data for rhizome density and vegetative color (Table 2) were taken two months after treatment application. While phosphorus treated plots did not exhibit any rhizome response, the application of 63 lbs/acre of potash gave a significant increase in rhizomes.

Table 2. Rhizome and vegetative color responses of Kentucky bluegrass two months after application of potassium on Houghton muck soil. Averages for 3 replications. Data taken 2 months after application.

| Treatment | | Rhizome tips | Color rating |
|---|---|---|---|
| $P_2O_5$ | $K_2O$ | no./sq. ft. | 1-poor; 9-excellent |
| lbs/A | lbs/A | | |
| 0 | 0 | 18 B* | 3.3 D |
| 63 | 0 | 18 B | 4.0 CD |
| 63 | 63 | 78 AB | 6.7 A |
| 63 | 125 | 121 A | 6.0 AB |
| 63 | 250 | 136 A | 5.3 ABC |
| 63 | 500 | 137 A | 5.7 ABC |
| 250 | 0 | 16 B | 3.0 D |
| 250 | 63 | 89 A | 5.3 ABC |
| 250 | 125 | 116 A | 5.7 ABC |
| 250 | 250 | 108 A | 4.7 BCD |
| 250 | 500 | 127 A | 4.7 BCD |

*Column means followed by the same letter are not significantly different at the 1% level (DMRT).

The field study was concluded October of 1981, at which time final sample data were taken. Parameters measured included: vegetative (clipping) yield, color ratings, density ratings, sod strength and tissue nutrient analysis (Tables 3 and 4). Of the four field parameters measured (Table 3), only sod strength failed to show a significant response to potassium application. While there was not a significant response found in the data for sod strength, the trend was for the sod strength to increase with increasing potassium application. Vegetative yields (dry clipping weights) responded dramatically to increases in potassium application. Color and density ratings reflected the same response to potassium

application as did the vegetative yields. Laboratory analysis of the clippings (Table 4) showed a significant increase in phosphorus over the check plot. There was a steady increase in tissue potassium with increasing levels of applied potassium. The increase in phosphorus concentration with phosphate application was variable indicating the phosphorus level in the soil was only marginal for Kentucky bluegrass.

Table 3. Responses of Kentucky bluegrass to treatments on Houghton muck. Averages for 3 replications. October, 1981.

| Treatment | | Clipping yield | Sod Strength | Color 1-poor; 9-good | Density 1-poor; 9-good |
|---|---|---|---|---|---|
| $P_2O_5$ | $K_2O$ | | | | |
| lbs/A | lbs/A | lbs/A | lbs to tear | | |
| 0 | 0 | 399 B* | 66 a* | 4.3 D* | 6.8B* |
| 63 | 0 | 711 A | 57 a | 5.7 C | 7.5 B |
| 63 | 63 | 687 A | 87 a | 7.2 B | 8.7 A |
| 63 | 125 | 753 A | 86 a | 8.2 A | 9.0 A |
| 63 | 250 | 795 A | 99 a | 8.8 A | 9.0 A |
| 63 | 500 | 840 A | 81 a | 9.0 A | 9.0 A |
| 250 | 0 | 411 B | 62 a | 3.8 D | 5.7 B |
| 250 | 63 | 785 A | 91 a | 7.0 B | 8.8 A |
| 250 | 125 | 774 A | 97 a | 8.3 A | 9.0 A |
| 250 | 250 | 906 A | 92 a | 8.8 A | 9.0 A |
| 250 | 500 | 888 A | 90 a | 9.0 A | 9.0 A |

*Column means followed by the same letter are not significantly different at the 1% level (DMRT).

Table 4. Effects of phosphorus and potassium applications on Houghton muck under field conditions on tissue concentration of P and K of Kentucky bluegrass clippings. Averages for 3 replications. October, 1981.

| Treatment | | Tissue concentration | |
|---|---|---|---|
| $P_2O_5$ | $K_2O$ | P | K |
| lbs/A | lbs/A | % | % |
| 0 | 0 | .29 B* | 1.3 DE* |
| 63 | 0 | .43 A | 1.8 CD |
| 63 | 63 | .39 A | 1.8 CD |
| 63 | 125 | .40 A | 2.4 AB |
| 63 | 250 | .36 AB | 2.6 AB |
| 63 | 500 | .40 A | 2.9 A |
| 250 | 0 | .41 A | 1.1 E |
| 250 | 63 | .40 A | 2.1 BC |
| 250 | 125 | .38 AB | 2.4 AB |
| 250 | 250 | .38 AB | 2.6 AB |
| 250 | 500 | .40 A | 2.8 A |

*Column means followed by the same letter are not significantly different at the 1% level (DMRT).

The conclusions of these studies are:

1) Rhizome production was greatly increased by potassium applications in both greenhouse and field studies;
2) Vegetative growth was increased with all treatment levels of potassium in greenhouse and field studies; and
3) Potassium was very limiting in this soil for growth of Kentucky bluegrass for sod, while phosphorus was marginally limiting. The conclusion is that soil testing is very important to determine whether adequate levels of these nutrients are present.