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INTERPRETATION GUIDE TO SOIL TEST REPORTS

TPSL®'s Daubeny Carbon Dioxide *Plant Natural*™ Extraction Method works with all types of soils and is the most accurate in the industry.

It is essential to provide full and detailed information requested on lab forms for most accurate recommendations.

TEXTURE Ranges from: 1-Sand through 3-Loam to 6-Heavy Clay.
CEC (Cation Exchange Capacity) – The higher the CEC, the higher the soil's nutrient and water-holding capacity. **TEXTURE** is determined by the Hand Method and indicates CEC. The Bouyoucos Hydrometer Method is available as an option.
 TEX 1 = 3 – 8; ranges through 6 = 30 - 50 CEC.
 O.M. increases CEC about 3.5 for each percent increase in Humus.

ORGANIC MATTER % – Total (LOI [Loss On Ignition]) (optional) includes both Raw and Active O.M. The original material (leaves, twigs, etc.) of the Raw are easily discernable. **Active** has been decayed into Humus and the original material cannot be discerned. O.M. improves CEC, tilth (soil physical condition / structure), water and nutrient holding capacity - the more the better – and their original plant-forms cannot be discerned. However, high OM soils can be at higher risk of over-fertilization.

SOIL TEXTURE	1	2	3	4	5	6
SOIL CEC RANGE	3 – 8	6 – 12	10 – 20	15 – 25	20 – 35	30 – 50+
IDEAL HUMUS %	2.8	3.1	3.6	4.1	4.5	4.8

CO₂ NATURAL (DAUBENY) EXTRACTION – Plant roots produce CO₂ in the immediate root-zone which combines with soil moisture to produce **Carbonic Acid**. Therefore, **TPSL**® mimics that same extraction to obtain nutrient values that are much more realistic and **calibrate to actual plant uptake**. Most labs extract with much stronger reagents, thus usually report much higher numbers with **no calibration**.

NO₃ (N) This highly-soluble nitrate ion moves easily up and down with water and is a constantly changing value. Plant uptake is rapid. Excess can be toxic.

P₂O₅ (P) Extracted with CO₂ - amount reported in lbs. per acre for the top foot of soil. Amount reported is **available** to a crop in a normal growing season. Responses can be expected below 40 lbs. per acre and high requiring crops may respond to additional phosphate up to 200 lbs. per acre test.

K Extractable Potassium (CO₂) - is the amount available to the crop in a growing season. 80 PPM minimum and up to 120 PPM for crops with high potash needs. Soil availabilities vary with texture, soil moisture conditions, interference from Sodium levels & ratios of Na to Ca and to Mg.

pH Acidity measurement is variable. Most crops prefer 6.5 - 7.3. Neutral is 7.0 -- above is alkaline, below is acid. **TPSL**® air dries soil at 81°F to avoid altering soil chemistry for best accuracy. pH is a nebulous, dynamic factor - highly variable.

EC SALTS A measure of Total Water-Soluble Salts - expressed as mmhos/cm.
EC = Electrical Conductivity X 640 = Total Suspended Solids (TSS) in ppm.

SALT CATIONS H₂O - Water-soluble cations determined with ICAP Spectrometer. Calcium is important - should exceed 100 PPM. CO₂-Extractable (Carbonic Acid equivalent), same as the plant root process. Sodium is the main extractable harmful element - should be below 180 PPM. The amount of extractable Calcium reserve in the soil is also reported and must be known to properly manage excess salts.

SAR **Sodium Adsorption Ratio** is the relationship between Sodium and soluble Calcium (and also, Magnesium). A high SAR requires the addition of large amounts of soluble Calcium.

SAR	RATING	SAR	RATING	SAR	RATING	SAR	RATING	SAR	RATING
0-3	LOW	3-6	UPPER LOW	6-9	MARGINAL	9-12	HIGH	12+	EX. HIGH

Na (CO₂) : Ca (H₂O) These ratios help evaluate salt problems and are indicators of the soil's physical condition for water and root penetration.

Na:Ca should be less than **6**.

Na:Mg should be below **20** for regular crops and below **10** for sugar-producing crops such as melons, citrus, sugar cane, sugar beets, etc...

RATING GUIDE TO TPSL® PLANT-AVAILABLE SOIL TEST REPORTS CALIBRATED AGAINST PLANT (SAP) ANALYSIS (ACTUAL PLANT UPTAKE)

NITRATE NO₃ – N lb/ac 12" Sample: ppm = lb/ac ÷ 4 6" Sample: ppm = lb/ac ÷ 2	1 - 9	very low	PHOSPHATE P₂O₅ – P lb/ac ppm P x 2.291 = P₂O₅ CO₂ Extraction	1 - 10	very low
	10 - 19	low		11 - 19	low
	20 - 29	upper low		20 - 39	upper low
	30 - 59	medium		40 - 59	low medium
	60 - 89	high medium		60 - 79	medium
	90 - 139	high		80 - 139	low high
	> 140	high -- caution, seedling injury possible		140 - 199	high
		> 200	extremely high - Micros may tie up.		

POTASSIUM K – ppm 12" Sample: lb/ac = ppm x 4 6" Sample: lb/ac = ppm x 2 ppm K x 1.205 = K₂O	H₂O Extraction	CO₂ Extraction	Rating
	1-39	1-59	very low
	40-59	60-79	low
	60-79	80-99	medium
	80-99	100-119	high medium
	> 100	> 120	high

CALCIUM Ca - ppm	H₂O Extraction	CO₂ Extraction	Rating	MAGNESIUM Mg – ppm	H₂O Extraction	CO₂ Extraction	Rating
	< 19	< 149	very low		< 9	< 39	very low
	20 - 69	150 - 249	low		10 - 12	40 - 59	low
	70 - 89	250 - 399	marginal		13 - 14	60 - 79	marginal
	90 - 119	400 - 599	medium		15 - 17	80 - 99	medium
	> 120	> 600	high		> 18	> 100	high

Electrical Conductivity EC SALTS EC X 640 = ppm TSS	mmhos/cm★	Rating	TEXTURE	CEC
	< 0.49	very favorably low	1	3 - 8
	0.50 - 0.99	low	2	6 - 12
	1.00 - 1.59	slight accumulation	3	10 - 20
	1.60 - 1.99	medium - little problem – but caution.	4	15 - 25
	2.00 - 3.99	high - affects many crops, treatment needed.	5	20 - 35
> 4.00	affects most crops, treatment essential.	6	30 - 50	

★ mmhos/cm = dS/m

CO₃ Free Carbonates - Mostly Ca & Mg - Rated: 0 = None to EH = Extremely High

SODIUM Na – ppm H₂O Na should be over 50% of the CO₂ Na so it can leach through the soil profile. The solubility of the Na is affected by Sulfur (acidity) and soluble Calcium.

When the H₂O Na is over 50% of the CO₂ Na and the EC (total soluble salt) is high, this indicates that better internal drainage is needed. Subsoils need testing.

When CO₂ Na is high (>180) and the H₂O Na is less than 50%, this indicates need for chemical treatment to increase soluble Na so it will leach. Also, test soil for soluble (H₂O) cations especially Ca and Na to determine best salt management treatment.

Converting PPM to Pounds -

Results for some major and minor elements are reported in parts per million (ppm). This unit of measurement is equivalent to pounds of nutrient per million pounds of soil. One acre of soil 6 inches deep weighs about 2,000,000 pounds. Therefore, to convert ppm to lbs/ac, multiply by 2. So, if the client does not report to the lab their sample depth, the Nitrates (NO₃) and Phosphate (P₂O₅) will be calculated as a 12-inch sample; therefore, the calculation used is a factor of 4. Thus, if your sample is only 6 inches, your results will be twice as high. This will only affect the Nitrate and Phosphate since they are the only nutrients converted to pounds per acre on our soil report.

To calculate the factor for sample depth you multiply the depth (in inches) by 0.33. This result will be the factor to use to multiply by ppm of nutrients to convert to pounds per acre.

Or to convert to pounds per 1,000 square feet, the factor is $0.33 \div 43.56 = 0.00758$. (Per 100 square feet, 0.000758)

For example, a sample depth of 8 inches and 55 ppm of Magnesium per acre: $8 \text{ inches} \times 0.33 = 2.64$.

Therefore, $55 \text{ ppm Magnesium} \times 2.64 = 145 \text{ lbs/ac of Magnesium}$.

Or, a sample depth of 8 inches and 55 ppm of Magnesium per 1,000 square feet: $8 \text{ inches} \times .00758 = 0.0606$.

Therefore, $55 \text{ ppm Magnesium} \times 0.0606 = 3.3 \text{ lbs/1,000 sq. ft. of Magnesium}$.

Accordingly, it is

Very Important to accurately report the actual depth (interval) of your sample.

THE MOST ACCURATE WAY TO PREDICT THE AVAILABILITY OF SOIL NUTRIENTS IS BY USING THE TPSL[®] DAUBENY PLANT NATURAL[™] METHOD OF NUTRIENT EXTRACTION

(calibrated against actual plant uptake)

OF PLANT-AVAILABLE NUTRIENTS.

WORKS BEST AND ACCURATELY WITH

ALL SOILS – ACID OR ALKALINE – SANDS OR CLAYS – AROUND THE WORLD.

PLANT SAP or TISSUE ANALYSIS – *Ask The Plant*[®]

is the only way to determine and correct crop nutritional problems to achieve maximum crop performance under existing growing conditions.

PLANT NUTRIENT REQUIREMENTS can change dramatically with the age and development stage of your crop.

ADEQUATE FIELD INFORMATION IS NEEDED FOR PROPER INTERPRETATIONS OF THE ABOVE INFORMATION AND TO PROVIDE YOU WITH THE ANSWERS TO THE MOST EFFICIENT USE OF YOUR FERTILIZER MONEY AND TO OBTAIN THE BEST FIELD PERFORMANCE WITH FEWEST BUG AND DISEASE INFESTATIONS UNDER YOUR PREVAILING GROWING CONDITIONS.