**Boron in Agriculture**

Boron is an essential micronutrient for growth and development of healthy plants. Since the early 1920s, the importance of Boron has been demonstrated essential in plant production. In small concentrations boron compounds are used as micronutrients in fertilizers. It is considered possibly the most essential of the seven micronutrients offered.

**Borate Benefits – Micronutrient**

* Improved cell wall structure by movement of calcium
* Improved cell division at root tips, leaf and bud development
* Improved sugar transport rate via photosynthesis in root region
* Regulation of hormone levels in plant for growth and reproduction
* Meristem differentiation providing flowering and fruiting of plant

**Soil Factor**

Boron (B) deficiencies in crops are found mainly in soils with low organic matter content, and in acidic, sandy soils in humid regions. Boron availability to plants generally decreases with increasing soil pH, especially above pH 6.5. However, strongly acidic soils (soil pH less than 5.0) also tend to be low in available B due to B sorption to iron and aluminum oxide surfaces of soil minerals.

The most consistent responses, to B fertilization have been observed on coarse-textured soils with low organic matter content and on recently limed acidic soils over the whole range of soil textures. Though plants’ boron requirement is very low in amount, their growth and crop yielding are severely affected when there is boron deficiency in the soil.

Tillage and drought conditions should also be considered when assessing boron availability.

**Plant Factor**

Boron is an essential element for plant development, growth, crop yielding and seed development by helping the transfer of water and nutrition in plants.

It is essential in the balance between sugar and starch, and functions in the movement of sugar and carbohydrates.
• Valuable in pollination and seed production.
• Necessary for normal cell division, protein formation, and nitrogen metabolism.

**Main Types of Fertilizer Application**

* Dry Bulk Blending
* Liquid Suspension
* Clear Liquid Fertilizer

**Application Methods**

The three main application methods include broadcast, banding and foliar applications.

In the broadcast application are given to the soil directly in the solid form and dissolved in humid conditions as Boron is taken up by the plants’ roots.

Another application technique is foliar application method, borates are sprayed over the leaves since some plants intake better through their leaves. In some cases spraying is a better way of fertilizing particularly if the season for dry bulk blend broadcast has expired.

The amount of boron used in the soil as fertilizer varies according to application, rain, soiling liming, organic matter and more importantly plant type.

Still other methods of liquid application include fertigation which involves both field and drip irrigation systems. It is critical to have a careful concentration in a nurse tank that will provide consistent rates.

**Boron Deficiency Diagnosis**

The two methods of diagnosis are either soil or leaf tissue analysis. Generally speaking ways to determine boron deficiency from visual inspection of the plant includes:

* Cracks in fruit, stems and petioles
* Growing points that appear to be dying off
* Irregular fruit shape
* Shorten stems
* Stunted root growth
* Thick and miss-shaped leaves

It is important to check with your local Agricultural extension agent to determine boron deficiency in field, fruit and vegetable crops. Leaf tissue analysis should be taken from the second oldest leaf near the apical meristem. This will provide a basis for proper application rates.

**Borate Profile**

**Refined**

Refined sodium borates (Borax 10 Mol & Etibor 48) can be used directly applied on the soil or by spraying onto plants successfully because of their good solubility. However, concern should be given to the particle size offered for dry bulk blended material due to potential particle size segregation in the blend. (See below)

Boric acid is another good source for boron and is often used in clear liquid boron-based foliar fertilizers.

Disodium octaborate tetrahydrate (Etidot® 67) which is specially made for agricultural applications is one of the more preferred agricultural boron products since it has a higher solubility compared to the aforementioned conventional refined and mineral boron products. It is used in clear liquid spray when dissolved properly.

**Mineral**

Colemanite, which is a naturally occurring calcium borate, is used especially in sandy soils because of its low solubility and it remains in soil longer than refined sodium borates.

Ulexite is yet another naturally occurring sodium-calcium borate and also is slow releasing borate compound that can offer a good source of boron versus refined borates.

It has been reported that mineral borates have been used in liquid applications.

**Borate Mesh Size**

Based on their current mesh size both refined and mineral borates will not work well in a dry bulk blending operation. Their mesh size can result in particle segregation in these types of fertilizers. Those looking to use borates in this form of dry fertilizer will need to granulate the borate to a larger mesh size using a pan granulator or some other method to insure a good size guide analysis and crushing strength.

It is suggested if the customer is looking for a more granular borate they should seek others who are well versed in this technology. See links below for possible further help.

**American Borate Company** **Products:**

**Refined**

Borax 10 Mol, Etibor 48 (Borax 5 Mol), Boric acid, Etidot 67 (Disodium octaborate tetrahydrate)

**Mineral**

Ulexite, Colemanite

**Investigate these potentially helpful links**

Links: The Fertilizer Institute: <http://www.tfi.org/>

 International Plant Nutrition Institute: <http://www.ipni.net/>