Soil Health - Electrical Conductivity (EC)

Salinity Classes and Relationship Between $EC_{1:1}$ and EC_e Values[1]

Soil Texture	Degree of Salinity (Salinity Classes)					
	Nonsaline	Slightly Saline	Moderately Saline	Strongly Saline	Very Strongly Saline	Ratio of $EC_{1:1}$ to EC_e
$EC_{1:1}$ Method (dS/m)						
Coarse sand to loamy sand	0-1.1	1.2-2.4	2.5-4.4	4.5-8.9	9.0+	0.56
Loamy fine sand to loam	0-1.2	1.3-2.4	2.5-4.7	4.8-9.4	9.5+	0.59
Silt loam to clay loam	0-1.3	1.4-2.5	2.6-5.0	5.1-10.0	10.1+	0.63
Silty clay loam to clay	0-1.4	1.5-2.8	2.9-5.7	5.8-11.4	11.5+	0.71
EC_e Method (dS/m)						
All textures	0-2.0	2.1-4.0	4.1-8.0	8.1-16.0	16.1+	N/A

Salt Tolerance and Decrease in Yields Beyond EC Threshold[2]

Crops	EC_e Threshold (dS/m)	$EC_{1:1}$ Threshold (dS/m)	Percent Decrease in Yields per $EC_{1:1}$ Unit (dS/m) Beyond Threshold
Barley	8.0	4.5 to 5.7	5.0
Cotton	7.7	4.3 to 5.5	5.2
Sugar beets	7.0	3.9 to 5.0	5.9
Wheat	6.0	3.4 to 4.3	7.1
Perennial Ryegrass	5.6	3.1 to 4.0	7.6
Soybeans	5.0	2.8 to 3.6	20.0
Tall Fescue	3.9	2.2 to 2.8	5.3
Crested Wheatgrass	3.5	2.0 to 2.5	4.0
Peanuts	3.2	1.8 to 2.3	29.0
Rice, common vetch	3.0	1.7 to 2.1	12.0
otatoes	2.5	1.4 to 1.8	9.9
Alfalfa	2.0	1.1 to 1.4	7.3
Corn, potatoes	1.7	1.0 to 1.2	12.0
Berseem clover, orchardgrass, grapes, peppers	1.5	0.8 to 1.1	5.7
Lettuce, cowpeas	1.3	0.7 to 0.9	13.0
Green beans	1.0	0.6 to 0.7	19.0

Soil EC Influence on Microbial Processes and Gaseous N Production in Soils amended with Sodium Chloride (NaCl) or Nitrogen Fertilizer[3]

Process	$EC_{1:1}$ Range (dS/m)	Relative Decrease/Increase (percent)	EC1:1 Threshold
Respiration	0.7 to 2.8	-17 to -47	0.7
Decomposition	0.7 to 2.9	-2 to -25	0.7
Nitrification	0.7 to 2.9	-10 to -37	0.7
Denitrification	1.0 to 1.8	+32 to +88	1.0
Anaerobic N_2O gas production (high NO_3)	0.02 to 2.8	+1,500 to +31,500	1.0 to 1.5
Anaerobic N_2O gas production (low NO_3)	0.5 to 2.0	+200 to +90,000	0.7 to 1.0

[1]Smith and Doran, 1996, adapted from Dahnke and Whitney, 1988

[2]Smith and Doran, 1996; EC1:1 based on Hoffman and Maas, 1977

[3]Adapted from Smith and Doran, 1996 (Tables 10-5 and 10-6) and Adviento-Borbe and others, 2006

Soil Health - Electrical Conductivity (EC)

Measuring Electrical Conductivity (EC)

Materials needed:

Soil Probe and plastic container
1/8 cup (29.5 mL) measuring scoop
Squirt bottle
Distilled water or rainwater
Calibrated 120mL vial with lid
EC meter
1.41 dS/m calibration solution
Pen, notebook, permanent marker
Resealable plastic bags

Procedure:

1. Calibrate EC probe by immersing in a standard salt solution (1.41 dS/m) at 25 °C (77 °F) and turning the adjustment knob on the probe to 1.4. Second, insert EC probe into calibration resistor on probe holder. Record reading. Future readings are taken at the same air temperature.

2. Using a soil probe, gather at least 10 randomly selected samples from an area representative of a particular soil type, condition, and management history. The probe should extent to a depth of 8 inches or less. Place samples in the small plastic container and mix. Do not include large stones and plant residue. Repeat step 1 for each sampling area.

3. Fill one scoop (29.5 mL) with mixed soil, tamping down during filling by carefully striking scoop on a hard, level surface. Place soil in calibrated vial. Add one scoopful (29.5 mL) of distilled water. The vial will contain a 1:1 ratio of soil to water, on a volume basis.

4. Tightly cap vial and shake 25 times.

5. Remove EC probe cap, turn probe on, and insert probe into soil and water mixture in vial, keeping the tip of the probe in the center of the suspended soil particles. Take reading while soil particles are still suspended in solution. To keep soil particles from settling, stir gently with EC probe. Do not immerse probe below maximum immersion level.

6. Reading will stabilize in about 10 seconds. Record EC1:1 as dS/m.

7. Save soil and water mixture to measure pH, nitrates, nitrites, and phosphorus, if applicable. Nitrate levels can be estimated for soils that are nonsaline and have a pH of less than 7.2 if nitrates make up most of the soluble salts in the EC reading.

8. Turn off probe, thoroughly rinse with water, and replace cap.

*Note: EC test can be conducted in the field by inserting the EC probe into the soil to the desired depth and saturating the soil with distilled water. This simulates the EC1:1 test.

Calculations:

Soil nitrate nitrogen (ppm) (Step 7)

NO_3 </= EC 1:1 x 140