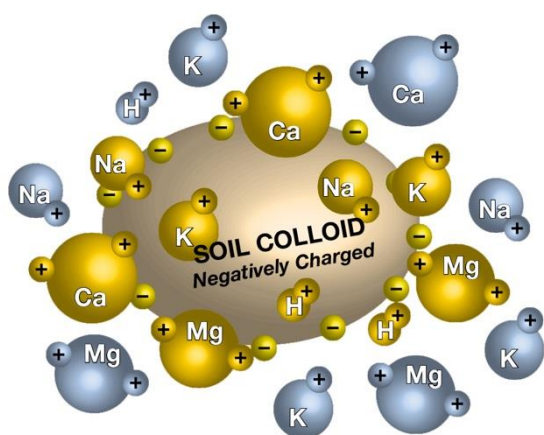
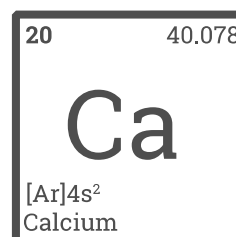


THE ROLE OF CALCIUM IN THE SOIL

Calcium has two major effects in the soil. Firstly, Calcium works as a bonding agent in the aggregation of soil particles, in which it helps to bind organic and inorganic substances. This is important for the development of a good soil structure. Secondly, it acts as a nutrient filler, to maintain balance amongst nutrients and occupy space which otherwise would be taken up by acidic elements. The high molecular weight and two electrons are the main reasons for these effects.



The process of cationic exchange begins when water and basic cations (Ca, Mg, K, Na) meet the soil colloid. Based on the soil colloids degree of cation affinity, Calcium (Ca⁺⁺) will attach to the soil colloid releasing the smaller cations. The released cations (Mg⁺⁺, Na⁺, K⁺, H⁺) are solubilized in the soil solution and made available to the plant or removed from the soil profile. As hydrogen is released from the soil colloid into the soil solution, acidity is reduced and pH is raised.

Cations are held by negatively charged particles of clay and humus called colloids. Colloids consist of thin, flat plates and considering their size, they have a proportionally large surface area. Therefore, they are capable of holding enormous quantities of cations. They act as a storehouse of nutrients for plant roots.

The soil colloid has degrees of affinity for various basic cations. This bonding increases with larger atomic weight, ion size and amount of charge. The percentage saturation for each of the cations will usually be within the following ranges for optimum performance.

Element	Ideal percentage
Calcium (Ca)	60 - 70 %
Magnesium (Mg)	10 - 18 %
Potassium (K)	3 - 6 %
Sodium (Na)	2 - 5 %
Hydrogen (H)	10 - 15 %

Exchangeable cations are those absorbed on the colloid.
Water soluble cations are those ionized in the soil solution.
CEC is determined by the number of negative sites on the colloids.

VerdeCal G is specifically designed to have an impact on the CEC, either to correct the CEC to the appropriate levels or to maintain the CEC on the correct levels.



After application of VerdeCal G, the total CEC is raised and balance within the cations is restored. The goal is to raise the overall CEC within the physical boundaries of the soil structure, the ratio between sand, silt and clay. The higher the CEC, the more efficient the soils fertility can be used.

VerdeCal G is capable of making the Calcium readily available for the plant; independent research has shown significant increases in the Calcium levels both in the soil as well as inside the plant. Results show an increase in the plant after just 9 days. The reason why the calcium in VerdeCal G is so quickly available, is due to the secret ingredient: thCa™. This is a combination of plant extracts which are formed into trihydroxycarboxylic acid.

This acid oxidizes the Calcium molecules in VerdeCal G, making it available to the plant and soil. The thCa™ also oxidizes currently unavailable Calcium in the soil, therefore adjusting the CEC even more. In addition, the Calcium will also be available over a longer period of time.

The formulation VerdeCal G contains very high concentrations of readily available Calcium. Due to the combination of the thCa and a low dose of a polyol wetting agent, the application rate for VerdeCal G is very low compared to conventional Calcium products. Where conventional Calcium products have application rates ranging from 1.000 to 2.000 kg/Ha, VerdeCal G has an application rate of 250 to 500 kg/Ha. This is only 25 % of the rate of a conventional calcium product.

For regular maintenance, once the CEC levels are within the required range, the application rate is 250 kg/Ha. When the CEC levels are unbalanced, the application advice is 500 kg/Ha with a second application after 30 days in case the CEC percentages are not within the desired range.

The composition of VerdeCal G is 95 % Calcium Sulfate, due to the acidic effect of the Sulfate, VerdeCal G will not have an impact on the pH, unless the cations are very unbalanced on the CEC. In this case, VerdeCal G will even lower the pH of the soil. VerdeCal G also contains a 1 % Aqua-Aid polyol wetting agent. This wetting agent attributes to the high solubility of the product. After application, the product needs an irrigation cycle, VerdeCal G will dissolve directly and become available for plant and soil.

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The following example shows the impact of VerdeCal G on the CEC and corresponding levels of the cations. Just before the application of 250 kg/Ha, a soil paste extract was taken on the 23rd of June 2020. The analysis shows a low CEC value at 18 mmol+/kg, the CEC saturation is high at 100 % with 72 % Calcium on the CEC. The level of Magnesium stands out, at 23 % which is considered too high.

23-06-2020

Clay-humus (CEC)	mmol+/kg	18	> 14	
CEC-saturation	%	100	> 95	
Ca-saturation	%	72	75 - 85	
Mg-saturation	%	23	6,0 - 10	
K-saturation	%	3,9	2,0 - 5,0	
Na-saturation	%	2,2	1,0 - 1,5	
H-saturation	%	< 0,1	< 1,0	
Al-saturation	%	< 0,1	< 1,0	
Ca-plant available	kg Ca/ha	10	105 - 245	
Ca-soil stock	kg Ca/ha	380	295 - 440	

The goal of VerdeCal G is to both raise the total CEC and to increase the Calcium percentage on the CEC. When the Calcium level is increased, the other levels will decrease – in this case Magnesium.

18-8-2020

Clay-humus (CEC)	mmol+/kg	27	> 31	
CEC-saturation	%	100	> 95	
Ca-saturation	%	85	75 - 85	
Mg-saturation	%	11	6,0 - 10	
K-saturation	%	3,7	2,0 - 5,0	
Na-saturation	%	1,1	1,0 - 1,5	
H-saturation	%	< 0,1	< 1,0	
Al-saturation	%	< 0,1	< 1,0	
Ca-plant available	kg Ca/ha	10	100 - 235	
Ca-soil stock	kg Ca/ha	645	440 - 660	

The second analysis was done almost two months later, this shows the results of a VerdeCal G application at the normal application rate of 250 kg/Ha.

Total CEC was increased from 18 to 27 mmol+/kg, which is an increase of 50 %. The Calcium presence in the CEC was raised from 75 % to 85 %, dropping the Magnesium level from 23 % to 11 %. This is within the ideal percentage range for the CEC.

The conclusion from these soil analyses is that VerdeCal G is able to raise the general soil structure of the root zone by increasing the CEC and correcting the percentages of the different cations present in the CEC.