Nutra-Boost®

by AGRIGUARDIAN

Nutrients for All Crops

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AGRIGUARDIAN™

AgriGuardian™ is dedicated to helping growers to be more successful. The company was founded in 2005 by Dr. David Sasseville, who has decades of field and research experience in plant nutrition in over 30 countries. In partnership with Casey Staloch, AgriGuardian™ works with growers across North America and internationally. The AgriGuardian™ team desires to help growers achieve maximum return on their investment, while sustaining agricultural soils. To achieve this, AgriGuardian Nutra-Boost® and other AgriGuardian™ products are designed to meet the nutritional needs of all crops. In addition to soil and foliar application, these products also incorporate seed treatments, beneficial microbiology, natural growth promoting compounds and defense mechanisms.

What is Nutra-Boost®?

AgriGuardian Nutra-Boost® is a proprietary formulated blend of soluble potassium, magnesium and sulfur. These are all essential plant nutrients required by all plants and crops to complete their life cycles. Nutra-Boost® is readily absorbed through plant leaves, shoots, roots and reproductive structures. When properly used it promotes greater crop health and higher yields whenever any of these nutrients are limiting crop performance.

Why use Nutra-Boost®?

Nutrient deficiencies of potassium, magnesium and sulfur are much more common that would be anticipated based on soil test results of agricultural soils. Many factors in the soil interfere with the availability and uptake of these essential nutrients by plant roots. During times of rapid plant growth, when these nutrients are needed the most, the plant cannot take up enough of these nutrients to keep up with the plant's needs. This results in poorer growth and yields.

Nutra-Boost® is an effective way to ensure that crops have adequate levels of these nutrients to meet their needs, especially during periods of peak demand by the crop. Nutra-Boost® is easy to use and cost effective. Foliar application rates of one (1) gallon per acre of Nutra-Boost® are typically enough to satisfy the nutritional needs of most crops. Nutra-Boost® is highly efficient and the quantity needed is much less than traditional soil applied fertilizers. With the three nutrients applied together, there is also a synergy among these nutrients that has a greater impact than when applied individually.

GUARANTEED ANALYSIS

Soluble Potash (K_2O) 6.0%
Magnesium 3.0%
Sulfur 6.0%

DERIVED FROM: Potassium magnesium thiosulfate and magnesium acetate.

How to use Nutra-Boost®

The nutrients in Nutra-Boost® are formulated for rapid absorption by the crop, making the nutrients immediately available for plant use. Nutra-Boost® can be applied many ways to crops:

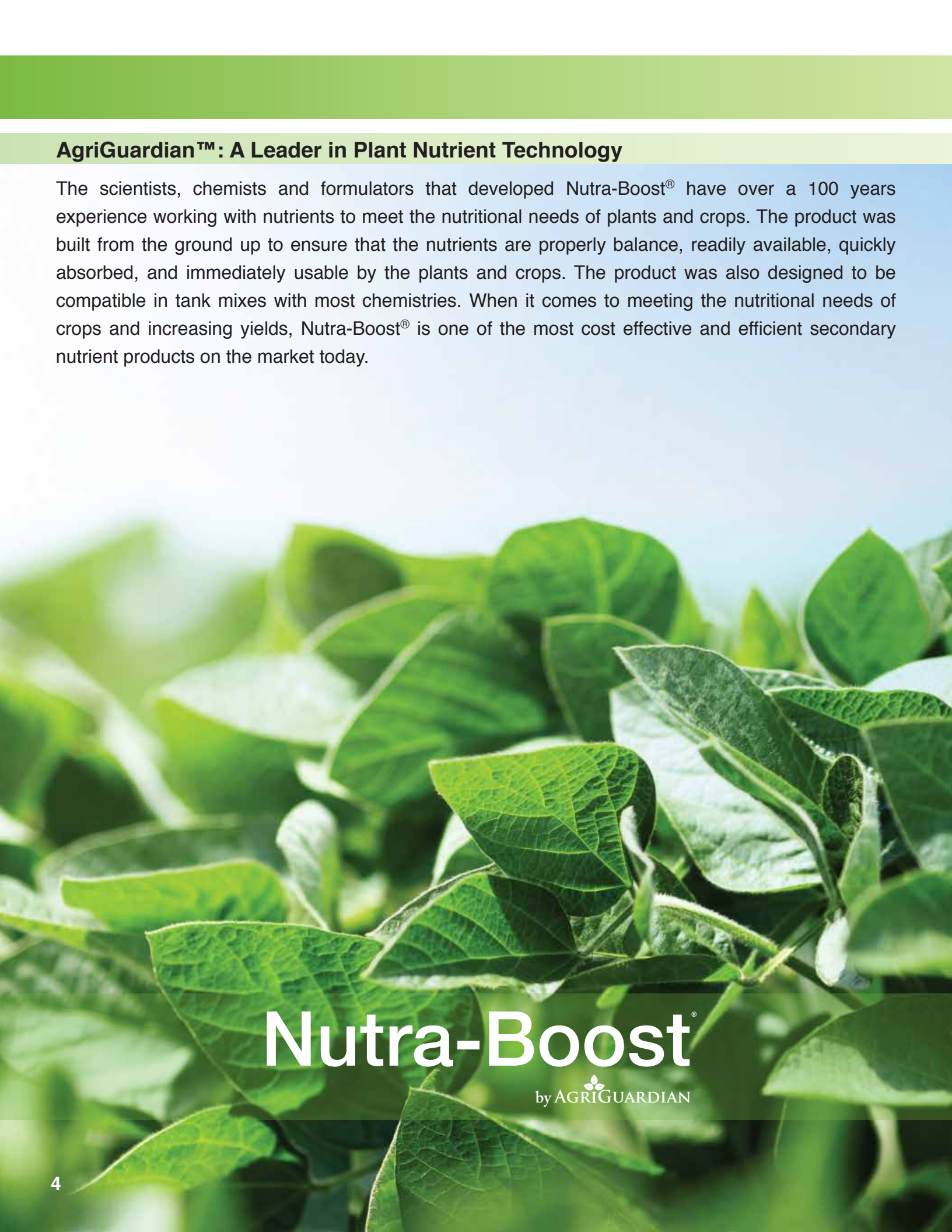
- **Foliar Spray**, used alone or tank mixed with most other fertilizers and pesticides.

- **Irrigation Systems**, used alone or mixed with most other fertilizers and pesticides.

- **Nutrient Solutions** for hydroponics and greenhouse house production, used alone or mixed with most other fertilizers and chemicals.

AgriGuardian™: A Leader in Plant Nutrient Technology

The scientists, chemists and formulators that developed Nutra-Boost® have over a 100 years experience working with nutrients to meet the nutritional needs of plants and crops. The product was built from the ground up to ensure that the nutrients are properly balance, readily available, quickly absorbed, and immediately usable by the plants and crops. The product was also designed to be compatible in tank mixes with most chemistries. When it comes to meeting the nutritional needs of crops and increasing yields, Nutra-Boost® is one of the most cost effective and efficient secondary nutrient products on the market today.

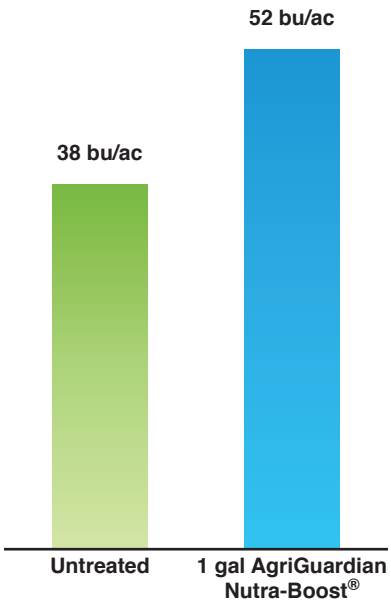


Need for Nutrients in Crops

Potassium, magnesium and sulfur are required by all crops to grow properly, produce high yields and quality products. Deficiency of these nutrients is becoming more common in agricultural soils, especially sulfur. Because of the interrelationship of these nutrients, supplying the nutrients together gives a greater a benefit to the crop, than when these nutrients are applied separately.

AgriGuardian Nutra-Boost® on Late Season Soybean Yields in Missouri.

Late season soybean planted in Central Missouri following wheat tested low in potassium. One gallon of AgriGuardian Nutra-Boost® was foliarly applied during early pod development (R2). *Data by grower in Jefferson City, Missouri.*



Potassium

Potassium, also known as potash, is routinely applied as part of an N-P-K fertilization program. However, even when soil tests indicate that adequate potassium is available in the soil, the plant often cannot take up the nutrient fast enough to keep up with the needs of the crop. This most frequently occurs during peak demand periods such as during early rapid vegetative growth of crops, and during grain fill and rapid fruit growth. When potassium is limiting in the crop, its rapid early growth is slowed, and yield potential cannot be achieved.

Magnesium

Magnesium is present in most soils, but not necessarily in adequate amounts to meet a crop's needs. Magnesium also has a dynamic relationship with calcium. In high calcium soils, calcium suppresses magnesium uptake. This is why soil laboratories often include Ca:Mg ratio in their reports. When soils are high in calcium, soil application of magnesium is often ineffective. Foliar application of magnesium is a much more efficient means of applying magnesium to a growing crop.

Sulfur

Crops can get sulfur from both the soil and air. With environmental efforts to reduce "acid rain", which contains sulfur, sulfur deficiency has become a greater concern in crops. Soils often do not contain adequate available sulfur, especially sandy soils, soils high in calcium, high pH soils and soils low in organic matter. Also, sulfate is the primary form of sulfur in soils that is used by plants. Sulfate is leachable. Sandy soils and heavy rainfall or irrigation can result in sulfate being leached from the soil. Foliar application of sulfur is an effective way of meeting a crop's sulfur needs, especially with these soil conditions.

The nutrients in Nutra-Boost® play several important roles that benefit the harvested crop. When Nutra-Boost® is used, soybean growers routinely report increased yields, earlier maturity, pods filled out more completely and larger seed size.

Important Roles of Nutrients in Crops

• **Water and nutrient uptake from soil** – potassium regulates water uptake into the plant, influencing the uptake of nutrients from the soil. Low potassium in the plant can worsen the effects of drought conditions and low soil nutrient levels.

• **Movement of carbohydrates and nutrients within plant** – potassium and magnesium regulate the movement of carbohydrates and nutrients from roots, stems and leaves into fruit and seed (grain), which is responsible for both the quantity and quality of yields.

• **Photosynthesis** – magnesium is the center atom of the chlorophyll molecule that carries on photosynthesis. Without magnesium, photosynthesis does not take place, thus reducing the quantity of carbohydrates available to support growth and higher yields.

• **Amino acids and enzymes** – sulfur is an essential part of two essential amino acids, and is involved with formation of several enzymes that influence plant growth. Both potassium and magnesium are involved with the formation, activation and activity of numerous plant enzymes.

Soil Conditions Limiting Nutrient Uptake

• **Acidic or low pH soils** - nutrients in Nutra-Boost® are less available for plant uptake when soil pH is low.

• **Alkaline or high pH soils** - magnesium is less available for plant uptake when soil pH is high.

• **Sandy or highly leachable soils** - nutrients in Nutra-Boost® can be leached out from soils, especially soils with low cation exchange capacity.

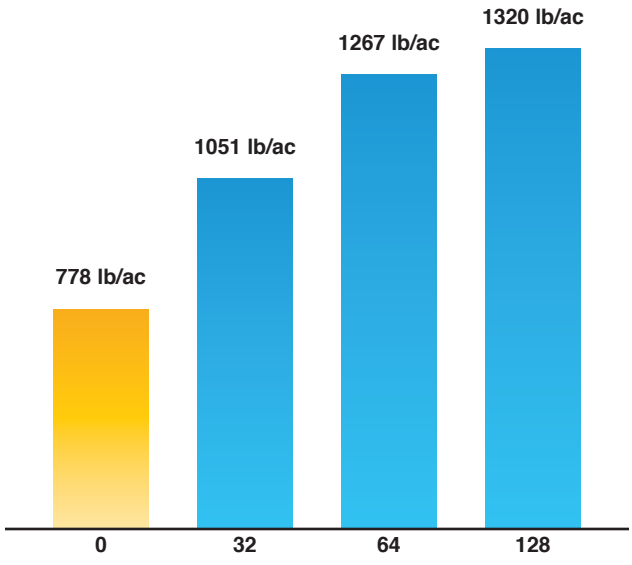
• **Soils with high rainfall** - increases leaching of these nutrients, especially in sandy soils or in soils with low cation exchange capacity.

• **Soils high in calcium** - competes with and suppresses uptake of magnesium and potassium.

• **Soils low in organic matter** - fewer of these nutrients to be mineralized and made available to crop.

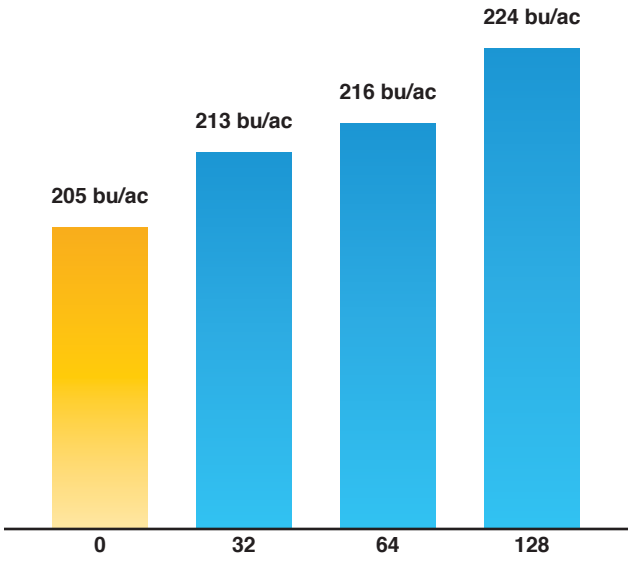
AgriGuardian Nutra-Boost® on Cotton Yield in California

AgriGuardian Nutrat-Boost® was foliar applied to young plant and again at first square. *Data by University of California Researcher.*

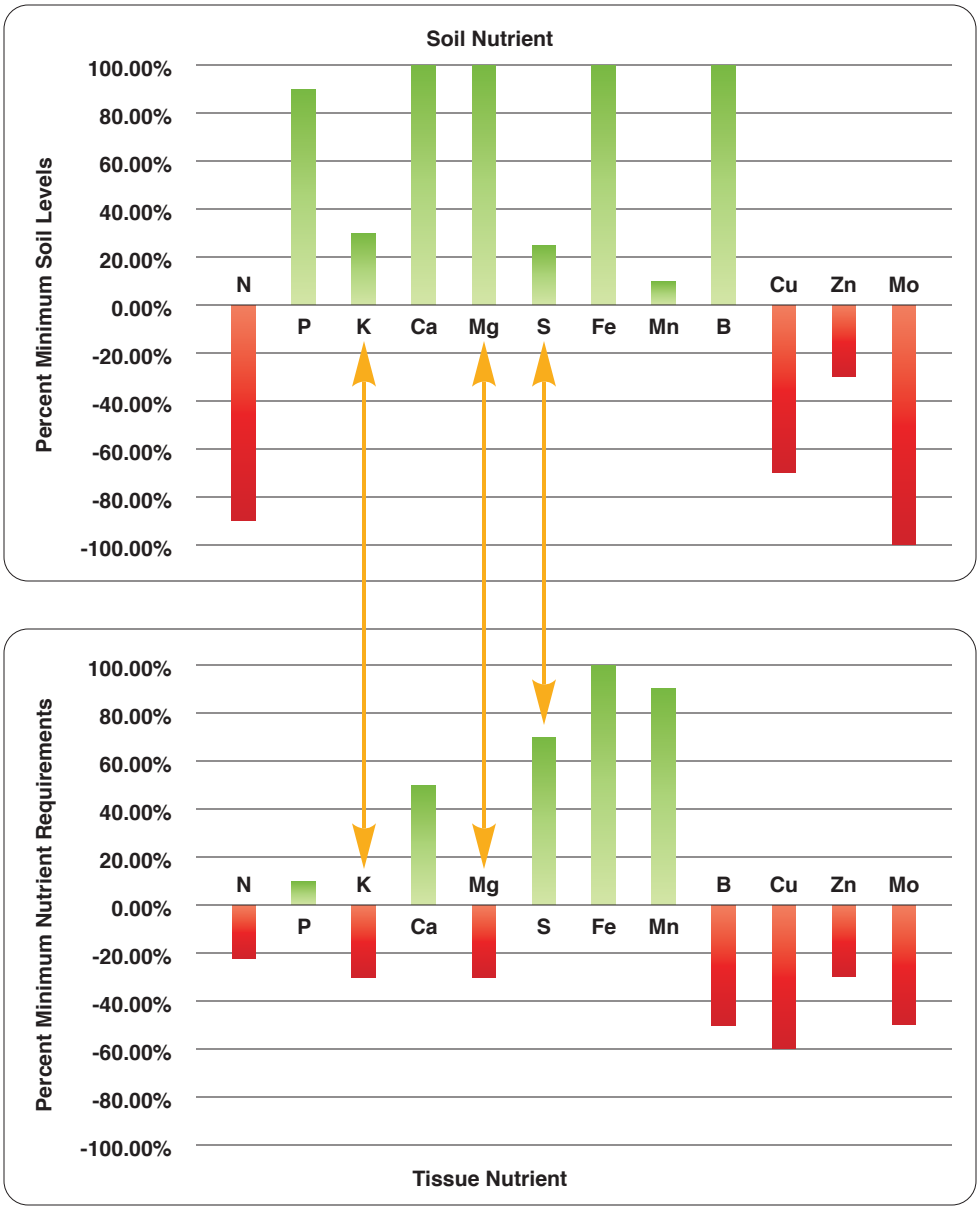


AgriGuardian Nutra-Boost® on Corn Yield in Georgia

AgriGuardian Nutrat-Boost® was foliar applied at V5 and again at pre-tassel. *Data by University of Georgia Researcher.*



Soil tests alone are not good indicators of uptake of K, Mg and S by crops. Examples of actual soil and tissue tests taken at the same time from a soybean field at flowering (R1-R2) in Iowa. Bar chart show relative amounts of nutrients in the soil and plants. These results are without the use of foliar applied nutrients. Nutra-Boost® is an effective way to ensure that crops have adequate K. Mg and S in the tissue.



Note: In addition to K, Mg and S, whenever micronutrients are low in the tissue and soil, as is shown in the above example, use AgriGuardian MicroMix Complete™ as an efficient and cost effective means to get essential and beneficial micronutrients into the crop.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Benefits

When potassium, magnesium and sulfur are deficient in crops, Nutra-Boost® can be beneficial to every crop grown. Here are some of the ways that Nutra-Boost® can increase yields and crop performance.

Needed by All Crops

• Potassium, magnesium and sulfur are essential plant nutrients, required by every crop.

• Improves fruit and seed (grain) quantity and quality.

• Improves water uptake and utilization.

• Increases photosynthesis (keeps plants greener longer).

• Increase carbohydrate production and utilization.

• Increases efficiency of soil nutrients.

• Increases protein content of crops, including wheat and other small grains.

• Increases overall growth and yields of all crops.

Improves Plant Health and Quality

• Improves fruit and seed quality.

• Offsets the negative effects of high nitrogen levels on fruit and seed quality.

• Increases the size and quality of seed, such as kernels of corn or the size and number of spikes in wheat and other small grains.

• Increases the size and quality of fruit crops, such as peaches and tomatoes.

Application and Uptake

• Provides potassium, magnesium and sulfur that are rapidly taken up through leaves, stems and roots to quickly correct deficiencies and to enhance growth and yield.

• Can be applied as a foliar application, through irrigation systems, in starter solutions, either alone or mixed with most other fertilizers and chemicals.

• Foliar application bypasses soil conditions that reduce uptake of these nutrients (e.g. high pH, high calcium, leaching, or when roots have been damaged by diseases, nematodes, insects or mechanical injury).

Use with Other Products

• Tank mix compatible with most fertilizers and chemicals.

Nutra-Boost® helps to increase the size of spikes in wheat, including the number and size of grains, and helps improve overall quality and yield.


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The Science Behind AgriGuardian Nutra-Boost®

The nutrients in Nutra-Boost® play many roles in plants that impact the way a plant grows and the quantity and quality of yields produced. Below are some of the roles that these nutrients play in crop performance, and why the use of Nutra-Boost® can be beneficial to most crops.

Potassium

The uptake of potassium (K) by roots is reduced by high concentrations of NH_4^+, Ca^{+2}, Mg^{+2}, Na^+ and H^+ (low pH). Most agricultural soils are low in potassium for good plant growth. Even when potassium is applied to the soil as a fertilizer, it is often not available to the crop because of the soil conditions, including drought conditions. Foliar applications of potassium in a form that the plant can easily absorb can bypass these soil conditions and provide adequate potassium to meet the needs of crops.

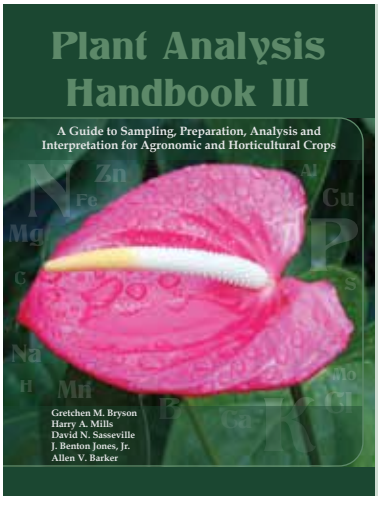
Potassium plays a role in many enzymatic reactions in the plant, both as an activator of the enzymes, and regulating the pH within the cell. The enzyme that forms the energy-carrying compound, adenosine triphosphate (ATP) requires potassium. ATP provides the energy used by all plant cells for growth and reproduction. Potassium is also required by separate enzyme that releases this energy for the plants to actually use. Potassium plays a role in the formation of enzymes, such as nitrate reductase, the enzyme that converts nitrate (NO_3^-) into ammonium inside the plant. Consequently, potassium plays a role in nitrogen utilization in crops.

One of the most important roles of potassium is the control of the gas exchange through the stomata (small openings in the leaves) where transpiration occurs and carbon dioxide (CO_2) is taken up. Potassium deficiency in crops reduces the uptake of CO_2 and limits photosynthesis.

Another important role of potassium is the regulation of water and nutrient movement from the roots to leaves. As water vapor evaporates from the stomata, water is pulled up from the roots by capillary action. This water contains essential plant nutrients such as calcium and boron, among others. Potassium also regulates the movement of water and nutrients into cells increasing cellular turgor, cell size and leaf area. Without adequate potassium, cell elongation stimulated by growth regulators (such indoleacetic acid (IAA)) slows and stops. This is required for cell division, which leads to growth.

Potassium plays a major role in the accumulation and movement of carbohydrates, especially sugars, within the plant. For example, soybeans with good potassium levels are capable of greater nitrogen fixation because more carbohydrates are moved to the nodules to support rhizobium bacteria living in the nodules. Similarly, potassium is required to increase the size and test weight of seed and grains. It also increases the quality of fruit crops, including higher sugar content, and offsets the negative effects of excessive nitrogen fertilization.

Crops that are low in potassium are more susceptible to plant stresses. These include drought, temperature extremes, salt and nutrient toxicities, high wind damage, pest and diseases pressure. Foliar applied potassium that the plant can readily absorb and use helps to alleviate many of these stresses and improves crop performance.



To learn more about micronutrients and plant nutrition, obtain a copy of their book *Plant Analysis Handbook III* from your AgriGuardian™ distributor.

Magnesium

The uptake of magnesium by roots is reduced by high concentrations of K^+, NH_4^+, Ca^{+2}, Mn^{+2} and H^+ (low pH). Because of this, magnesium deficiency is widespread in agricultural soils. Foliar applications of magnesium in forms that are readily absorbed bypass these soil conditions to get sufficient magnesium into the plant.

A major function of magnesium is that it is the center atom of the chlorophyll molecule, where photosynthesis takes place. Without magnesium, photosynthesis is not possible. When magnesium is deficient, chlorophyll breaks down in older cells, and is not formed in new cells, causing chlorosis (yellowing of the leaves) throughout the whole plant, but typically appearing first in the older leaves.

Magnesium also acts as a catalyst and activator of numerous enzymes, including an essential role in the formation of all proteins within the plant. Magnesium is also required for the conversion of ammonium (NH_4^+) into protein. Thus it has direct influence on many metabolic processes within the plant.

Magnesium is involved in the regulation of the pH and cation-anion balance within the plant's cells. When not needed by the active portion of plant's cells, excess magnesium is stored in the vacuole (a small bag-like structure inside each cell), and is moved in and out of the vacuole as needed to help regulate cellular pH, cation-anion balance and turgor pressure within individual plant's cells. This balance between magnesium with other cations, especially potassium and calcium, is needed to keep photosynthesis and other processes functioning properly.

Magnesium, similar to potassium, is required for the formation of the energy-carrying compound, adenosine triphosphate (ATP). ATP provides the energy used by all plant cells for growth and reproduction. High calcium inside cells inhibits the formation of ATP.

Magnesium, similar to potassium, is also involved with the transport of carbohydrates from leaves to other parts of plants. When magnesium is deficient, growth in roots, shoots and/or reproductive structures (such as soybean pods) are reduced because of insufficient carbohydrates moving into these parts of the plant. With lower carbohydrate accumulation in seed, crops like soybeans




Science Based Products

and wheat have lower test weights. At the same time, there is an accumulation of free starch and sugar in the leaves, causing photosynthesis to shut down even before Mg-deficiency symptoms appear in the plant. This is similar to what happens with K-deficiency.

Mg-deficiency in forages is also a contributing factor in grass tetany in ruminant animals.

Sulfur

Roots of plants take up the majority of sulfur as sulfate (SO_4^{-2}). From the air, sulfur dioxide (SO_2) can be taken up but it must be detoxified before the plant can used this form. Excess sulfur is commonly stored in the plant as sulfate.

Sulfur is a component of the amino acids cysteine and methionine, which are required by all plants. These amino acids are used to make numerous enzymes and other organic compounds needed for plants to live and grow. Consequently, sulfur is classified as an essential plant nutrient. Sulfur is used in many enzymes that affect the overall growth and health of the plant. Some of enzymes require magnesium to work, such as to detoxify heavy metals and free radicals inside the plant. This is only one of the ways that S and Mg work together inside the plant to promote growth.

When sulfur is limiting, crops have less resistance to environmental stresses (e.g. drought, temperature extremes, high salts, heavy metals, etc.) and biotic (i.e. living) stresses (e.g. diseases, insects, nematodes, etc.).

Sulfur is part of all membranes in plants, which regulates the movement of nutrients, carbohydrates, proteins and other compounds into and within the plant. Sulfur is particularly important for increasing salt tolerance in plants. Sulfur deficiency will reduce the overall size of plants, especially the above ground portions. A reduction in chlorophyll and protein content is common in sulfur deficient plants. Concurrently, S-deficient plants tend to accumulate nitrate and other soluble nitrogen compounds. In S-deficient plants, chlorosis (yellowing) of the leaves appears throughout the entire plant, unlike N-deficiency that is more severe in older leaves. In legumes, S-deficiency can reduce N-fixation in nodules, which can lead to N-deficiency, making the visual symptoms of the two deficiencies indistinguishable.




to Help Feed the World

Application Guidelines for Crops

Always use adequate water (typically 10 gallons or more per acre) for foliar application to ensure good coverage. The product may be foliar applied at any time during the growth cycle so long as the crop has adequate foliage for good absorption. If the crop is deficient in one or more of these nutrients, one or more applications may be required. The nutrients are most often needed whenever rapid growth is occurring such as during rapid vegetative growth, and during fruit and seed development. Tissue or sap tests are a better predictor of the need for this product than are soil tests alone. This is because these nutrients may be present in the soil, but the plant cannot take up adequate amounts to meet the needs of the rapidly growing crop. When multiple applications are listed in the guidelines below, tissue tests prior to each application to help determine need and application rate. If mixing with other chemicals or fertilizers, always do jar test to determine compatibility, and also do test application on a small portion of field to ensure no toxic effects occur before applying to all of crop.

Alfalfa • Hay • Forage Crops

Apply foliar application of 1/2-1 gallon Nutra-Boost® per acre in spring when early growth is 4-6" tall. Apply an additional 1-2 quarts per acre after each cutting when crop has regrown to 4-6" tall.

Canola

Apply foliar application of 1/2-1 gallon Nutra-Boost® per acre during mid-late rosette stage when good foliage is present. Apply an additional 1/2-1 gallon per acre at flowering.

Corn

Apply foliar application of 1/2-1 gallon Nutra-Boost® per acre at V4-V5 stage. Apply an additional 1/2-1 gallon per acre per acre at V9-V12. A third application of 1/2-1 gallon per acre may be applied at silking.

Cotton

Apply foliar application of 1/2-1 gallon Nutra-Boost® per acre as soon as adequate foliage is present for good absorption. Apply a second foliar application of 1/2-1 gallon per acre at pinhead square, and a third application of 1/2-1 gallon per acre at early bloom.

Fruit and Nut Trees

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply 1/2-1 gallon per acre every 4-6 weeks throughout growing season, especially during reproductive stages of development.

Grain Sorghum

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption, typically 5-7 leaf stage. Apply a second application of 1/2-1 gallon per acre at boot initiation.

Pasture

Apply foliar application of 1/2-1 gallon Nutra-Boost® in spring when early growth is 4-6" tall. Apply 1-2 quarts per acre every 4-6 weeks throughout season.

Peanuts

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply a second foliar application of 1/2-1 gallon per acre between pegging and beginning pod development.

Potatoes

Apply foliar application of 1/2-1 gallon Nutra-Boost® per acre approximately 3-4 weeks after crop emergence when a good canopy has formed. Apply a second foliar application of 1/2-1 gallon per acre 3-4 weeks later when tubers are forming.

Rice

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply a second foliar application of 1/2-1 gallon per acre after internode elongation or joint movement.

Small Fruits • Grapes • Strawberries • Blueberries • Brambles

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply 1/2-1 gallon per acre every 6-8 weeks throughout growing season.

Soybeans • Beans • Peas

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply a second foliar application of 1/2-1 gallon per acre at the beginning pod development.

Sugar Beets

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply 1/2-1 gallon per acre approximately 3-4 weeks after initial application.

Sunflower

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply a second foliar application of 1/2-1 gallon per acre at flower initiation.

Turf • Ornamentals

Apply foliar application of 1/2-1 gallon Nutra-Boost® as soon as adequate foliage is present for good absorption. Apply 1/2-1 gallon per acre every 3-4 weeks throughout growing season.

Vegetables

Vegetables include a wide variety of crops. With short season vegetable crops one application at 1/2-1 gallon Nutra-Boost® is applied as soon as crop has adequate foliage for good absorption. For long season crops or perennial crops, apply 1/2-1 gallon per acre every 4-6 weeks during growing season.

Wheat • Small Grains

Apply foliar application of 1/2-1 gallon Nutra-Boost® during early tillering when good foliage is present. Apply a second foliar application of 1/2-1 gallon per acre after first flag leaf stage.

A Product of

AGRIGUARDIAN™

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