# BORON, THE OVERLOOKED ESSENTIAL ELEMENT

by Dirk W. Muntean, Consultant
Soil and Plant Laboratory Inc. P.O Box 1648 Bellevue, WA 98009
Phone 425-746-6665---Fax 425-562-9531---Email---splabnw@flash.net

Of the mineral elements essential for plant growth, boron is frequently considered to have a minor role since it is used in relatively small quantities in plant metabolism. This, however, does not diminish the importance of maintaining adequate boron in Northwest landscape soils. All too often there is a tendency to concentrate on the big three mineral elements - nitrogen, phosphorus and potassium - while assuming that remaining minor element levels are adequate. Insufficient boron can lead to plant growth and development problems in landscape plants. Landscape soil preparation should therefore focus on establishing and maintaining optimum levels of all mineral elements, including boron, prior to planting either turf or ornamentals.

## Boron Background

The element boron is unique among the essential elements in that a narrow range in concentration can mean the difference between plant deficiency and plant toxicity. Whereas a fraction of one part per million may be required, a few parts per million may be toxic to plants. Boron is absorbed from the soil by plants as borate, a negatively charged ion (anion). Since boron is non-mobile in plants, a continuous supply from soil or planting media is required in all plant meristems. In mineral soils, release of boron is usually quite slow. Much of the available soil boron is held rather tightly by soil organic material. As organic matter decomposition occurs boron is released with a portion being absorbed by plants, leached below the root zone area (especially in high rainfall/acid soil areas) or tied up (unavailable) under alkaline soil conditions.

Most laboratories determine available boron status by measuring the concentration in a saturated soil paste extract. For the majority of landscape plants boron concentrations in the saturated soil paste extract between 0.15-0.5 parts per million are desired. Boron concentrations below 0.15 ppm usually indicate a need for adding supplemental boron. Depending on plant sensitivity boron can be toxic at soil test concentrations above one part per million!

## Boron Toxicity

Boron does not often occur in toxic quantities in most arable soils. Toxicities are normally associated with inland desert areas where native soil high in boron and low rainfall co-exist. Soils derived from marine sediment deposits can also be high in naturally occurring boron. Sometimes even west of the Cascades irrigation waters can contribute significant boron amounts to soils. Some fertilizers, like muriate of potash (potassium chloride) can contribute substantial amounts of boron to soils where they are used. Some animal manures can also add appreciable boron to soils where applied. When toxic levels are reached, excessive boron can cause off color and stunting of plant growth. As boron concentrations in plant tissue increase to toxic levels, older foliage may exhibit leaf edge burning or necrosis. Some plants will also develop black spots on older foliage.

High levels boron can only be removed from soils through the leaching action of water passing through and below the active plant root zone. It is at times necessary to treat high boron soils that are alkaline with soil-acidifying amendments like elemental sulfur prior to the leaching process. Infrequently, conditions may necessitate removal of high boron soil and replacement with an agriculturally suitable import soil.

## Boron Deficiency

Boron deficiencies are generally related to high rainfall areas and acid soil conditions common in soils west of the Cascades. Under acid soil conditions, boron is more water-soluble and can therefore be leached below the root-zones of plants by rainfall or irrigations. It has also been shown that symptoms of boron deficiency are associated with high soil pH values (alkaline conditions). Reduced boron solubility under alkaline soil conditions can result in less plant uptake and increased potential for boron deficiencies.

Boron is critical for the process of cell differentiation at all growing tips of plants (meristems) where cell division is active. Plants deficient in boron continue to undergo cell division in growing tips without differentiation of cells which would otherwise result in cells becoming stems, leaves, flowers, etc. As boron becomes deficient the vegetative growing point of the affected plant becomes stunted, deformed or altogether disappears. When this occurs, apical dominance of the growing point ceases to exert control over lateral shoot development. Thus, one may see a proliferation of side shoots resulting in a "witches broom" condition. Deformed flowers are a common symptom of boron deficiency. Many plants may respond by reduced flowering and improper pollination as well as thickened, curled, wilted and chlorotic new growth.

Once laboratory testing has confirmed deficient boron, corrective action can be taken. Common products used for supplementing boron are Laundry Borax (11%B) or Solubor (20%B). The amounts used to correct low boron are on the order of one-half to one ounce of boron fertilizer per 1000 square feet! Do not add boron unless soil test data indicate a need for it!

## Conclusions

Optimum plant growth response in landscape soils can be gained by making sure plants are provided a reasonable supply of all essential elements. With many soils west of the Cascades, conditions are conducive to low soil levels of boron. By including soil testing for boron, deficiencies or toxicities can be identified and corrected before or after planting. A little boron goes a long way in preventing deficiencies or creating toxicities.