#GroundChat

Date: June 6, 2014
Topic: #SoilBasics series
Cation Exchange Capacity (CEC). What it is and how it affects gardening.

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Tweets were not recovered in time for this chat. Instead I have uploaded my prepared tweets.

Lovely, lovely day in Brampton, Ontario. Sunny, blue skies and a comfortable 25 C (77F) in my backyard. Zone 5 #groundchat

If you are joining us on #groundchat, let us know where you are tweeting from & what kind of weather you having! #groundchat

@CoronaTools sends us his regards. He can't make to #groundchat today. He is driving!

Let me start #groundchat with a shoutout to @TBG_Canada who are having their annual fundraising garden tour next week! http://bit.ly/1hW0Rsl

Please feel free to ask questions & comment on #SoilBasics. Someone out there is probably wondering exactly the same thing! #groundchat

The concept of cation exchange capacity (CEC) is one that often confuses novice and seasoned gardeners alike #groundchat

Let us go step by step to get a basic understanding of CEC #groundchat

Every soil particle surface carries a slight electrical charge that attracts & hold nutrients with the opposite electrical charge #groundchat

It’s not a strong chemical bond, more like Velcro attachment. The charge holds the nutrients, yet they can still be pulled away #groundchat

The dominant charge on soil particles is negative. So nutrients held by soil are positively charged. #groundchat

Any chemical that carries a positive charge when dissolved in soil water is called a cation #groundchat.

Nutrients with a positive charge include ammonium, calcium, magnesium and potassium

The amount of cations that a particular soil can hold is set by the amount of that soil’s negative charge. #groundchat

Which is where the term Cation Exchange Capacity (CEC) comes from #groundchat

Cation exchange capacity (CEC) is a measure of the soil’s ability to hold positively charged ions. #groundchat

With me so far? #groundchat

CEC is the #soil’s capacity to absorb important nutrients. The higher the score the better #groundchat

Another way to look at CEC: it’s a rating of your #soil’s fertility-holding capacity. #groundchat

#soil CEC is dependent on the amount of soil surface area, type of minerals and organic matter #groundchat

Let us look at the soil particle surface area and type of minerals found in the soil first. #groundchat

Sandy soils have low CEC because quartz sand grains have a very small negative charge & sand grains also have a low surface area. #groundchat

Low CEC soils, like sandy soils leach & store less nutrients #groundchat

Clay soils have a higher CEC than sandy soils #groundchat

Clay soils not only have a large surface area (because of small particle size) but clay minerals carry more negative charge #groundchat

Higher CEC soil, like clay soils hold onto and store more nutrients than sandy soils #grounchat

But even among clay soils, the CEC varies depending on the type of clay found in soil! #groundchat

The heavily weathered kaolin clay soils in SE USA has lower CEC than the illite and montmorillonte clays of the Great Plains #groundchat

The other source of CEC is organic matter (OM), particularly the fully decomposed OM: humus #groundchat

Organic matter can have a 4 to 50 times higher CEC per given weight than clay. #groundchat

The source of negative charge in organic matter is different from that of clay minerals. #groundchat

The dissociation (separation into smaller units) of organic acids causes a net negative charge in soil OM #groundchat

The negative charge on soil OM is balanced by cations in the soil. #groundchat

Because organic acid dissociation depends on the soil pH, the CEC associated with OM is called pH-dependent CEC. #groundchat

CEC originating from OM in the soil depends on the pH of the soil. #groundchat

CEC of a soil with pH-dependent charge will increase with an increase in pH. #groundchat

Given the same amount and type of OM, a neutral soil (pH ~7) will have a higher CEC than an acidic soil with e.g. pH 5 #groundchat

@PhDAg put it this way, CEC is measurement of the type of clay and the amount of clay and organic matter in your soil #groundchat

The CEC of a soil is expressed in cmolc/kg (centimol positive charge per kg of soil)

CEC of a soil is also expressed as meq/100 g (milli-equivalents per 100 grams of soil). #groundchat

Both expressions are numerically identical (10 cmolc/kg = 10 meq/100 g).

CEC values: Sandy soil 2-10, Loam soil 7-25, clay soil 20-40, OM (humus) 200-400, and organic soil 25-100 #groundchat

CEC is an inherent soil characteristic and is difficult to alter significantly. #groundchat

Adding organic matter will increase the CEC of the soil. But it takes time & plenty of organic matter #groundchat

@Dirtgirl7066 reminds us (again) that under intense soil management it takes 5-10 years to increase soil OM by 1% #grounchat

The bottom line is that you can't change the CEC of your soil very easily. We have to work with what we have #groundchat

So what are the gardening implications of CEC? #groundchat

The higher the CEC, the more clay or organic matter is present in the soil. #groundchat

This usually means that high CEC (clay) soils have a greater water holding capacity than low CEC (sandy) soils. #groundchat

Low CEC soils are more likely to develop potassium and magnesium (and other cation) deficiencies #groundchat

High CEC soils are less susceptible to leaching losses of these cations.

So, for sandy soils, a large one-time addition of cations e.g. potassium can lead to large leaching losses

Sandy soils iaren't able to hold on to the excess cations. More frequent additions of smaller amounts are better. #groundchat

The lower the CEC, the faster the soil pH will decrease with time. So, sandy soils need to be limed more often than clay soils. #groundchat

The higher the CEC, the larger the quantity of lime that must be added to increase the soil pH #groundchat

Sandy soils need less lime than clay soils to increase the pH to desired levels #groundchat

Since soil with a low CEC cannot hold many nutrients, smaller amounts of fertilizer should be applied more frequently. #groundchat

Feeding a lawn growing on soil with a low CEC is analogous to feeding an infant. It doesn't eat a lot but must be fed often.

As the CEC of the soil improves, larger doses of fertilizers can be applied less frequently.

Any questions, queries, concerns? #groundchat

@CornellClas has a great fact sheet on CEC http://bit.ly/1kI5t9S #groundchat

Australian Soil Quality org has a great summary on soil CEC http://bit.ly/1pMrqYA #groundchat

More information about the difficulty of changing CEC is found on http://bit.ly/1mkuVis #groundchat

If you haven't seen it yet, watch @PhDAg's video on CEC. @BrianHefty & @DarrenHefty explains CEC from a farmer's POV #groundchat http://bit.ly/UhasVw

Great #SoilBasics #groundchat everyone! Thank you for all your great comments.

Hope you all enjoyed today's #groundchat as much as I did.

You can show your appreciation at the #groundchat tip jar ;-) http://bit.ly/1cchiAj

Thank you for your support. Tipping is like giving #groundchat a high-five with money in your hand. http://bit.ly/1cchiAj

A big thank you to @jchapstk who contributed at the #groundchat tip jar last week. I really appreciate it!

Next week we have John Slack, CEO of @BorealAgro on #groundchat. Topic: remineralizing soil.

Enjoy your weekend everyone! #groundchat