

Table 1. Soil nutritional guidelines. Iron and manganese values are reported in Table 2 below. The “desired” guideline values were derived based on three different sources of information: sufficiency (SLAN) guidelines, balance (BSCR) guidelines and PACE data collected from good performing golf course greens, tees and fairways. Soil analysis using Melich III extraction by Brookside Laboratories, New Knoxville, OH. Please note that the ppm desired values for potassium, calcium and magnesium are based on a BSCR analysis, using the average TEC values of 9.9, 14.5 and 24 for greens, tees and fairways, respectively. If your TEC values are lower than this, the desired ppm levels of K, Ca and Mg should be concomitantly lowered based on the formulae presented for BSCR deficit correction in PACE Insights 9:9.

Nutrient concentration (ppm)	Greens		Tees		Fairways	
	Average	Desired	Average	Desired	Average	Desired
Nitrate:Ammonium	2.7 to 1	3 to 1	4.1 to 1	3 to 1	5.5 to 1	3 to 1
Nitrate (NO₃)	6.7	3-20	17.1	3-20	24.2	3-20
Ammonium (NH₄)	2.5	<7	4.2	<7	4.4	<7
NO₃ + NH₄	9.4	<20	21.3	<20	28.6	<20
Phosphorous (P)	99	51	92	40	101	44
Potassium (K)	156	144	135	174	235	229
Calcium (Ca)	1346	1327	1857	1916	2640	3043
Magnesium (Mg)	174	140	332	203	611	322
Sodium (Na)	174	<67	260	<67	584	<67
Sulfur (S)	139	15 - 40	135	15 - 40	490	15 - 40
Boron (B)	1.0	0.4 - 1.5	1.2	0.4 - 1.5	1.7	0.4 - 1.5
Copper (Cu)	4.7	0.6 - 2.0	3.1	0.6 - 2.0	2.4	0.6 - 2.0
Iron (Fe)	185	See Table 2	175	See Table 2	157	See Table 2
Manganese (Mn)	30	See Table 2	30	See Table 2	43	See Table 2
Zinc (Zn)	18.9	1.3 - 3.5	13.9	1.3 - 3.5	8.4	1.3 - 3.5

Other measurements	Greens		Tees		Fairways	
	Average	Desired	Average	Desired	Average	Desired
pH	7.1	6.5 - 7.5	7.4	6.5 - 7.5	7.2	6.5 - 7.5
EC (dS/m)	3.2	<3.0	3.0	<3.0	6.4	<3.0
TEC (meq/100 g)	9.9	NA	14.5	NA	24	NA
OM%	2.0	<2.0	3.0	<6.0	4.4	<6.0
% Ca	69	68	66	68	59	68
% Mg	15	12-20	20	12-20	23	12-20
% K	4	4	3	4	3	4
%Na	8	<3	8	<3	11	<3
% H	0	10 - 15	0	10 - 15	0	10 - 15

Table 2. Guidelines for iron and manganese, for soils at a range of different pHs. Note that the desired levels of micronutrients increases as soil pH increases. Maintaining higher levels of manganese and iron helps to overcome their tendency to become bound, and therefore unavailable, to the plant in more basic soils. We have paid special attention to these two micronutrients because plants are more likely to be deficient in iron than any other micronutrient. And higher levels of manganese appear to play a role in suppressing turf diseases caused by *Gaeumannomyces* such as bermudagrass decline, kikuyugrass decline, and take-all patch.

	Desired soil ppm for pH 6 - 8.5 soils						Avg. for greens, tees & fairways (across all pHs)
	6	6.5	7	7.5	8	8.5	
Iron (Fe)	80	86	92	98	104	110	157-185
Manganese (Mn)	27	29	31	33	35	37	30-43

Table 3. Selected Cancun soil reports. Analysis by Logan Labs. (probalby Mehlich-3 for cations).

Parameter	Desired value (Sufficiency)	Playacar Green	Playacar Fairway	Moon Green (Dunes)	Moon Fairway (Dunes)	Riviera Green	Riviera Fairway
pH	6.0-7.5	8.3	8.3	8.2	8.3	8.4	8.1
Phosphorous (ppm)	>50	12	3.1	16	3.9	9.0	8.8
Calcium (ppm)	>750	17,497	27,563	627	20,168	284	25,380
Magnesium (ppm)	>140	808	610	63	282	51	484
Potassium (ppm)	51 - 116	34	44	45	39	71	156
Sodium (ppm)	<110	141	191	108	96	135	737
Sulphur (ppm)	15 - 40	83	29	53	45	31	260
Boron (ppm)	0.5 – 1.5	1.5	0.6	0.6	0.7	0.9	1.5
Copper (ppm)	0.1 – 2.5	0.91	0.6	0.7	0.3	0.7	0.4
Iron (ppm)	90 - 150	11	24	26	11	17	13
Manganese (ppm)	30-50	6	12	14	2	5	6
Zinc (ppm)	1 - 2	17	4.3	7	3	1.9	8.7
% Base Saturation							
% calcium	65 – 80%	89	93	72	94	59	91
% magnesium	10 - 20%	6.9	3.4	12	2.2	18	2.9
% potassium	2 - 7%	0.1	0.1	2.6	0.1	7.6	0.3
% sodium	<3%	0.6	0.6	11	0.4	12	2.3
Other Values							
EC (dS/m)	<6	--	--	--	--	--	--
TEC (meq/100g)	>4	98	148	4.4	107	2.4	139
% Organic matter	<3%	1.8	1.6	0.04	0.1	0.1	1.9

Table 3. Soil chemical guidelines - Saturated Paste Extraction. Soil Saturated Paste Analysis desired values for soils that are calcareous or for soils that otherwise can not be effectively analyzed using Melich III extraction methods.

	Desired
PH	6.2 – 6.9
Salt (ppm)	< 1280
Chloride (ppm)	<400
Nitrate (ppm)	5 - 20
ammonium	<7
Bicarb HCO ₃ (ppm)	<60
Phosphorous (ppm)	2 – 10
Calcium	60 – 200 ppm or >20%
Magnesium	20 – 70 ppm
Potassium	40 – 100 ppm
Sodium	0 – 30 ppm or <35%
ESP	<5.0%
SAR	< 4.0