



Mavis Consulting, Ltd

Turf & Soil Specialist

Agronomic Report Country Club

Prepared for:

Prepared by: Brian Mavis

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Greens Nutrient Summary:

Greens 4, 5, 6, 7, 8, 10, 11, 13, 15, 16, and 18 were sampled. The standard soil analysis indicates what nutrient levels are in reserve on the soil colloid and in soil solution. The Saturated Soil Analysis gives us a picture of what nutrients are available in soil solution only, and this test was run on 7 and 15.



Standard Soil Reports: There were deficient levels of Phosphorus, Magnesium, Potassium, and Boron on all while the Sodium levels remain much higher than desired. The biggest differences are the reduced organic matter and lowest Phosphorus, Magnesium, and Potassium levels to date. Fortunately Sodium levels are no higher than usual, but the drop in Potassium is more of a concern especially with the increased heat and traffic this year. The Potassium was a little higher on #15, but not nearly high enough with the Sodium being much higher and more soluble. This will normally result in weaker turf that wilts sooner and does not withstand traffic nearly as well. I recommend at least monthly granular apps on this green due to the limited sunlight, air movement and concentrated traffic patterns. Also plan to prune tree roots again as discussed. The Sulfur level remains highest on #10 indicating reduced leaching/drainage compared to the others. Fortunately the turf quality/ density was as good if not better than ever, but this was mostly a dry and hot summer minimizing the drainage concern. Drainage installation is still recommended on this green.

Saturated Soil Reports: The soluble levels of Magnesium were deficient on both while Phosphorus was low on #7 only. However an application of Phosphorus was made prior to sampling #15. The Nitrate level was also higher on #15 and would be a concern in the heat of the summer but not during cooler weather and needed for recovery. Available Potassium would normally be sufficient, but the Sodium levels are four times higher. Chlorine levels are also much higher than desired and should be toxic to roots at these concentrations. It is surprising that the turf performed as well as it did with these levels, which suggests the turf has adapted to the Sodium and Chlorine from the irrigation water. Monthly granular applications of Potassium are most likely needed to maintain levels as high as the Sodium.

Greens Physical Summary:

The 0-1.75" root-zone in #17 green was analyzed for physical properties. The Clay and Silt levels are slightly higher, but this is a normal fluctuation and not a concern unless they increase significantly beyond the levels already measured. The organic matter (OM) has decreased slightly and is within an excellent range. If working to maintain Poa, then organic matter levels between 2.5-3% are more desirable as compared to bentgrass <2.5%. The main

concern is that the sand particle distribution is not as coarse as in 2017. The top-dressing sand should contain 25-30% Coarse particles for improved firmness and stability. Ideally there would be <50% on any one sieve (Medium). The Fine and Very Fine particles are within USGA guidelines and not a concern. Desired OM range 2-3% and should allow for increased control of moisture content, firmness, and playability. The on-site infiltration has significantly improved and considered "excellent" for older soil based greens (>6"/hr.). This may be driven in part by dry conditions and wetting agents, but late summer readings are typically at their worst due to play and maintenance traffic. Continue with current cultural practices and change sand sources to one that contains more coarse and less medium particles. As before, the HP sand from Osburn or the #30 sand from Sand Sales typically contains 30% coarse particles and 45% Medium particles which should work to correct this as their content is increased.

Date	Sample ID	Clay (%)	Silt (%)	Sand (%)	Organic Matter (%)	Fine Gravel - 2 mm (%)	Very Coarse Sand - 1 mm (%)	Coarse Sand - 0.5 mm (%)	Medium Sand - 0.25 mm (%)	Fine Sand - 0.15 mm (%)	Very Fine Sand - 0.106 mm (%)	Very Fine Sand - 0.053 mm (%)	Saturated Conductivity (in/hr)	On-Site Infiltration (in/hr)	30cm Moisture
	<i>USGA Guide</i>	≤3	≤5			≤3	≤10	≥60	≤20	≤5		≥6	≥6		
9/4/20	17-G (0-1.75")	1	3.2	96	2.9	0.3	2.2	16.9	56	16	3.7	0.9		8.4	
10/24/17	17-G (0-1.75")	0.3	1.7	98	3.1	0.4	4.1	21.5	54	14	2.7	0.8		3.8	
9/17/14	17-G (0-1.75")	1	3.9	92	3.5	2.7	2.3	18.5	52	15	2.9	1.3		2.3	



The left profile is from 17-G this year while the right profile is from 17-G last year. The profile picture from #17 this year indicates that aeration holes are being effectively filled and that there is a significant amount of sand in the upper 0.25" like 2017. This is an excellent improvement over the 2014 profile with the only concerns being the thin organic layers forming between heavy top-dressings when aerating. This is very common and mainly a concern if there are more than 3-4 layers and they are not breaking down as they move lower in the profile. The second profile from this year suggests there are 4-5 OM layers in the upper inch, and increased top-dressing frequency, verti-cutting, etc. are most likely needed to keep up with the OM accumulation.

Be sure to vent these greens as often as possible and at least once per month to aid in breaking these layers. Also consider the use of a bio-stimulant when spraying these greens to help in the process. As always, deep-tine aeration is recommended to reduce compaction in the original root-zone which was more compacted again this year. If deep-tine aerating, I recommend utilizing 7" tines next to 10-12" tines for variability in the fracturing kick.



Fairway Summary:

Fairways 1, 3, 6, 9, 11, 14, and 17 were sampled. Standard Soil Reports: The Calcium levels were the highest on average to date which is a significant improvement. Unfortunately the Potassium levels are as low as last year and among the lowest to date. Sodium levels are higher than desired, but they are also among the lowest to date. This is surprising with the limited rain and increased irrigation water needed this year. Continue with gypsum applications to further increase Calcium and reduce Magnesium and Sodium levels. This should help to improve soil structure (clay particle flocculation). Phosphorus and Manganese levels remain deficient on

nearly all samples while Boron levels are a little low on a few only. If there is needed recovery, then increase Phosphorus applications when over-seeding or utilize an organic based product. Sulfur levels are highest on 3 and 17, but #3 stands out with a much higher level suggesting reduced drainage or increased product application. Utilize Manganese applications to improve/maintain turf color and limit Nitrogen apps through the summer months. The high organic content in the soil has the potential to produce a significant amount of N, and little should need to be applied through June, July and August.

Consider the use of brushes when mowing the fairways for improved cut, turf health, and playability. Continue with deep-tine aeration (Aerway, Bannerman, Soil Reliever, Vertidrain, Weidenmann, etc.) to help improve water movement, rooting depth, and soil structure on these fairways. If playability is an issue on these fairways, the consider starting a sand/ compost top-dressing program to increase playability following rain events. This could also take the place of fertilizer applications due to the significant nutrient and biological activity in the compost.



General Nutrient Information:

Calcium: In the plant Calcium is essential for strengthening the cell wall structure and is needed for cell division. Plant deficiencies will occur in low exchange soils when the calcium levels are low in solution. In higher exchange soils, Calcium is needed to make the soil flocculate, to keep the pores open for air, water and nutrient movement, which will prevent the build-up of excess Sodium and Magnesium in the soil. Soluble Calcium displaces the excess Sodium and Magnesium ions from the soil colloid for percolation down through the soil. Calcium can be lost or leached through the soil by:

1. Irrigation water bicarbonates or high pH values
2. Sulfate fertilizers that dissolve the Calcium
3. Leaching from heavy or acidic rainfall

Magnesium: Magnesium is a part of chlorophyll that is needed for photosynthesis. It is essential for plant respiration and the metabolism of carbohydrates. In high exchange soils excess magnesium can be detrimental to the plant since it will tighten and bind the soil pores reducing air, water and nutrient movement which will cause poor drainage and a deficient root mass.

Potassium: Potassium helps the plant thicken its cell walls in order to build a resistance to pathogens. Potassium also aids in respiration, is essential to water movement, supplies carbohydrates, helps maintain sugar, and reduces water loss and wilting.

Phosphorus: Plant available Phosphorous will help the turfgrass tighten, tack down and enhance root mass. Plant unavailable Phosphorous reduces the uptake of other elements. Phosphorous can become unavailable because of a high or low pH, high soil Calcium or Zinc, imbalance of irrigation Bicarbonates, and temperatures below 55 degrees.

Sodium: Although Sodium is needed for plant growth, the soils should contain no more than 60-100# per acre or <1% base saturation. If the Sodium levels are equal to or more than the Potassium levels, the plant could take-up the Sodium ions, which hinders the uptake of water and nutrients. Stress along with excessive traffic and adverse weather conditions will make the plant more susceptible to disease and insect damage. Applying additional Nitrogen is NOT the correct response to this condition. Increasing and maintaining the soil Potassium at higher percentages will reduce Sodium plant uptake. The soluble Calcium will displace the Sodium off the soil

colloid and allow it to leach through the soil. This is the solution to the excess soil Sodium levels.

The **pH** levels should be close to 6.5 or at least acidic so that there is hydrogen available for nutrient uptake by the turf. Increasing the soluble levels of Calcium with the gypsum (Calcium Sulfate) should not increase the pH levels here while the use of lime (Calcium Carbonate) would.

Organic Matter should be 2-4%. When there is less than 2%, there is typically less microbial population, diversity, and activity in those soils. When there is greater than 5% organic matter in the soil, there is typically too much moisture retention. The location of the organic matter in the soil profile (thatch, subsoil, layers, etc....) is important to consider as well. Ideally the organic matter would be evenly distributed with 2-4%.

Sulfur: Sulfur in the form of sulfate is very important in the breakdown of nutrients from insoluble to soluble. It is also important as a microbial food source and has numerous functions in plant growth and production.

Bicarbonates: High Bicarbonates can decrease Calcium and Magnesium availability and lead to hydrophobic conditions (Localized Dry Spots). The negative RSC value found on the irrigation water test tells us that some Calcium and Magnesium is being supplied to the soil solution when irrigating. When concentrated enough, Bicarbonates surround the sand particles and bind together forming a seal in the profile which becomes hydrophobic.

The **Soluble Salts** levels on the Saturated Soil Analysis should be below 640 ppm. When the Soluble Salts level approaches 640 ppm, then a flushing irrigation cycle is needed. Again, venting the greens regularly and continuing with the deep and infrequent irrigation cycle will help to ensure that these salts do not cause an added stress on the turf.