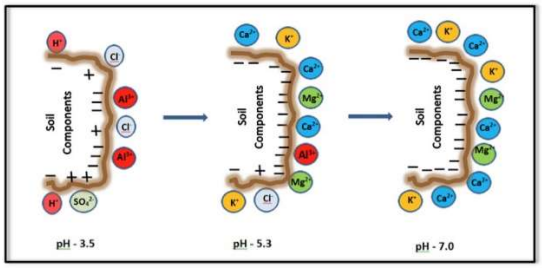
National Landcare Program: Smart Farms Small Grant – Fruit Growers Victoria

FACTSHEET 2 Cation Exchange Capacity?

Cation Exchange Capacity (CEC) is a soil chemical property and provides a measure of a soils ability to adsorb cations (positively charged ions). Soil clay minerals and organic matter particles are negatively charged, and they attract and hold positively charges ions known as cations. The cations held by the soil particles are called exchangeable cations. On the other hand, negatively charged soil particles repel negatively charged ions known as anions. The implication of this is negatively charged nutrients such as nitrates, sulphate and chlorides are vulnerable to leaching down the soil profile.

The adsorbed cations may easily exchange with other cations in the soil solution, hence the term "cation exchange."



Plant roots remove nutrients from the soil solution, which results in nutrients moving away from the clay particles. Addition of fertilizer provides an increase in nutrient concentration in the soil solution, which results in nutrients moving toward clay particles.

The nutrient cations plants use in the largest amounts are potassium (K), calcium (Ca^{2+}) and magnesium (Mg). Other cations adsorbed on exchange sites are ammonium (NH_4), sodium (Na), hydrogen (H), aluminium (Al), iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn).

Typical CEC Values in Soils

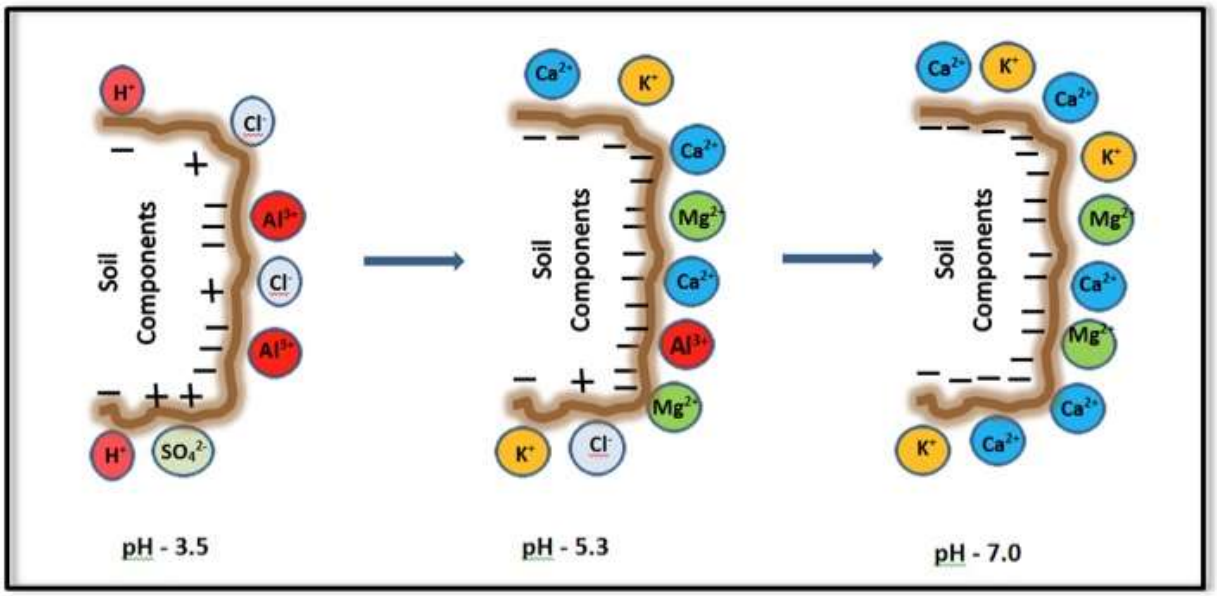
In most soil reports, CEC is expressed as milliequivalents (meq) of charge (number of charges) per 100 grams of soil (meq/100 g or as cmol/kg). The number of milliequivalents is used rather than a weight (kilograms, grams, etc.) of adsorbed cations because CEC represents the total number of charges, which is a better standard of comparison.

Because soil is a mixture of different particle sizes (sand, silt and clay), clay mineral types and organic matter in various proportions, the dominant components and soil pH dictates the soil's CEC.

Significance of CEC

The CEC affects fertilization and liming practices. For example, soils with high CEC retain more nutrients than low-CEC soils. With large quantities of fertilizers applied in a single application to sandy soils with low CEC, loss of nutrients is more likely to occur via leaching. In contrast, these nutrients are much less susceptible to losses in clay soils.

Darren Cribbes,
conNEXUS global



Influence of pH on the surface charge of soil and its components.

https://extension.uga.edu/publications/detail.html?number=C1040&title=cation-exchange-capacity-and-base-saturation Accessed Feb 2024