

Zeolite is a mineral component of altered volcanic rock. The unique ability of Zeolite to capture ammonium (NH_4^{+1}) is well documented in research. Zeolite holds ammonium through its high cation exchange capacity (CEC) and frees organically bound nitrogen (energy) to plants instead of oxidizing to water soluble nitrates and nitrites that pollute the ground water and the atmosphere as ammonia (gas). Zeolite provides temporary storage for ammonium during livestock digestion, in manure, and in compost.

Zeolite is also able to store up to 55% of its weight in water in its permeable pore space. This ability to store water maintains soil moisture for plant hydration in dry conditions or arid climates.

The following content highlights land application benefits for plants, soils, and the micro-organisms that provide nutrients for plant growth and vitality.

Plant growth

- Significant increase in root and shoot growth due to a higher level of mineralization in the soil and the moisture to deliver plant nutrients.
- Impressive initial growth with Zeolite combined with poultry manure is thought to be due to the increase in nitrifying micro-organisms in the rhizosphere.



Soil systems

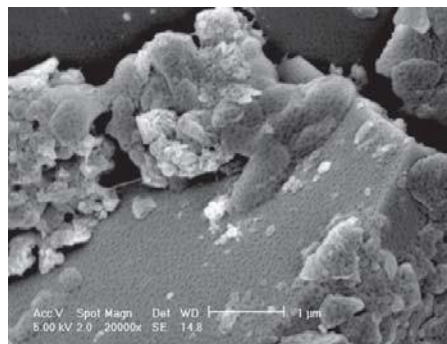
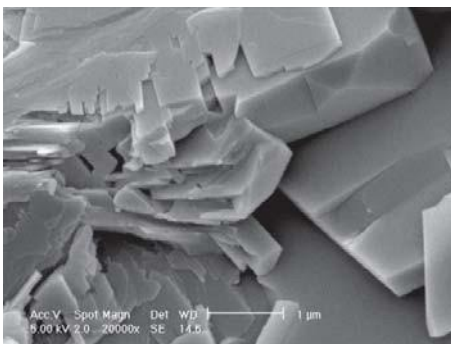
Greater runoff and groundwater contamination results from structure less soil lacking the capacity to hold water. Poor soil can result from repeat applications of nitrogen, phosphorus, potassium (NPK) fertilizers and failure to maintain soil organic matter (OM) with the addition of livestock waste, compost or digestate. In the latter situation, microbes have limited nutrient sources and rapidly decompose soil OM, resulting in soil that is unable to hold water.

Improved soil structure

- Moderate physical strength, lack of clay minerals, high pore space and permeability provide a material which promotes aeration to provide oxygen in soil.
- Moisture held in the Zeolite channel ways reduces the drying rate of soils.
- Soil improvements benefited plant growth the following season
- Fungal species decreased by half due to the proliferation of mycolitic bacteria
- Calcium exchanged from Zeolite acts as a buffer to reduce acidification

Supports micro-organisms beneficial to plants

- When added to moist soil, Zeolite in combination with a nitrogen source gradually exchanges held ammonium that is oxidized by nitrifying micro-organisms and significantly raises the level of microbes in the soil.
- Zeolite increases aeration for aerobic bacteria development.
- Provides a moist surface to support micro-organism colonization.



Left image:
Dry Zeolite surface

Right image:
Amended Zeolite from moist soil substrate shows clusters of densely packed micro-organisms with other granular particles.

CATION EXCHANGE

Reports indicate approximately 40 to 70 % nitrogen losses from applied fertilizers, which can leach directly to the water table and pollute aquifers. The High CEC (Cation Exchange Capacity) of Zeolite allows it to hold nitrogen (ammonium) from manure and fertilizer, reducing nitrogen losses.



Zeolite has two methods of holding fluids and plant nutrients:

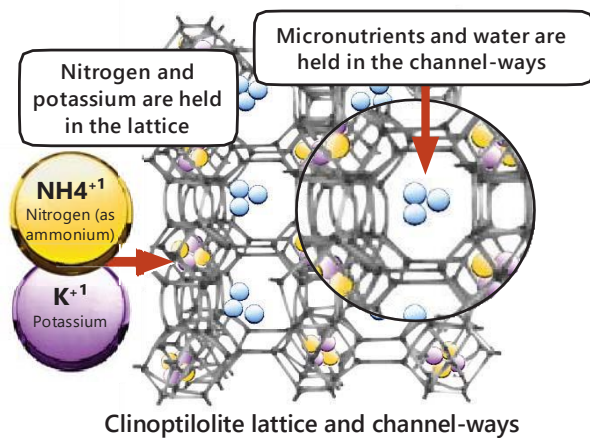
Absorption

Zeolite will absorb water or other liquids. Water and other plant nutrients that are held in this position are loosely held and are water soluble. Water permeates through the growth zone to the aquifer in sandy soils. The addition of Zeolite will hold the water in the growth zone.

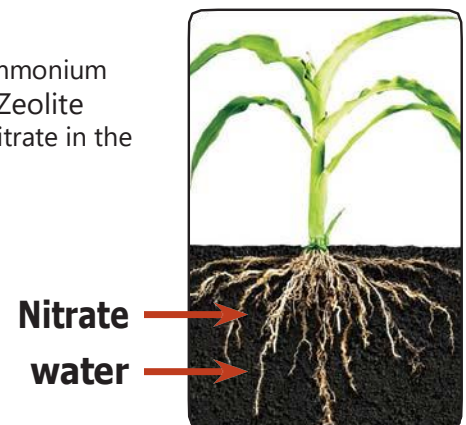
Adsorption

The second method is adsorption by cation exchange. Zeolite is a negatively charged cation exchange agent. As a result of its high cation exchange capacity, Zeolite is able to exchange various cations (ions with a positive charge) into its lattice depending on their molecular size, competing cations, and concentrations. During the cation exchange process, cations move from the Zeolite mineral lattice and are replaced by other cations, which are held in a non-water soluble state within the lattice.

Zeolite holds cations such as ammonium (nitrogen), potassium, calcium, and other plant nutrients. The cations and plant nutrients are held in the growth zone and are accessible to plants on a demand basis. The nitrogen held in this position will not burn the plant.



Micro-organisms oxidize ammonium (NH_4^+) exchanged from the Zeolite lattice to gradually deliver nitrate in the plant root zone.



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