EFFECT OF HIGH POTASSIUM RATES ON TURF AND SOIL TESTS

Over the past few years there has been a significant increase in the amount of potash applied to many turfs, particularly on golf courses. There is concern that too high rates of potash could be used on some turfs resulting in nutrient imbalances or high salt levels in the soil. With this in mind, three studies were initiated in 1990 at the Hancock Turfgrass Research, one each on Bristol bluegrass growing on loam soil, annual bluegrass growing on loam soil and Penncross creeping bentgrass under maintained under greens conditions. Treatments applied included rates of 0, 4, 8 and 12 lbs. potash per 1000 sq. ft. applied annually as potassium chloride (0-0-60). One other treatment was 12 lbs. potash applied as potassium sulfate. On each turf there was also one treatment where potash was applied at rates recommended by soil tests. These rates were: 5.5 lbs. potash applied on the bentgrass; 3.0 lbs. on the Kentucky bluegrass; and 3.5 lbs. potash on the annual bluegrass. Potash treatments were applied at rates of no more than 2.0 lbs. per 1000 sq. ft. per application in one application. Plot size was 4 ft. by 6 ft. with 3 replications of each treatment.

There were no observable differences in turf quality on any of the grasses during the year. Soil samples were collected in late October to determine the effect of potash fertilization program on available levels of potassium, calcium and magnesium. Samples were obtained from the 0-3 and 3-6 inch depths. Data for the soil tests are given in Tables 7 through 9 for the K, Ca and Mg tests on the Kentucky bluegrass plots, respectively. There is a clear response in soil K tests (Table 7) on this soil which has a medium level of available K. For no apparent reason the 4 lb. potash treatment tested higher in K than the 8 lb. treatment. Otherwise, the results are about as would be expected There were no effects on Ca or Mg tests in this first year.

On the annual bluegrass plots the K tests (Table 10) on the check plots was lower than on the Kentucky bluegrass plots. Again there was a clear response to the K applications. Small differences were even seen in the 3-6 inch depth on this soil. There was no difference in Ca soil tests (Table 11), but Mg tests dropped under higher rates of potash in the 0-3 inch depth (Table 12).

The soil K tests for putting green soil (Table 13) were much lower than on the soils with more silt and clay. Sands have very little cation exchange capacity to attract and hold the K. As a result, potassium will be more susceptibility to leaching. There was a clear response to the applied potash in the 0-3 inch depth as well as in the 3-6 inch depth. There were no significant differences in available Ca tests (Table 14) or in the 0-3 inch depth for Mg tests (Table 15). There was some evidence of a reduction in the Mg tests in the 3-6 inch depth with the higher K rates, however. In sandy soils, the K can move more readily into the lower depths which could result in replacement of some of the Mg in the soil.

Table 7 1990 High Potassium Study
Soil Potassium Levels, Bristol Kentucky Bluegrass,Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	145 d*	253
Soil Test 3.5	KCL	292 c	103
4.0	KCL	360 b	116
8.0	KCL	282 c	94
12.0	KCL	465a	145
12.0	K_2SO_4	458a	149

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

Table 8 1990 High Potassium Study
Soil Calcium Levels, Bristol Kentucky Bluegrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	2040	1400
Soil Test 3.5	KCL	1920	1060
4.0	KCL	2000	1280
8.0	KCL	2040	1163
12.0	KCL	1980	1222
12.0	K_2SO_4	2000	1020

Table 9 1990 High Potassium Study
Soil Magnesium Levels, Bristol Kentucky Bluegrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	360a*	270
Soil Test 3.5	KCL	352ab	260
4.0	KCL	354ab	260
8.0	KCL	330ab	274
12.0	KCL	320ab	256
12.0	K_2SO_4	310 b	244

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

Table 10 1990 High Potassium Study
Soil Potassium Levels, Annual Bluegrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	90 c*	70 b
Soil Test 3.5	KCL	238 b	104a
4.0	KCL	200 b	88ab
8.0	KCL	191 b	86ab
12.0	KCL	406a	100a
12.0	K_2SO_4	392a	110a

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

Table 11 1990 High Potassium Study
Soil Calcium Levels, Annual Bluegrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	1867	1562
Soil Test 3.5	KCL	1810	1619
4.0	KCL	1752	1505
8.0	KCL	1772	1486
12.0	KCL	1810	1486
12.0	K_2SO_4	1829	1581

Table 12 1990 High Potassium Study
Soil Magnesium Levels, Annual Bluegrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	340a*	304
Soil Test 3.5	KCL	325ab	296
4.0	KCL	321ab	288
8.0	KCL	319ab	296
12.0	KCL	303 b	286
12.0	K_2SO_4	311 b	296

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

Table 13 1990 High Potassium Study
Soil Potassium Levels, Penncross Creeping Bentgrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	46 c*	34 c
Soil Test 3.5	KCL	118 b	108a
4.0	KCL	130 b	60 b
8.0	KCL	112 b	60 b
12.0	KCL	222a	118a
12.0	K_2SO_4	222a	114a

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

Table 14 1990 High Potassium Study
Soil Calcium Levels, Penncross Creeping Bentgrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	990	838
Soil Test 3.5	KCL	971	819
4.0	KCL	1009	819
8.0	KCL	971	762
12.0	KCL	1010	762
12.0	K_2SO_4	952	762

Table 15 1990 High Potassium Study
Soil Magnesium Levels, Penncross Creeping Bentgrass, Samples Collected November 16, 1990, HTRC.

Treatment lbs K_2O/M	K Source	0-3 inches lbs/Acre	3-6 inches lbs/Acre
0.0	KCL	149	140a*
Soil Test 3.5	KCL	134	116ab
4.0	KCL	130	123ab
8.0	KCL	139	120ab
12.0	KCL	128	116ab
12.0	K_2SO_4	122	112 b

* - Means followed by the same letter are not significantly different at the 5% level using Duncans Multiple Range Test.

The continued use of very high K rates could result in leaching of Mg. On sandy soils it is especially important to monitor soil Mg tests when using high K rates. Since many water sources come from limestone aquifers which contain some Mg, this may not present a problem where such water is used for irrigation. We have consistently observed increases in soil Mg tests on such sites. While increased use of potash is considered important because of improvement in wear and stress tolerance, turf managers should also be aware of potential problems with overuse of potash. Soil tests should be used more frequently when applying high rates of potash (5-6 lbs. per 1000 sq. ft. annually), especially on sands.

WETTING AGENT STUDIES

There are several new wetting agent products which have become commercially available in the past several years. We have received many questions about the efficacy of these newer products. In order to learn more about some of these newer products, we established wetting agent trials on 3 turf sites in 1990. For several years we have had studies in East Lansing to evaluate wetting agent materials, but had very limited success because we could not develop the hydrophobic conditions over a long enough period of time to evaluate the wetting agents. When the dry spot conditions began to appear, rains would rewet the soil such that no differences occurred among treatments. So in 1990 we selected 3 sites in different locations in the state, thinking surely one of these areas would experience dry enough weather that localized dry spots would develop on at least on of the sites. The studies were established on: 1)the putting green growing on a loamy sand soil at the Hancock Turfgrass Research Center; 2) on a fairway at the Crystal Downs Country Club near Frankfort; and 3) on a fairway at the Pines Golf Course near Mount Pleasant. Both fairways were growing on sandy soils. Wetting agents applied and the application schedules are given in Tables 16, 17 and 18, respectively, for the 3 sites. Five treatment dates were utilized on the plots in East Lansing and 3 treatment dates (on a monthly basis) at the other 2 locations. All treatments were watered in after application. There were 3 replications of each treatment.

In spite of our efforts to establish plots in 3 widely diverse locations in the state, 1990 was not the year to study localized dry spot problems. On a few occasions it appeared as if some differences were about to develop, then rains masked those differences very quickly. Unfortunately, this occurred at all 3 locations. As a result there were no visible differences among any of the treatments. Soil samples were obtained at all 3 locations to determine if there were any soil effects due to wetting agents. In previous studies we have observed that effective wetting agents permitted rewetting of the hydrophobic soil conditions. This resulted in higher soil moisture following irrigation than when the dry condition remained. In the 3 studies established in 1990, there were no consistent differences due to treatment. This again, was a result of the relatively wet summer.