CEC and Exchangeable Sodium Percentage Summary

Mid North and Yorke SA Regional Insights

The cation exchange capacity (CEC) is a property of soil that describes its ability to supply nutrient cations to the soil solution for plant uptake. Soil CEC is a measure of the total negative charges within the soil that adsorb positively charged cations such as calcium (Ca2+), magnesium (Mg2+), potassium (K+), sodium (Na+) and aluminium (Al3+). Soil clay particles and organic matter tend to have a net-negative charge and so attract cations on to their surfaces by electrostatic forces. As a result, the cations remain within the soil root zone and are not easily lost through leaching compared to anions such as nitrate (NO3-) or sulphate (SO42-). The adsorbed cations may easily exchange with other cations in the soil solution, hence the term "cation exchange". The adsorbed cations replenish the ions in the soil solution when concentrations decrease due to uptake by plant roots or leaching.

Over 200 paddocks sampled in the Mid North and Yorke region of SA between 2018 and 2022 were used in this insight. They had an average CEC of 19.5 cmol(+)/kg with paddock average CEC ranging from 4.9 to 51 cmol(+)/kg. Similar to other soil constituents, CEC varied significantly within paddocks with an average range of 24 cmol(+)/kg within a paddock up to a maximum of 58 cmol(+)/kg. Figure 1. highlights the variation in CEC seen within paddocks of the Mid North and Yorke regions.

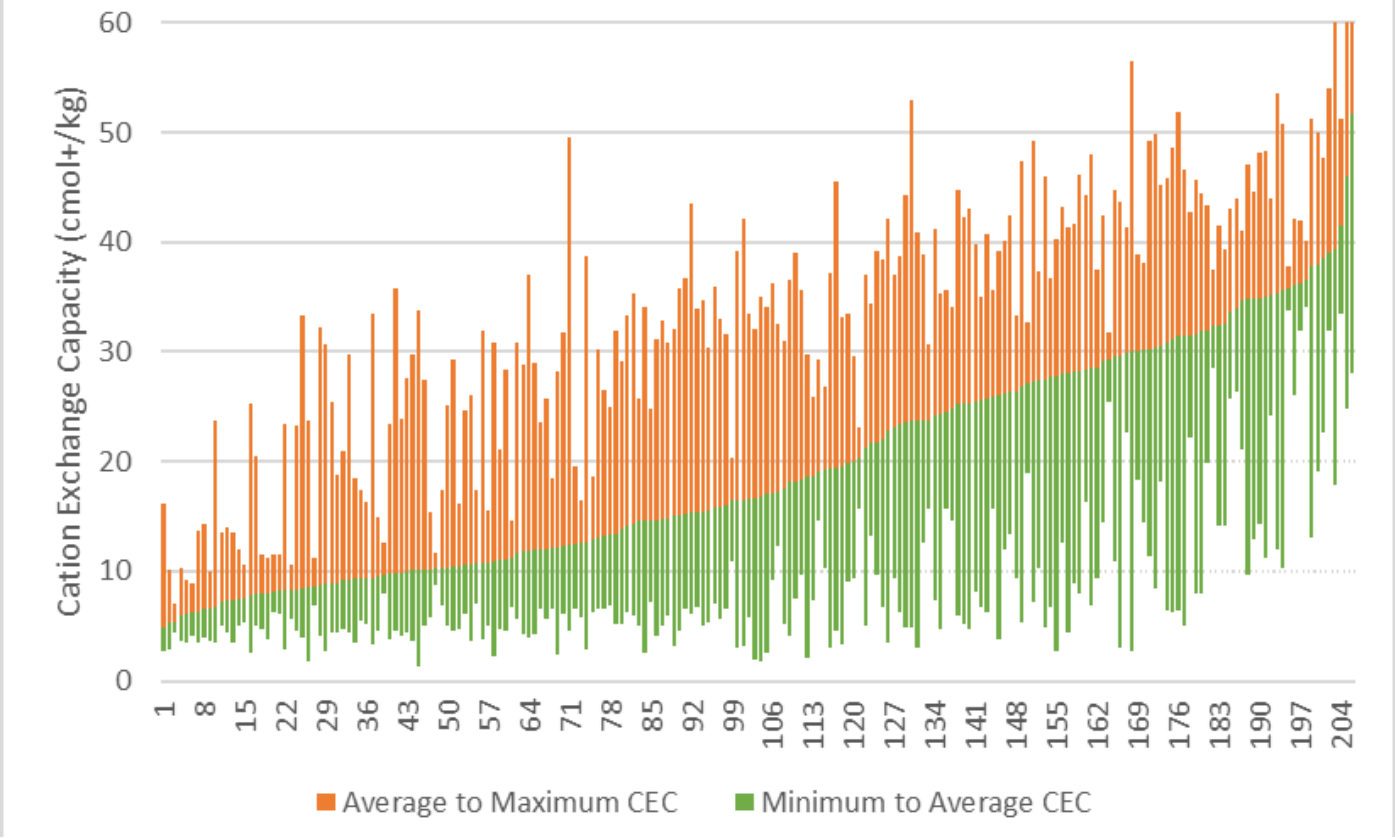

Figure 1. *Soil Cation Exchangeable Capacity data fro individual paddocks sorted by average, lowest to highest. The green line is the minimum to average and the orange line is the average to maximum.*

The exchangeable sodium percentage (ESP) measures the proportion of cation exchange capacity (CEC) occupied by sodium. High exchangeable sodium levels can cause soils to disperse, resulting in poor soil structure which can impede the movement of air and water to the plant roots and lead to compaction and waterlogging issues. When the ESP is greater than 6% soils are classed as sodic and are more likely to be dispersive. Across the Mid North and Yorke dataset the paddock average ESP varied significantly (Figure 2.), with an average paddock ESP of 2.4%, with the highest paddock average being 17.7%. Consistent with other soil properties, ESP varied significantly within paddocks (Figure 3.), this variation is highlighted by the fact that only 5% of paddocks had an average ESP greater than 6%, while 40% of paddocks had a maximum ESP of greater than 6% with at least some areas of the paddock being classified as sodic.

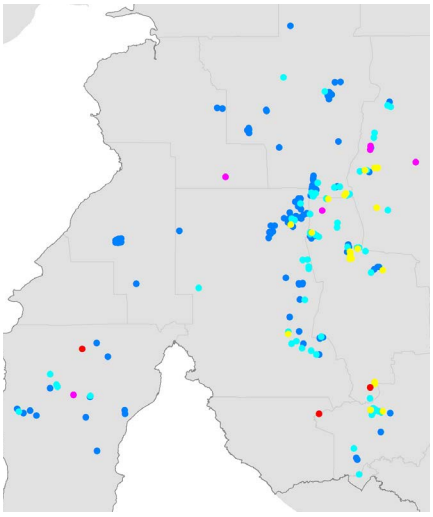

Figure 2. *The paddock average Exchangeable Sodium Percentage across 200 paddocks in the Mid North and York Region.*

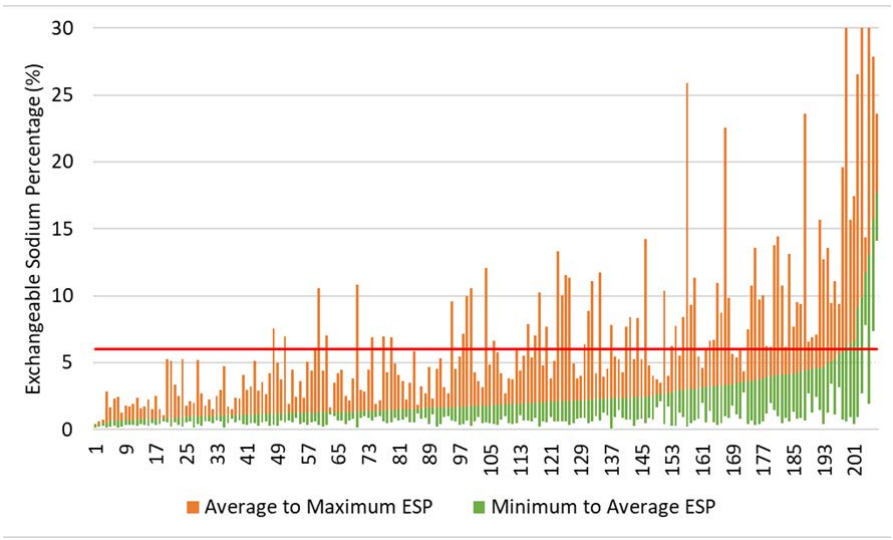

Figure 3. *Exchangeable Sodium Percentage for individual paddocks sorted by average ESP, lowest to highest. The green line is the minimum to average and the orange line is the average to maximum ESP. The red line represents 6% ESP above which a soil may be considered sodic.*

The results are best demonstrated using an individual paddock (Figure 4.). In this paddock the soils CEC ranged from 3.0 to 37 cmol(+)/kg, while the ESP average 2.4% and ranged from 0.7 to 7.7%.

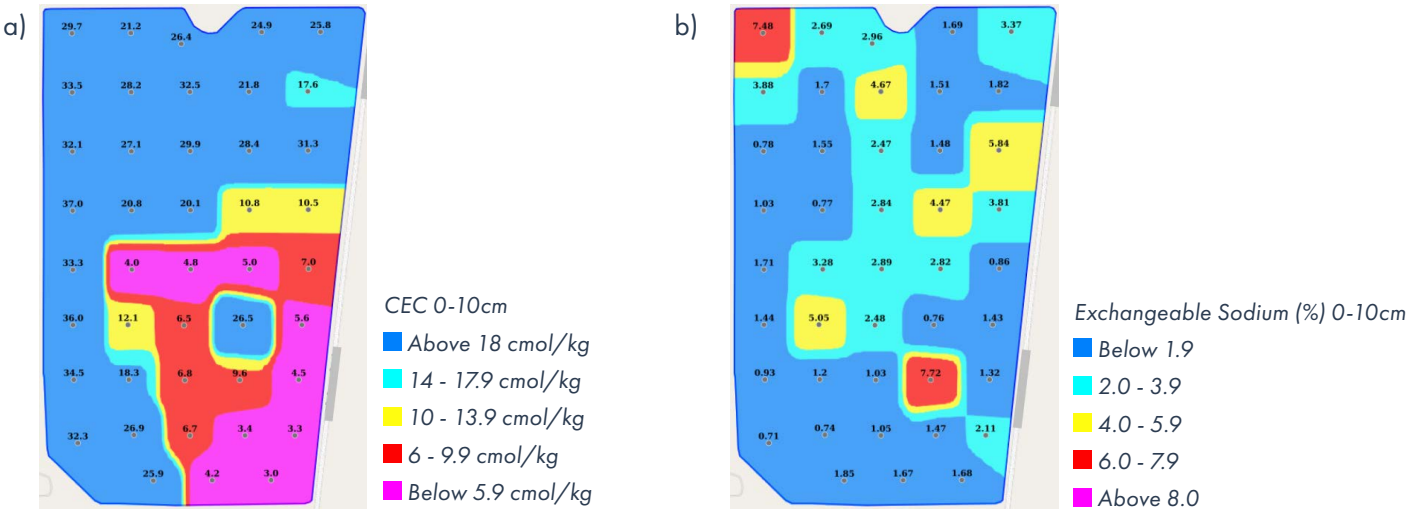

Figure 4. *Cation Exchange Capacity (a) and Exchangeable Sodium Percentage (b) for an individual paddock in the Mid North and Yorke region, highlighting the within paddock variability.*

1800 773 247
sales@precisionagriculture.com.au
precisionagriculture.com.au

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