

Trends in global micronutrient consumption

# Boron PhD:

## advancing understanding of boron to a higher Level

*Modern global farming challenges require precision, performance, and results from micronutrients*

by Jordi Bru, **Director, Global Market Development – Agriculture, Rio Tinto Borates**

**In the 21st century, technology provides high-speed access to information about every topic and in every industry. People are learning to approach everything we do with more precise information and advanced methods. This evolution is especially true in agriculture. As agronomists and farmers tackle critical global issues - ranging from soil conservation to increasing yields to feeding growing populations - they increasingly rely on advanced knowledge to inform their solutions.**

At the core of many of these central issues is the way that agriculture professionals approach crop

nutrition and fertilization. The right blend of nutrients - including the essential micronutrient boron - can help farmers create healthy soil that provides improved yields and better crops overall. However, understanding of how to choose the right boron source - and how to tailor boron application for different crops, regions, and soils - is still at a basic level for many farmers. Market experts must continue to drive deeper understanding of the importance of micronutrients.

Let's take a look at how we can offer advanced education about boron in our markets.

soluble element. So, for example, an area with sandy, acidic soil that has not recently had a soluble boron application is likely to be susceptible to boron deficiency—especially if that location experiences high rainfall.

Likewise, if the cultivated crop is one that has a high boron demand, production will be affected if the proper level of boron is not available to the plants. Lack of boron results in a variety of symptoms including misshapen, thick, small, brittle leaves (typically affecting the youngest leaves first); short, shrunken stems and stunted or reduced growth points; cracked or watery tissue or fruit; and malformed or irregular fruit or kernels.

Naturally, such symptoms can be devastating to the yield and profitability of a crop. And if not corrected, boron deficiency remains an ongoing problem.

### Getting a grip on boron deficiency

Just as with all fertilizer and supplementation considerations, identification of boron deficiency in soils is never a one-size-fits-all proposition. A proper analysis of boron in both soil and plant tissue is key to helping farmers create a tailored solution that incorporates the right level of boron in their fertilizer mixes.

That said, identification of boron deficiency usually starts with general knowledge of regional soil characteristics. Boron is a water-

### Market shift: boron knowledge is growing

The boron market has grown significantly over the past 12 years thanks to the exceptional work of agricultural experts in the market (agronomists, technical consultants, official institutions, the scientific community, and organizations



Comparison of healthy and boron-deficient fruit

such as Argus and Rio Tinto Borates distributors and fertilizer partner companies). These experts are in the field every year, explaining the importance of boron for crops and recommending balanced nutrition solutions.

However, knowledge of how boron supports crop health is still building in many developing countries. There is an awareness of the fact that boron is important, but in this case, a little knowledge can be a dangerous thing. As farmers begin to identify signs of boron deficiency, they may reflexively seek to solve the problem quickly, with the least expensive material available. However, a low-quality boron supplement (such as raw mineral borates) can be ineffective—or even worse than no supplement at all. Issues that experts may see when working with farmers using raw mineral borates include:

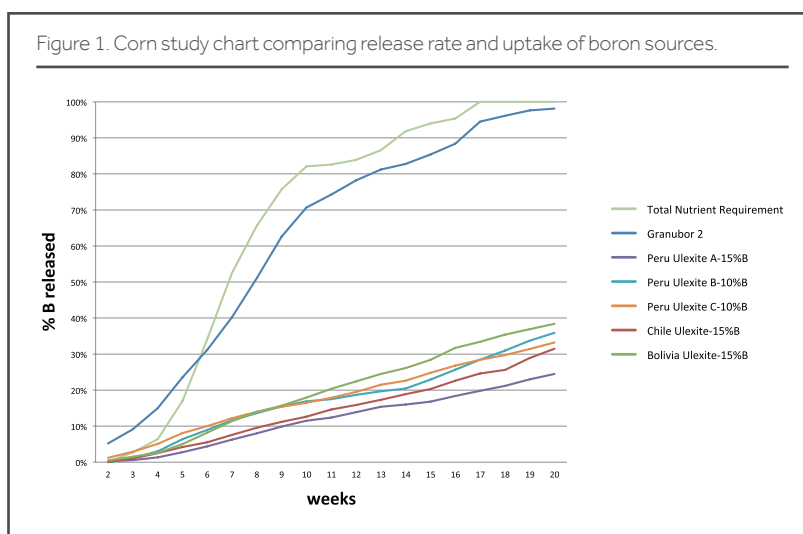
- **Low solubility** - Borate minerals that are only partially soluble provide only patchy coverage and do not allow effective uptake by plants.
- **Introduction of impurities** - Unrefined mineral borates can contain highly undesirable impurities including measurable amounts of arsenic and barium.
- **Ineffective levels of available boron** - Fertilizers with lower-than-recommended levels of boron will not meet the requirements of the crop.
- **Segregation within the fertilizer mix** - Industrial boron in crystalline or powder form blended with granulated fertilizers creates a mixture with high segregation, risking over-supplementation in some parts of a field and under-supplementation in other areas.

Conversely, a high-quality refined boron supplement eliminates these issues and actually provides a significantly better end result. Although some farmers may be concerned with upfront cost of a refined product, numerous field studies have demonstrated the cost effectiveness of using smaller quantities of high-quality boron to achieving better crop quality and yield.

Table 1. Sources of boron: Granubor 2 vs. Raw minerals

	Granubor 2	Minerals
<b>% B average</b>	15.20%	Inconsistent B levels
<b>Particle Size</b>	Average size: 2.4mm (4.75mm to 1.40mm, 95% retained guaranteed)	Average size: 1.4mm [4.75 mm to 1.40mm, 85% typical with up to 15% <1.40mm (dust)]
<b>Water solubility</b>	100% soluble	Incomplete dissolution
<b>Research</b>	>15 years of worldwide field tests and research	Limited field tests
<b>Purity</b>	No added ingredients, filters, or coatings	Can contain high levels of arsenic, aluminum, and barium

Figure 1. Corn study chart comparing release rate and uptake of boron sources.



### A modern approach to boron application and dosing

When farmers measure success in terms of improved yield and higher profits, it's natural that they should demand the highest performance from fertilizers. As experts with the backing of research and field experience, it's the responsibility of all of us—fertilizer producers, distributors, agronomists, and raw material providers—to advance education about micronutrients such as boron.

To help simplify information about proper boron use for farmers, it's important to address three key questions:

1. Is the boron contained in the fertilizer from a 100% water-soluble source (sodium borate)?
2. Is the dosage recommended enough to protect the crop?

- a. Which kind of crop?
- b. What type of soil?

3. Are we using the right product and the right type of application?
  - a. Blending requires compacted boron with the right granulometry.
  - b. NPK +B compounded mixes need crystalline natural sodium borate.
  - c. Foliar applications demand highly soluble natural borates or liquid formulations, with solvents or without.

### Evaluating boron products for soil applications

It is important to highlight the word "soluble." Please, don't spend time and money applying boron that is not 100% water soluble. Research has proven that borate salts in the form of sodium borate are ideal for correcting

boron deficiency, and 100% soluble boron will be released gradually over the growing season when applied in compacted form (such as *Granubor 2*), thus meeting the ongoing needs of the crop. In addition, boron in compacted form has the right granulometry to be blended with other fertilizer raw materials in granulated form. The resulting blended fertilizer product will deliver targeted performance.

When farmers are considering a boron product to incorporate into an NPK fertilizer, they also need to be sure the boron used in the formulation is highly soluble and delivers a consistently measurable concentration of the micronutrient (as with *Fertibor*). Then, depending on the quantity of fertilizer per hectare and the requirement of the crop, it is possible to accurately determine the right amount of boron to incorporate. A typical recommended dosage is between 1-3 Kg B/Hectare. If after the calculation the amount of boron is below 1 Kg B/Hectare, the farmer may consider using another NPK fertilizer containing higher levels of boron. Many formulations with different levels of boron are available, but for soil application, the typical concentrations are between 0.1-1% B.

### Evaluating boron products for foliar applications

Boron application through a foliar spray treatment has the advantage of convenience (farmers can mix the product with crop-protection products) and timely application (farmers can spray at the most sensitive moment, when a crop's boron requirement is highest). Liquid formulations are also easy to handle. Those that are produced with chemical solvents are quite popular in some countries. The liquid formulations coexist in the market with natural sodium borates in powder form that offer high solubility and high efficiency.

For foliar application, very highly soluble boron is required. In the market, there are natural sodium borates (such as *Solubor*) that contain a consistent chemical formula for



Granular, refined boron

delivering boron through the leaves of the plant. You can even find micro-granular natural sodium borates (such as the dry *Solubor Flow*) with easy handling properties. More recently, liquid products in suspension have been introduced. These products are formulated without solvents and propose a new, more environmentally friendly solution.

Liquids and naturally soluble powder products used in foliar applications are good solutions to complement boron correction after a soil application or to prevent boron deficiencies in crops. Farmers have the ability to choose products that best suit their preferences and crop needs. The recommendation is always to check the soluble boron content of each product before the application and ensure that 0.5 Kg B/Hectare is applied in each foliar treatment. (Depending on the crop, the dosage can differ.)

### Providing leadership with precision and expertise

Farmer and consumers are demanding more from fertilizers, looking for solutions that are as natural as possible, free from impurities, and soluble and efficient to ensure good results. Food security and environmental challenges are not minor issues and our industry should

make every effort to satisfy these demands.

Boron is a key part of the solutions we offer, and it's important to help increase understanding of how this micronutrient provides macro-benefits for all types of agricultural applications.

Fertilizer producers and distributors should partner with boron suppliers that have the right experience and knowledge to help them in designing and producing the best solution to prevent and correct a boron deficiency. ■

**Rio Tinto Borates (U.S. Borax)** is a global supplier of refined borates for agriculture. Our OMRI-certified products include Granubor® 2, a high-quality granulated borate manufactured for bulk blenders; Fertibor®, a fine crystalline borate ideal for NPK compound fertilizers; and Solubor®, a concentrated, water-soluble powder designed for use in foliar sprays or fertigation. Since 1940, we have conducted more trials globally than any other boron supplier. U.S. Borax mines, refines, and ships from its operations in Boron, California, about 90 miles east of Los Angeles, to customers in 100 countries. Learn more at [www.agriculture.borax.com](http://www.agriculture.borax.com)