Soil salinity adjuster - Root activator

Powered by BSM*

Free Root

* BSM: Beneficial Soil Microorganisms

Free Root is a liquid product especially designed to unblock root operation in degraded soils because of high Sodium ions (Na^+) concentration. **Free Root** is mainly applied in the following cases:

- ✓ In soils irrigated with high conductivity water, because of NaCl salt content.
- ✓ In soils with Sodium salts accumulation on the surface, because of constant irrigation with high conductivity water and evaporation of irrigation water
- ✓ In soils in regions affected by drought
- ✓ In soils of limited draining which are not sufficiently irrigated
- ✓ In cleared soils
- ✓ In soils that have been degraded because of imprudent fertilizers use

PROPERTIES

Free Root functions at many levels in order to allow the operation of root and, as a consequence, of plant under conditions of salinity stress.

<u>AT SOIL LEVEL</u>

- **It decreases the levels of toxic Sodium (Na^+) in the soil**
- **It accelerates the drainage rate of Sodium salts**
- **It improves the chemical structure of the soil**
- **It restores the natural microflora of the soil**
- **It increases the plasticity of the soil**
- **It facilitates water filtering and draining**

<u>AT PLANT LEVEL</u>

- **It decreases the ionic and osmotic stress caused by high salinity**
- **It allows the absorption, intake and transport of nutritional elements in plant tissues under conditions of high salinity**
- **It reduces deficiencies occurrence (especially of Nitrogen, Potassium and Calcium)**
- **It prevents plant cells senescence**
- **It increases the fotosynthetic capability of plants**
- **It enhances the proteinic synthesis and enzymes activity inside the plant cells**

Free Root is the outcome of systematic research conducted by R&D department of HUMOFERT SA in collaboration with the Agricultural University of Athens

Produced by

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What are saline and what sodic soils?

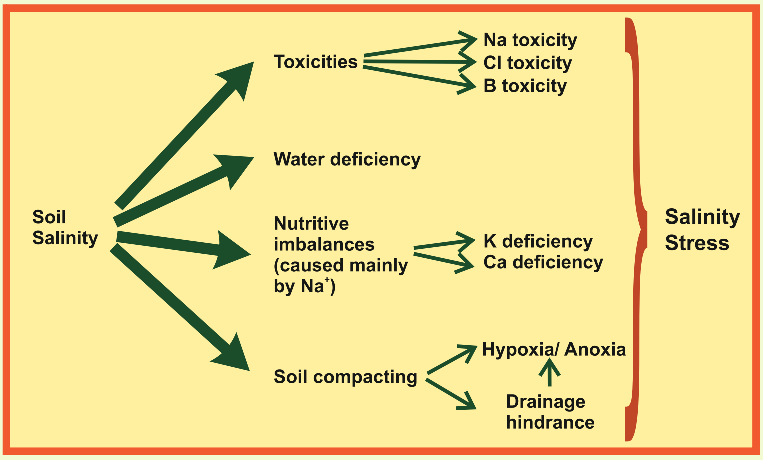
Saline soils are the soils which contain excessive levels of soluble salts. Soil salts consist of Na^{+}, Mg^{+2}, Ca^{+2}, SO_4^{-2} and HCO^{-3} ions as well as of lower quantities of NH_4^{+}, NO_3^{-} and CO_3^{-2} ions. Soluble salts accumulate along soil longitudinal section and particularly in the rhizosphere, but they may appear also on the ground surface in the form of a white superficial layer.

Sodic soils contain excessive levels of sodium Na^{+}. Moreover, there exist soils which combine the presence of excessive soluble salts levels with excessive sodium levels, identified as saline/sodic soils.

How are they formed?

Saline and sodic soils are created in regions with dry and hot climate, with low rainfalls and high temperatures. Due to these conditions, water evaporates from soil surface provoking the condensation of salts. The most significant salt sources in the soil are the parent minerals and rocks, the evapotranspiration of plants which is increased at the above mentioned sites, the infiltration of marine water into the soil through underground currents and tide waves, the atmospheric depositions of salts originating from marine water in coastal regions, the elevation of level of underground waters because of clearance, the irrigation water that usually in these regions is of bad quality, the fertilizers and the animal manure.

Which problems does high soil salinity provoke?



High salts concentration in the soil has undesirable effects both on plants health and on soil quality. It impedes plants growth and it accelerates their senescence and death, while it reduces soil fertility and it provokes nutrient deficiences, resulting finally in reduced yield. More precisely:

In plants

Particularly sensitive plant growth stages to salinity are emergence, vegetative stage and reproduction. The effects on plants which grow under salinity conditions are the following:

1. Soil solution osmotic potential is decreased because of salts accumulation. Consequently, water flow rate from soil to root is decreased. This provokes osmotic stress inside the plant and inability to absorb water, which finally cause water deficiency, with repercussions on growth and survival.
2. There appears competition among different ions and nutrition problems:
   - At the rizosphere, the Cl^{-} of soil solution competes with N and obstructs its absorption by the plant. At the same time, many nutrients become unavailable to the plant because its filtration capacity of the water where the nutrients are dissolved is decreased.

Simultaneously, on the root surface, high Na^+ concentration strongly hinders K^+ uptake.

- Inside the plant, salinity elicits K^+ ions outflow from the cells. K^+ has an essential role in maintening cellular vigor and keeping intact the cellular membrane as well as the activity of enzymes. Due to K^+ lack, the transport of malic acid from leaves to roots is hindered, leading to malnutrition of the plant, cessation of many biochemical processes and appearence of deficiences or imbalances of nutrients. As a consequence, the growth of both the above and the below ground parts of the plant is impeded, fruiting and flowers number is reduced, the size and the quality of fruits is degraded and the susceptibility of the plant to infections and abiotic stress factors is augmented.

  The accumulation of Na^+ in the plant cell influences nutrients uptake capacity by the plant and as a result deficiencies problems occur, e.g. in Fe and Mn. Na^+ ions hamper binding of Ca^{+2} ions to the plasma membrane of the cell, they impede its uptake and they increase its outflow from the plant cell, resulting in Ca^{+2} lack. Moreover, high salt concentration hinders considerably Ca^{+2} transportation from root to leaves.

3. Under salt stress conditions, hormonal balances of the plant are disrupted, causing damage to the cells and their organelles and leading finally to cellular death. Cytocinins transportation from roots to shoots and the recuperation of diffused auxins are hampered. The composition of Absisic acid, which triggers the overproduction of oxidative roots (reactive oxygen species: ROS), the peroxidation of lipids and finally the senescence of plant cells, is elicited.
4. There is a negative effect on photosynthetic procedures. As mentioned above, there takes place an inopportune composition of Absisic acid, which provokes the closure of stomata, resulting to obstruction of photosynthesis and proteinosynthesis and to reduction of enzymes activity.

At soil

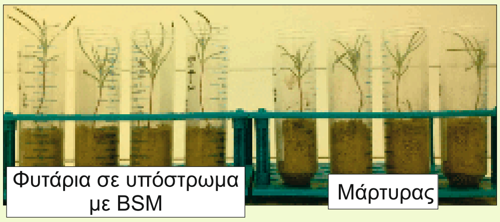
High salts concentration in the soil causes dispersal of soil particles hence structure collapse and loss of its plasticity. Moreover, it impedes water infiltration and drainage as well as air circulation, while high pH hinders nutrients availability to the plants. At the same time, rhizosphere microbial activity is impeded. Usually, in salinic soils a cohesive and impenetrable surface crust is created.

Are all cultures equally sensitive to salinity?

Not all cultures are equally sensitive to salinity. As a result, there are cultures which are:

- Sensitive: bean, carrot, onion, lettuce, strawberry, vine, citrus, fruit trees
- Moderately sensitive: pepper, tomato, cucumber, cauliflower, melon, potato, watermelon, rye, soya, maize, groundnut, turnip, rice, festuca
- Tolerant: courgette, cotton, wheat, barley, sugar beet, olive, pomegranate, fig

How do BSM (Beneficial Soil Microorganisms) contribute to salinity resistance;



BSM (Beneficial Soil Microorganisms) produce a variety of enzymes and fytormones which degrade the oxidative roots produced by the plant in case of salinity stress. They promote lateral roots growth in order to increase root surface and they decrease ethylene levels inside the plants, which causes growth reduction of roots and shoots. They also produce osmolytes, which act synergistically with plant osmolytes, ensuring osmotic adaptation. In addition, they elicit the resistance of the plant to biotic and abiotic stress factors, they excrete polysaccharides, which improve the physical, chemical and structural soil properties and they bind Na^+ ions, limiting salinity stress.

STANDARD ANALYSIS

Nitrogen (N)	0,1 %	Magnesium (MgO)	400 ppm	Manganese (Mn)	600 ppm
Phosphorus (P_2O_5)	0,5 %	Sulphur (S)	600 ppm	Copper (Cu)	100 ppm
Potassium (K_2O)	0,5 %	Iron (Fe)	800 ppm	Boron (B)	300 ppm
Calcium (CaO)	4,0 %	Zinc (Zn)	800 ppm	Molybdenum (Mo)	1 ppm

It contains Beneficial Soil Microorganisms

APPLICATION METHOD

Free Root is applied by root irrigation via irrigation/fertilization system or foliarly after being diluted in an appropriate quantity of water. The number of required applications and the dosage are determined by soil conditions, irrigation water conductivity, climatic conditions and fertilization of cultures.

DOSAGES-APPLICATION FREQUENCY

Applications by root irrigation

Greenhouse cultures (Tomato, Pepper, Aubergine, Cucumber, Courgette, Melon): 50-100 lt per hectare. Application every 7-10 days from planting until harvest.

Open field horticultural crops and vegetables: 10-40 lt per hectare. Application every 7-10 days from planting until harvest.

Strawberry: 100-200 lt per hectare. Application every 7-10 days from planting until harvest.

Ornamental: 50-100 lt per hectare. Application every 10-15 days.

Fruit cultures, Vines: 50-100 lt per hectare. Application every 7-10 days during irrigation period.

Citrus: 30-50 lt per hectare. Application every 7-10 days during irrigation period.

Foliar applications

Dilution rate 0,5 liter per 100 liters of water

Note: The above rates are applied when the conductivity of irrigation water is maximum 2 mS/cm, because of NaCl salt content. If the irrigation water conductivity is higher because of NaCl presence, then the application rate should be increased or applications should be performed more frequently. In any case, the conductivity of irrigation water should be checked at a regular basis and the application method should be approprietly adapted.