NUTRIENT AGRI PRODUCTS™
Micros that drive performance

Boron and its inter-reactions with plants

Historical facts of boron and its industrial use

Naturally occurring boron is extremely hard and is poorly absorbed. Crystalline boron is silvery black in color. Boron is mined industrially as evaporates such as borax and kernite. The largest deposits of boron are in Turkey. It is also being mined in California, Southwest US, Chile, and Bolivia. **Borax and boric acid are used in the fertilizer industry due to the ability of the plant to absorb these byproducts.** Borax or sodium borate is a mineral and salt of boric acid. Powdered borax is white in color.

Borax was first discovered in dry lake beds in Tibet. Its use became more widespread following the mining of the product in California and the brand development of 20 Mule Team Borax based on how they brought the product out of the mines of California. Borax is currently used in many different industries:

1. Component of many detergents, cosmetics, and enamel glazes.
2. Used in fire retardants
3. Used as anti-fungal compounds.
4. Involved in the manufacture of fiberglass.
5. Used as flux in metallurgy.
6. Used in neutron capture shields for radiation source.
7. Half of the boron use, is as an additive for insulation and structural materials, followed by use in polymers and ceramics.
8. Used as texturing agent in cooking.
9. Boric acid is an important insecticide.
10. **Essential nutrient for many plants.**

As more soil and plant tissue samples are taken, producers are finding that they need to add boron to their fertilizer mixes in order to fill the plants need for boron.

Boron is the most widespread micronutrient deficiency in plants. Soil levels of boron is insufficient or low when extractable boron is less than 0.1 lb./ acre. Calcium, potassium and nitrogen concentration in soil can affect boron availability and plant function. Calcium/boron ratio is most important as soils high in calcium which will require more boron supplementation while soils low in calcium will not require as much. High boron supplementation will also be needed in high clay soils, high organic material containing soils or soils high in water pH and low calcium content. Boron is in the soil solution in the form of weak disassociated boric acid (H_3BO_3). Anything that promotes microbial activity aids the release of boron. Many scientist feel that boron in the soil solution, flows into the plant roots with water in a process known as **mass flow** which is passive uptake vs **metabolic uptake** where the plant exerts energy to draw up the nutrient.

Plants showing boron deficiency have growing points which abort (pinching of the plant) which results in the branching of the plant, which can be distorted, thick and brittle. The upper foliage inhibits a mottled chloroses (scattered yellowing of leaves). Boron is an immobile element in plants. Once it is taken up by the plant, it will not be located elsewhere in the plant.

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Why is boron or borax important to plant growth?

1. Boron is needed in plants to build new cell walls.
2. Boron maintains a balance between sugars and starches in plant cells, then translocates sugars and starches throughout the plant.
3. Builds sugar and carbohydrates in leaves after photosynthesis and is one of the essential nutrients that move them throughout the plant all the way to the roots.
4. Involved in nitrogen metabolism and protein formation.
5. Boron helps manage water within the plant. Plants regulate water levels by opening and closing the guard cells of the stomata in the leaves. This is accomplished by pushing potassium into the guard cells to open them and pulling potassium out of the guard cells to close them.
6. Plays a role in helping plants imbibe water throughout the root system. Boron deficiency can be misdiagnosed as symptoms of drought.
7. Boron contributes to higher yield in early season application and is used as a bloom spray in avocados.

Boron availability declines in basic soils from 6.5-8.0 ph. These soils are where yield response are seen from boron.

How does a boron deficiency affect the growth of corn, soybeans or other key grains?

In corn, boron is involved in pollination. In plants grown on deficient soils, plants may have barren ears or blank stalks. They may have banana shaped ears in which kernels abort off of one side of the ear. The field may appear as if it went through drought. Boron is critical for corn to aid in the regulation of water.

In soybeans, look for shortened internodes on the roots. Leaves will be greener than normal. In severe deficiency, leaves will be cupped or curled downward with appears similar to growth regulator herbicide damage. Boron does not allow soybeans to successfully flower and set pods.

Alfalfa is highly responsive to boron supplementation but corn and soybean are not as responsive. The following is the suggested amount of borax to be added to these major crop groups:

Corn	6-20 ppm @ tassling time
Soybeans	25-60 ppm
Wheat	6 ppm-10 ppm
Alfalfa	25 ppm-80 p

Nutrient Ag Products in Papillion, Nebraska, has boron available with Product #

Boron 21% Water Soluble in 25# bags

11005 Boron 15% Maxi Granular in 50 # bags or 1500 # totes.

Give Nutrient Ag Products a call at 402 502 4824 for your boron needs.