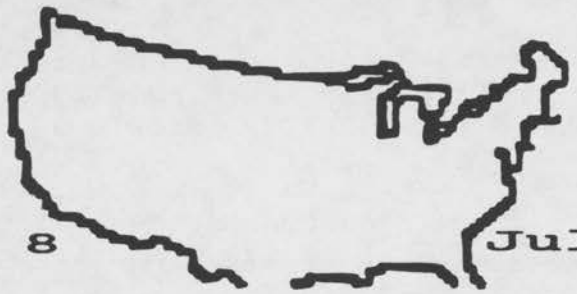
TURFCOMMS



V. 6, I. 8 July 2, '92

PURPOSE: To pass on what we learn willingly and happily to others in the profession so as to improve turf conditions around the country.

WHOA!!! DON'T GO SO DEEP: I (your editor) prepared this initially for a talk to the Bluegrass Golf Course Superintndents Assoc. in Lexington, KY. Dr. A.J. Powell, KY's turf extension specialist, was there and made my day. He not only agreed with me but said he had some supporting evidence for sampling greens only to a one inch depth. Other supporting data can be found in: Blanchar, R.W., SOIL TESTS FOR PHOSPHATE AND POTASSIUM REQUIREMENTS OF GOLF COURSE FAIRWAY AND ROUGH, Proceedings, 1981 Missouri Lawn & Turf Conf. Dest, W.M., MINIMAL PHOSPHORUS NEEDS OF BENTGRASS, Rutgers Turfgrass Proceedings, 1981. Waddington, D.V., STATUS OF SOIL AND TISSUE TESTING IN TURF MANAGEMENT, Proceedings 27th Rocky Mt. Reg. Turfgrass Conf. 1981. Interesting that all these articles are in '81.

With new aerifiers going deeper than ever before let us not lose track when taking soil samples that roots on bentgrass greens still are often very shallow and usually restricted in summer to the surface layer. The USGA Green Section brought this to our attention most recently in an article by James F. Moore in the March/April, 1987, USGA Green Section Record, "Rooting Depth and Soil Sampling", pg. 33. Jim suggested in this article that you may need to "adjust your fertility program based on the depth of the roots." The data provided here may make you reconsider how deep you take those summer soil samples on greens.

In October of 1991, I was hired by a venture capital firm wishing to break into the acid injection market. My role was to be their agronomic consultant and thus help them market the product. My first task was to obtain for myself and thus them a clear picture of

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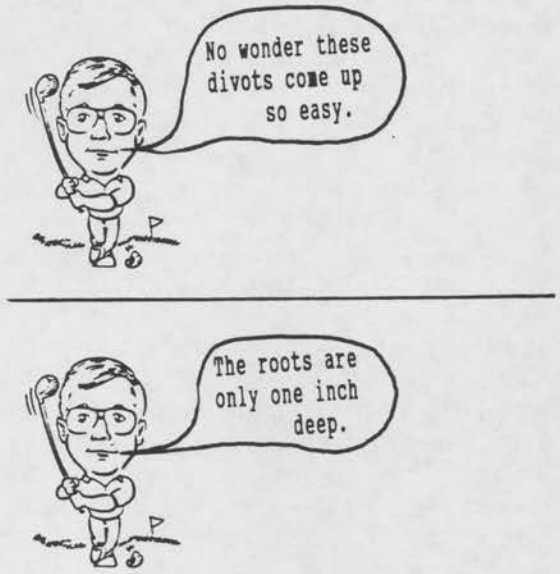
how the sulfuric acid-urea combination product presently being used in the Greater Dallas/Ft. Worth area was working.

I immediately contacted Gary Schinderle, CGCS, Oakmont C. C., Denton, TX., for not only was he and his water problems well known to me but he was the first to use acid injection in this area. Gary is author of the award winning article "Identifying and Correcting Severe Water Quality Problems", Golf Course Management, May, 1990.

Gary was using a high bicarbonate containing water for irrigation. He reported a level of 583 ppm bicarbonate from his worst well, 600 ppm is considered very high. This was giving him high sodium absorption ratios (SARs) - 26 in fairways 45 in water from his worst well, values greater than 8 are considered very high. Below are soil test results before acid injection.

TABLE 1: Soil test results for 20 greens, Oakmont C.C.
Nov. '87. Prior to Acid Injection, test run by Harris Lab.

Criteria	Range	Avg.
% organic matter	0.4-1.1	0.7
Nitrate in ppm	2 - 11	5
Phosphorus in ppm	7 - 25	16
Potassium in ppm	70 - 138	100
K as % of CEC	2.4 - 4.5	3.6
Magnesium in ppm	53 - 107	79
Mg as % of CEC	5.6 - 11.2	9
Calcium in ppm	986 - 1418	1237
Ca as % of CEC	78.3 - 86.9	82
Sulfur in ppm	40 - 80	56
Zinc in ppm	0.2 - 3.8	0.5
Manganese in ppm	1.3 - 2.9	1.9
Copper in ppm	0.1 - 0.2	0.1
Iron in ppm	4.5 - 9.7	6.1
Boron in ppm	0.2 - 1.0	0.5
Sodium as % of CEC	4.6 - 7.0	5.8
Sol. salts (mmhos/cm)	0.20 - 0.35	0.25
total CEC	6.0 - 8.7	7.6



Gary lost a lot of turf in 1987. Since early 1988 acid injection had made it possible for him to grow reasonably good turf during long summer periods without rain. You will note that the only thing badly out of line in these early soil test results (Table 1) are the sodium levels. Salt levels are normal, if not low. Although the above test were taken well before the data I wish to present, I would like to note here that other test taken after acid injection and before my soil sampling showed similar results. There were variations from the above but they appeared to be minor and seasonal. A few of these I will comment on in a future article on acid injection.

Most of the data presented here is based on the exploration of soil chemistry in his greens in relation to acid injection and

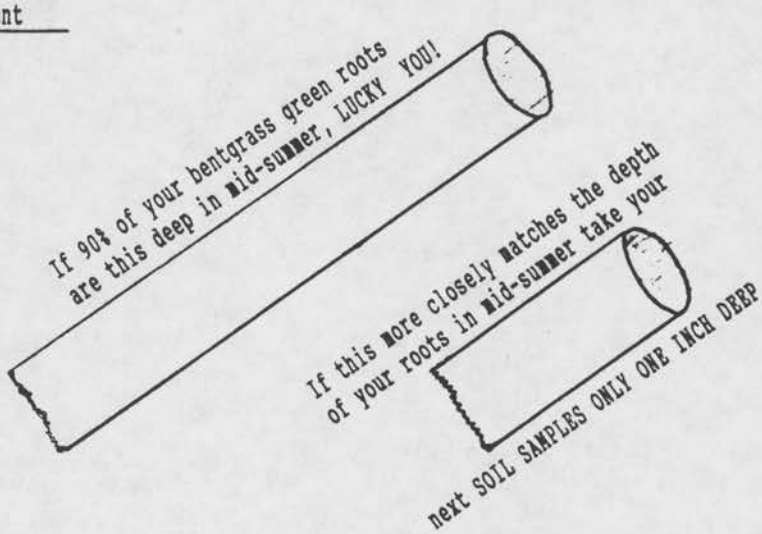
his attempts to deal with it. Remember this is just one more bit of info. pointing to a need to examine more closely the surface soil layer separate from the top 4". Some of the differences you will see here are due to the water and its sulfuric acid/urea trt. Other differences are due to Gary's attempts to correct inbalances in the soil that earlier soil test had shown.

We took soil samples on Oct. 17, '91 from greens 7, 11, and 17. These greens were chosen because green 7 had in the past been one of his better greens while 11 and 17 had been the poorest of his greens. Dry warm weather from mid-summer had preceded the sampling date. Gary had put on a 19-26-5 analysis fertilizer for 0.5 lb. N Sept. 11th. He had also applied a Ringers fertilizer at 1 lb. N, 0.25 lb. P and 0.5 lb. K/M on Oct. 1st.

TABLE 2: Soil test results for three greens.
Oakmont C. C., Oct. 1991. Test run by Harris Lab.

Criteria	TOP	BOTTOM	Significantly different
% organic matter	1.93	1.04	yes*
Nitrate in ppm	7	2	yes
Phosphorus in ppm	57	26	yes
K as % of CEC	5.9	2.2	yes
Mg as % of CEC	36	18	yes
Ca as % of CEC	42	74	yes
Sulfur in ppm	78	43	no
Zinc in ppm	15	4	yes
Manganese in ppm	11	3	yes
Copper in ppm	1.1	0.4	no
Iron in ppm	77	25	yes
Boron in ppm	1.5	0.5	yes
Sodium as % of CEC	15.5	5.5	yes
SAR	7.3	3.9	yes
Sol. salts (mmhos/cm)	1.93	1.04	no
total CEC	5.6	6.1	no

*yes = found significant at the 5% level



We divided sample cores into a top 1 and 1/2 inches and bottom 2 to 3 inches. The top layer represented topdressings with a new silica sand that had built up since construction and the lower portion was the original greens material. These layers will hereto be referred to as TOP and BOTTOM. The results (Table 2) are averages of three samples. the significance of the differences is based on statistical analysis. There was very little variation between greens, a lot between TOP and BOTTOM.

Gary had used four 10 lb. applications of Promag to raise magnesium (Mg) levels as well as four or five epsom ($MgSO_4$) salts applications at five pound per thousand.

Conclusion: At the end of summer the bentgrass roots were living in a soil system that was completely different than his old soil test had shown. His applications of epsom salt had dramatically altered the soil chemistry of the top soil layer. The top soil layer was generally much higher in micro nutrients, phosphorus and potassium. The sodium level and corresponding (SAR) was much higher in the surface layer. There was a need to flush out sodium from both layers but particularly the top layer.

In late October 1991, it began to rain. Over a 6 day period 10 inches fell. When the rain stopped I decided it would be an excellent opportunity to find out how such a rain affected soil nutrients in the Oakmont greens. On Nov. 4th we resampled the same three greens. Samples were again divided as before.

TABLE 3: Soil test results for three greens. Oakmont C.C.
Oct.(BEFORE), Nov.(AFTER) 1991. Test run by Harris Lab.

Criteria	TOP BEFORE	TOP AFTER	BOTTOM BEFORE	BOTTOM AFTER
% organic matter	1.6	2.4	0.6	1.0
Nitrate in ppm	7	6	2	1
Phosphorus in ppm	57	54	26	25
K as % of CEC	5.9	4.3	2.2	1.5
Mg as % of CEC	36	39	18	17
Ca as % of CEC	42	52	74	80
Sulfur in ppm	78	11	43	2
Zinc in ppm	15	22	4	5
Manganese in ppm	11	15	3	5
Copper in ppm	1.1	1.1	0.4	0.4
Iron in ppm	77	84	25	29
Boron in ppm	1.5	1.1	0.5	0.5
Na as % of CEC	15.5	4	5.5	2.2
SAR	7.3	0.9	3.9	0.5
Sol. salts (mmhos/cm)	1.93	0.76	1.04	0.21
CEC meq/100g	5.6	4.8	6.1	6.2

The November samples however due to budget limitations are composite samples for TOPS and BOTTOMS of the three greens and are labeled as AFTER in Table 3, while the samples labeled BEFORE are those of 10/17/91. Fertilizer was applied 10/17/91 immediately after the first samples were taken. This was a 22-0-12 analysis, at .5lb. N, 0.23lb. K/M.

Conclusion: The 10 inches of rain flushed out most of the sodium, thus lowering the pH, and the SAR. The sulfate anion was also flushed out with the sodium just like the textbooks say it will be. Potassium appears also to have been lowered by the rain even though more was applied between the two sampling dates.

This second sampling again confirms the large difference between the top one and one half inches and the bottom sample. Are you sampling only the important top layer where 90 to 100 percent of your July-August roots are? Consider doing so.

END