

deficiency has been observed. The higher the nitrogen rate, the more clippings removed, and the more severe the potassium deficiency observed. The deficiency was manifested by a grayish-blue color of the turf and wilting symptoms. There was also a definite thinning of the turf (Table 3). As potassium was applied, nitrogen rate had no effect on turf density when nitrogen was applied. Turfgrass quality ratings also reflected the need for more potassium at the higher nitrogen levels. These results substantiate the importance of following a good soil testing program on turf where clippings are removed. This is especially important in irrigated sands, such as greens, in which there is little cation exchange capacity to hold potassium in the soil.

The hydrophobic soil condition observed at Boyne Highlands in 1971 and 1972 continued in 1973. There was limited short-term turf recovery from coring and wetting agent treatments during 1972. For example, treatments applied in summer and early fall, 1972 increased soil moisture content during 1972, but turf recovery did not occur on these plots until spring and early summer, 1973. The hydrophobic soil condition continued in 1973 in spite of a wet spring season. Among the wetting agents studied earlier, Aqua-Gro and an experimental material from Colloidal Products, L-237, gave the most consistent wetting of soil under treated plots. These materials were selected for further study in 1973.

A series of treatments were applied on July 13, 1973 on a uniformly hydrophobic fairway. Several cultivation treatments were applied to the area: 1) coring with a greens coring unit using 5/8-inch tines; 2) coring with 1/2-inch tines; 3) one pass with a fairway coring unit; 4) two passes with a fairway coring unit; 5) two passes with a fairway spiker; and 6) no cultivation treatment. The soil cores were broken up with a light vertical mowing. Aqua-Gro and L-237 were each applied at rate of 16 and 32 ounces per 1000 square feet over each of the cultivation treatments. Each treatment was replicated 3 times.

The data are summarized in Tables 4 and 5. Both rates of both wetting agents resulted in increased moisture in soil one month after treatment (August 14) compared to the check. The L-237 was slightly more effective than Aqua-Gro although differences were small, especially at the 32 ounce rate. Turfgrass quality ratings on these plots in September and October substantiated these results and indicated a short-term (2 months) turfgrass recovery from the hydrophobic condition.

The more intensive coring with the 5/8-inch tine resulted in a higher percent water in the soil a month after treatment, but the 1/2-inch tines resulted in better turfgrass quality ratings observed in September and October. The other cultivation treatments were less effective. The hydrophobic soil condition causes the soil to become very hard and reduces penetration of standard coring units. When such a condition has developed it may be necessary to use a more intensive treatment, such as the greens coring unit, to improve moisture penetration.

Table 4. Effect of wetting agent treatments on a hydrophobic soil. Treatments applied 7/13/73. Average of 3 replications.

Treatment		Soil Water, %	Turfgrass Quality Rating (1=best; 9=poor)	
Chemical	Rate, ounces/1000 sq ft		Aug 14	Sept 20
None	--	5.3	4.6	5.7
Aqua-Gro	16	6.7	2.4	3.0
Aqua-Gro	32	8.1	1.9	1.9
L-237	16	8.3	1.6	1.8
L-237	32	9.2	1.5	1.6

Table 5. Effect of cultivation treatments on a hydrophobic soil. Treatments applied 7/13/73. Average of 3 replications.

<u>Tillage Treatment</u>	<u>Soil Water, %</u> Aug 14	<u>Turfgrass Quality Rating</u> (1=best, 9=poor)	
		Sept 20	Oct 26
None	6.5	4.0	4.6
Greens coring-5/8 inch tine	7.5	2.8	3.1
Greens coring-1/2 inch tine	7.1	2.5	2.7
Fairway coring-2 passes	7.0	3.1	3.8
Fairway coring-1 pass	6.7	3.3	3.9
Fairway spiker-2 passes	6.7	3.0	3.5