Food and Agriculture Organization of the United Nations

Global Soil Doctors Programme

Chemical soil properties – Exercise C03

SALINITY - ELECTRICAL CONDUCTIVITY 1:1 (Field-Lab protocol)

Reference poster 13a -13b-13c

RELEVANCE

Soil salinization is the excessive accumulation of soluble salts caused by natural and human-induced phenomena. It can occur when irrigation practices are carried out without due attention to drainage and leaching of the salts out of the soil. As soil salinity increases, its impacts can result in degradation of soils and inhibition of plant growth. One of the methods for measuring salinity and assessing the adequacy of drainage system is through the measurement of electrical conductivity (EC). The EC determination, however, requires specific apparatus.

MATERIALS

Water*

Spoon

Conductivity meter

Beaker

Scales**

0.01 *N* solution of KCl

**Deionized or non-salty tap and potable water can be used*

*** Scales with 0.1 or 1 g accuracy*

PROCEDURE

Instrument check [1]

1) Rinse the conductivity cell thoroughly with water (deionized water if possible) and dry the excess water.

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2) Put about 75 mL of KCl solution into a 100 mL glass beaker, and then put the clean and dried conductivity cell in the glass beaker.

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3) Record the reading. Check the accuracy of the EC meter, which should give a reading of 1.413 dS/m [2] . If the reading is wrong, perform the calibration of your instrument according to the instructions provided together with the instrument[3].

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Determination of soil EC using the 1:1 ratio method

1) Collect a soil sample. In the laboratory conditions, the soil sample should be air-dried, grinded and sieved through 2 mm sieve before proceeding with the next steps.

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	2) Put the dried soil sample into a beaker and add the same ratio of water. For example, 50 mL of water are added to 50 g of soil.
	3) Thoroughly mix the soil sample with water and let it settle for around 20 minutes.  © V. Zabolotskikh
	4) Measure the electrical conductivity in the solution above the precipitate[4].  © V. Zabolotskikh
	5) Recalculate your measurement ($EC_{1:1}$) to **saturated paste** solution (ECe)[5] : In sandy soil: ECe = $EC_{1:1}$ x 2.42 In loamy soil: ECe = $EC_{1:1}$ x 2.06 In clay soil: ECe = $EC_{1:1}$ x 1.96 If no information about soil texture is available: ECe = $EC_{1:1}$ x 2.11
ADVANTAGES OF THE METHOD	The reading from this method is highly accurate. This method is cheap and can therefore be used for a larger number of samples to determine differences between different areas of a same field.
LIMITATIONS OF THE METHOD	A device for measuring electrical conductivity is needed and requires calibration with a standard salt solution. Cannot be carried on in the field.
QUESTIONS TO BE ADDRESSED	What is the value of ECe measured? Is this value higher or lower than 2 dS/m? What does this imply? Did you find varying values between soils cultivated with different crops and different irrigation practices? Did you observe other signs of salinization in soil or plants? What are the causes of salinization? How to prevent soil salinization? What are the practices to best manage saline soils?

EVALUATION EXAMPLES				
POOR		MODERATE		GOOD
Only salt tolerant crops and halophytes yield satisfactory		Yields of sensitive crops are limited		Low risk of the negative impact on crops
Extremely saline soil: ECe values >15 dS/m	Very strongly saline soil: ECe values ranging from 8 to 15 dS/m	Strongly saline soil: ECe values ranging from 4 to 8 dS/m	Moderately saline soil: ECe values ranging from 2 to 4 dS/m	Not saline soil: ECe values <2 dS/m

[1] One of the possible options how to check a conductivity meter is proposed here. It is recommended to calibrate your device according to the instructions provided together with the instrument.
[2] The reference is given for 25°C. Most of EC devices perform an automated temperature correction. Please check the specifications of your instrument. If it's not the case, the recalculation to the temperature of the environment where you measure should be performed.
[3] The calibration instructions can be found online if you indicate the model of your device at the search engine.
[4] If non deionized water has been used, you should subtract the value of water EC from this reading.
[5] According to: Sonmez, S., Buyuktas, D., Okturen, F. & Citak, S. 2008. Assessment of different soil to water ratios (1:1, 1:2.5, 1:5) in soil salinity studies. Geoderma, 144(1–2): 361–369. https://doi.org/10.1016/j.geoderma.2007.12.005