131-1

Impact of Choosing the Right Soil Test: Lessons Learned in Saline and Sodic Environments.

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All About Discovery

Abstract

Making salt tolerant crop recommendations and estimating leaching fractions are hampered when 1:1 extracts are used over saturated paste. Soils were collected from 2011-2015 from various locations within New Mexico and using standard saturation extracts and 1:1 extracts for pH, salinity and sodicity. Soil pH was generally overestimated with 1:1 extracts and electrical conductivity and SAR were generally underestimated. Regressions demonstrated that 1:1 pH and EC can be mathematically adjusted to improve recommendations. SAR_e, on the other hand, did not lend itself well to interpretation from $SAR_{1:1}$(data not presented).

Introduction - Situation

- Saline and sodic soils are present in New Mexico agriculture and in much of the west.
- Soil testing can be used to identify saline and/or sodium affected soils.
- There exists a discrepancy in pH, Electrical Conductivity (EC), and Sodium Adsorption Ratio (SAR) between soil tests that use saturated paste (SP) extracts vs those that use 1:1 extracts.
- Leaching fractions, crop tolerances, and reclamation recommendations are based on SP.
- Clients are confused and may not meet expectations.
- Traditional SP methods are more expensive to the client.

? Can crop tolerances and reclamation recommendations be sufficiently estimated from 1:1 extracts after mathematical transformation to better estimate reclamation needs?

Methods

Whenever possible during 2011 – 2015 when soil test requests were received by the author samples were sent to Ward Laboratories, Kearney, NE, for standard and salinity analysis. Soils used for this evaluation were limited to New Mexico but not one geographic location within the state.

The standard analysis included
1:1 extracts: $pH_{1:1}$, $EC_{1:1}$
NH_4OAc extracts for Na, Ca, and Mg.

The salinity analysis included
saturation paste extracts for EC_e , SAR_e &
saturation percentage.

Step-wise regression analysis and linear regression routines found within the SigmaPlot® statistics package were utilized to evaluate relationships between the two methods.

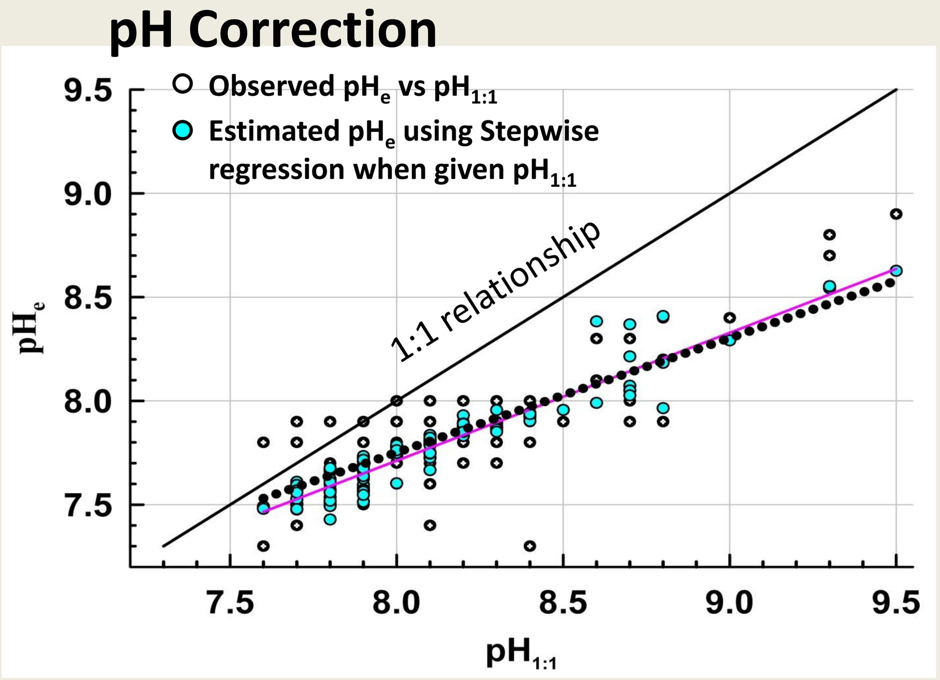
Gypsum recommendations were calculated for the routine vs estimated salinity and compared to the lab's salinity assessment.

Results

Samples Identified as saline by EC_e or by $EC_{1:1}$ and calculated yield reduction for corn.

	EC_e	$EC_{1:1}$
ID'd as Saline	34	4
Yield Reduction		
Average	34%	12%
Median	27%	30%
Maximum	100%	41%
Minimum	2%	0.10%
ID'd Yield Loss	55%	38%

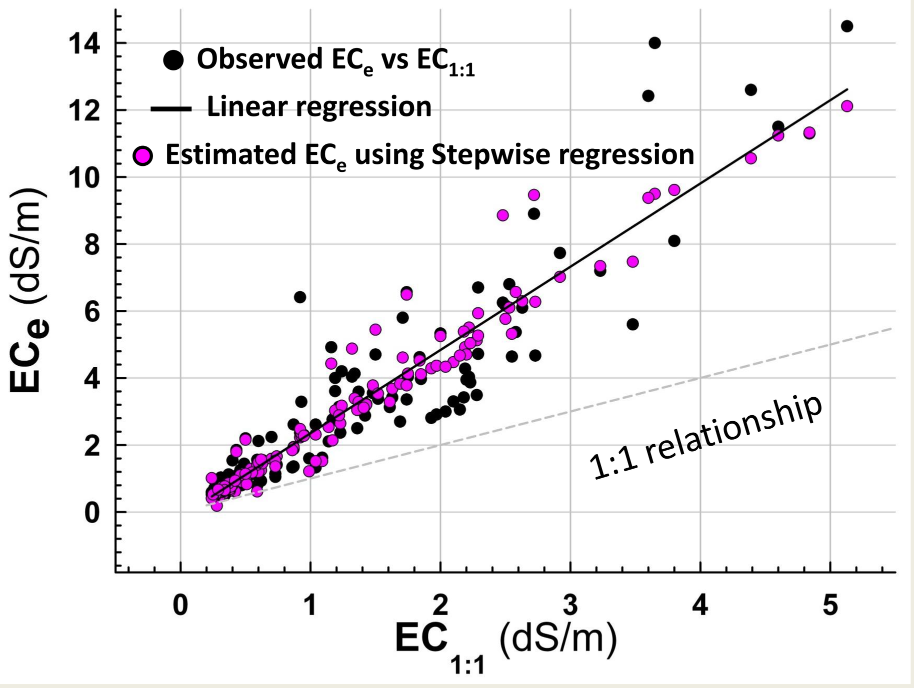
pH Correction



R^2_{adj}=0.726 pHe = $4.293 + 0.429(pH_{1:1}) - 0.0942(EC_{1:1}) + 1.19^{-5}(Ca_{1:1}) + 4.06^{-4}(Na_{1:1})$

R^2_{adj}=0.622 pHe = $3.335 + 0.552(pH_{1:1})$

EC Correction



R^2_{adj}=0.892 ECe = $0.0705 + 2.269(EC_{1:1}) - 1.51^{-3}(Mg_{1:1}) + 2.57^{-3}(Na_{1:1})$

R^2_{adj}=0.851 ECe = $3.335 + 0.552(EC_{1:1})$

Discussion

Salinity

Agricultural Handbook No. 60 as originally put forward in 1954 suggested the following scale for crop sensitivity to salinity:

	Sat'd Paste
Salinity effects mostly negligible	0 – 2 dS/m
Yields of very sensitive crops may be restricted	2 – 4 dS/m
Yields of many crops restricted	4 – 8 dS/m
Only tolerant crops yield satisfactorily	8 – 16 dS/m

When $EC_{1:1}$ is reported in lieu of EC_e there is a real possibility that the diagnosis for salinity could be missed.

A missed diagnosis could lead to improper selection of plant species or varieties that could tolerate the true salinity of the soil environment.

A proper diagnosis of salinity also assists with irrigation water management practices where leaching may be required.

It is most favorable to request a salinity assessment using the saturated paste method. However, from the population of samples analyzed for both EC_e and $EC_{1:1}$ a first approximation to crop sensitivity is:

	1:1 extract
Salinity effects mostly negligible	0 – 0.9 dS/m
Yields of very sensitive crops may be restricted	0.9 – 1.7 dS/m
Yields of many crops restricted	1.7 – 3.3 dS/m
Only tolerant crops yield satisfactorily	3.3 – 6.5 dS/m

Impact

EC_e can be estimated from $EC_{1:1}$ at a regional scale. This will assist in the adoption of management practices that include leaching fractions (when water quality is known) and identifying potential yield loss. Soil pH can also be corrected, however, soil lime in New Mexico soils limits what can be done in the short term.

Soil salinity adjustment (ECe') for samples extracted with 1:1 soil:water and corrected to EC_e for determining potential corn yield reduction.

	EC_e	$EC_{1:1}$	ECe estimate
ID'd as Saline	34	4	39
Yield Reduction		Percent of Samples	
Average	34%	12%	35%
Median	27%	30%	30%
Maximum	100%	41%	100%
Minimum	2%	0.10%	0.10%
Identified Yield Loss	55%	38%	47%