NDSU EXTENSION SERVICE
NORTH DAKOTA STATE UNIVERSITY

Making a difference

Remediating Soil Sodicity

The Situation

Often confused with soil salinity, soil sodicity persists without getting noticed. Its remediation requires an extra step of applying calcium (Ca^{++}) supplements (commonly gypsum) followed by salinity remediation practices of improving soil drainage and lowering down the water-table level. This is done to displace the excessive sodium from the cation exchange sites with the help of calcium. Once displaced, sodium (Na^{+}) converts into a salt (Na_2SO_4) and leach out of the rooting zone. In Fall-2012, Duaine Marxen, Hettinger County Agent was contacted by a Mott area landowner who wanted to get his soils (Site-1 and 2) tiled and analyzed to observe "**the effects of tiling on soil salinity and sodicity**".

Extension Response

This case study involved soil samples that were taken from Site-1 and Site-2 for 3 feet depth in 1 foot increments. Results showed that both sites were high for salts (salinity) with increasing levels of sodium (sodicity). Based on the soil analysis reports, calcium supplements in the form of gypsum ($CaSO_4$) were calculated as 11.15 and 10.77 tons/acre for Site-1 and Site-2. This was recommended in order to lower the soil sodium adsorption ratio (SAR) of 10 and 9.83 (Site-1 and 2 respectively) to an acceptable level of 5 at the 1 foot depth. Calculation was based on using 2.23 tons of 100% pure gypsum for each unit of sodium adsorption ratio. The landowner, however, showed reluctance to apply the full recommended rate of gypsum as he had recently invested in getting that land tiled and "**instead applied 5 tons of 98% pure gypsum/acre on 5 acres, on Site-1 only**" in Spring-2013. The total cost of gypsum was $1000/acre. After spreading the gypsum on soil surface, it was mixed thoroughly into the upper layers by disking. This was done with an understanding that either he will apply the remaining 5 tons of gypsum/acre in fall-2013 or will apply 1 ton of gypsum/acre for the next five years.

Impacts

Soil analysis reports from both sites showed remarkable differences between Site-1 (before and after gypsum application) and Site-2 (with no gypsum application) for Fall-2012 versus Fall-2013. Site-1 results showed that the soil SAR level dramatically dropped in the 1st foot from 10 to 5.53 within 6 months even by using half the recommended rate of gypsum. For the second foot, SAR level remained the same (4.74 versus 4.05) whereas for the third foot it actually increased (1.82 versus 3.39). This was a clear indication that the excessive sodium was moving down the soil profile with soil water. With the same principle, soil EC levels increased especially for the 3rd foot as once displaced sodium (Na^{+}) converts into a soluble salt; sodium sulfate (Na_2SO_4).

Site-1 with Gypsum Application (Spring-2013):

Depth (in)	pH	EC (dS/m)	SAR	S (lb/A)	Cl (lb/A)	CCE %
Before Gypsum Application (Fall-2012)						
0-12	6.3	4.26	10.0	832	64.9	0.3
12-24	7.9	4.00	4.74	832	27.5	1.1
24-36	6.7	1.94	1.82	832	21.0	0.7
After Gypsum Application (Fall-2013)						
0-12	6.6	4.59	5.53	832	75.3	0.1
12-24	7.8	4.56	4.05	832	58.7	1.9
24-36	7.5	3.7	3.39	832	31.9	0.4

Site-2 on the other hand showed a steady increase for salts and sodium for all three feet. Considering the 24" of rainfall in 2013 it can be a contribution from the weathering of soil parent material and impeded soil drainage due to soil dispersion.

Site-2 with No Gypsum Application:

Depth (in)	pH	EC (dS/m)	SAR	S (lb/A)	Cl (lb/A)	CCE %
			Fall-2012			
0-12	7.6	4.11	9.83	832	63.5	0.9
12-24	7.9	4.02	10.2	708	30.3	0.3
24-36	8.3	3.82	10.9	708	22.0	1.8
			Fall-2013			
0-12	7.6	4.30	13.2	832	51.3	1.0
12-24	7.9	4.32	13.9	832	49.9	0.6
24-36	8.0	5.07	15.5	832	51.7	3.2

Feedback

"I noticed significant change in soil structure and harvested my first wheat crop on Site-1 for the first time in last ten years".

Contact

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