SOIL FUNCTION DATASHEET #4
What is Cation Exchange Capacity?

This basic concept is not so hard to understand, but so often it seems that technical jargon is used to make it seem like something only "Experts" can handle.

A Cation (pronounced "Cat-Iron") is an atom with a Positive charge. Since "Opposites Attract", such atoms will become associated with anything that has a negative charge – such as a soil colloid. Many cations are metals. For example, if you took some Calcium chloride and dissolved it in water the Calcium would have the positive charge and the Chloride the negative. There must always be BOTH a positive and negative.

In soil it is the very tiniest particles (Clay and Humus) that are negatively charged. These particles are so small that they will remain suspended in water for many hours and so are termed "Colloids". Each of these particles can attract and hold a number of Cations – the most important of which are Calcium, Magnesium, Sodium, Potassium and Hydrogen. So the more colloids a soil contains the greater its "Capacity" to hold Cations – its Cation Exchange Capacity.

Imagine you have a jar full of jellybeans. The total number of jellybeans that will fit in the jar is its ***Jellybean Holding Capacity (JHC)***.

Now let's suppose you wanted one of the jellybeans – you have a problem. For this particular jar there is a rule that cannot be broken – ***The Jar MUST ALWAYS be Full!*** This means that if you want to take a jellybean out, you must put another one back – in exchange!

The result is that the size of the jar not only represents the number of jellybeans it can hold, but also the number available for *Exchange* so the JHC is also the ***Jellybean Exchange Capacity (JEC).*** Now instead of jellybeans, think of Cations in soil and guess what you have. That's right – the ***Cation Exchange Capacity (CEC)***. That is pretty much all there is to it!

An Important Soil Function

The importance of Cation Exchange in the way soil functions cannot be overstated. It is one of the important mechanisms by which plants obtain nutrients and it has a strong influence over soil structure and agricultural productivity.

Having said this, there is no good or bad level for the CEC and there is little you can do to change it. The CEC is more a characteristic of a particular soil than something to be managed. While it may change somewhat over time, you will generally find that the sandier the soil is the lower the CEC will be. Conversely, the CEC will go up as the amounts of clay and organic matter increase and also according to the type of clay minerals present.

The Exchange System in Soil

The CEC is actually the hub of a dynamic system. It has inter-relationships with plant roots (& other soil organisms), the soil solution and the minerals that are being weathered to form new soil.

The cations that occupy the exchange "sites" in the soil come from both the minerals in the soil and salts dissolved in the soil solution. One in particular – Hydrogen – also comes from the breakdown of organic matter and the exudates from plant roots, etc.

Hydrogen is (in a sense) the main "Currency" of the exchange system.

Remember our Jellybean Jar and how you could only get one out of the jar by exchanging it for another? Well this is precisely what plants do – they exchange Hydrogen for the nutrients they need.