Effects of Sodium in Borax on Soils and Crops

- Sodium is found in all soils and crops.
- Soils in humid regions, where most boron (B) deficiencies occur, contain about 50-150 lbs./acre of sodium in the surface 6-inch layer, but soils in drier regions may contain higher levels of sodium.
- While borax contains some sodium, one lb. of B/acre as borax only supplies about 0.9 lbs. of sodium/acre.
- Application of boron at recommended rates would result in an application of only 1-2 lbs. of sodium/acre, which would not significantly affect soils and crops.

Sodium (Na) is found in all soils and crops. Sodium is present as a monovalent cation (Na^+) and is loosely held by the cation exchange complex in soil. Therefore, Na^+ is easily leached by water moving through the soil profile by rainfall or irrigation. Sodium is not considered to be an essential plant nutrient, but all crops contain some Na.

Sodium in Soils

The sodium content of the earth's crust is about 2.8%, which is similar to that of potassium (K), but soils generally contain 0.1 to 1.0% total Na, compared to about 0.8% total K. The lower Na content in soils is due to weathering of Na from Na-containing minerals with subsequent leaching from the soil profile due to rainfall or irrigation. While there is less exchangeable Na in soils of humid regions, Na is more common in most arid and semi-arid soils.

The main forms of Na found in soil are Na^+ in soil solution, readily exchangeable and tightly held, and in insoluble silicates. Soil solution contains from 0.5 to 5.0 ppm Na in most temperate region soils. Levels of exchangeable Na are about equal to those of exchangeable K in humid region soils, where most B deficiencies generally occur.

Sodium contained in borax applied to soils in humid regions usually will leach from the surface layer of soil (root zone) soon after application. Exchangeable Na may be higher in poorly drained soils of arid and semi-arid regions.

Soils are considered to be saline when the electrical conductivity (a measure of salt content) is greater than 4 mmhos/cm. Soil salinity is caused by an accumulation of soluble salts in soils due to poor drainage, or low rainfall coupled with high evapotranspiration.

Excessive levels of Na in soils (sodic soils) may cause dispersion of soil clays, reducing soil aggregation, permeability to air and water, seed germination and root growth. Soil dispersion may occur when exchangeable Na exceeds 15% of the cation exchange capacity (CEC) of soils.

Sodium in Plant Nutrition

While Na is not considered to be a plant nutrient, it is essential for halophytes, salt-loving plant species that accumulate salts to maintain their turgor and growth. Crops that require Na for optimum growth are: celery, spinach, sugar beet, Swiss chard, table beet, and turnip. Favorable effects of Na also are reported to occur in cabbage, kale, kohlrabi, radish and rapeseed. Increased growth produced by salt in the above crops is thought to be due to increased turgor (rigidity due to increased water in the plant cells).

Concentrations of Na range from 0.01 to 10% in leaf tissues. Sugar beet appears to be especially responsive to Na, which increases its resistance to drought. Some of the effects ascribed to Na also may be due to chloride (Cl^-) ions, because the usual source of Na in soils is NaCl.

Summary

While borax contains some Na, 1 lb. of B/acre as borax only supplies about 0.9 lbs. of Na/acre to soil. Application of borax at recommended B rates of 0.25 to 2.0 lbs./acre will result in an application of less than 2 lbs. of Na/acre. Because soils of humid regions (where most B deficiencies occur) may contain up to 150 lbs. of Na/acre, the application of low amounts of Na contained in borax will not significantly affect soils and crops. In addition, Na that is applied in borax may be readily leached from the root zone by rainfall and irrigation.

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