RESEARCH FOR RESULTS

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BUILDING BRIX IN PLANTS

By Todd Zehr, Founder & Owner of SoilBiotics

WHAT IS BRIX?

Brix is a scale measuring sugar content based on a light refraction index. It is most commonly used in the fruit, vegetable, juice and wine making industries. But it has applicability to all plants. The Brix scale in plants has been known for over 50 years, however, it's only been in the last 30 years that its importance was recognized. Studies have found that the plants internal defenses (such as insect and disease resistance) are significantly affected by the nutrition of the plant.

High Brix level readings indicate internal help for plants growing in high stress periods, such as cold or drought conditions. Likewise, low Brix level readings increase the likelihood of a bacterial, insect or fungal attack on the plant. Average (good) readings still suggest the possibility of stress and trouble. Excellent Brix level readings indicate that proper fertilization has conferred general immunity to bacterial, fungal and insect attacks on the plants. Crop plans should focus on healthy plants that can defend themselves rather than by applying poisonous chemicals that have become the norm in modern agriculture today.

SOME BASICS

The term photosynthesis covers this formula:

$CO_2 + H_2O$ Sunlight = $(CH_2O) + O_2$

Green plants = (carbohydrates)

Unfortunately, neither the term nor the formula really explains what is happening or how important the process is to the final result. But there is one term that clearly and meaningfully explains the full story: **Brix**. During photosynthesis sucrose is formed in the leaves and through osmosis moves into the cells. Cells with high sugar (Brix) content achieve what is called "turgid pressure", the level of water pressing the cell membrane against the cell wall. This is what makes a plant appear wilted or crisp. Healthy plants have high turgidity. Plants that are not healthy have low turgidity and appear wilted.

The process begins with the chloroplast that contains chlorophyll A. The chlorophyll takes the CO_2 from the air and H_2O from the soil and converts them into simple sugars using sunlight as the power source. The Chloroplast adsorbs light to drive the process. When light is activated it loses an electron which changes it to a positive charge. The molecule can then strip electrons form other substances such as water. The loss of the electron causes water molecules to break down and release oxygen, then the hydrogen molecule will join with the CO_2 to form a simple sugar.

The leaf creates sugars during the day and then translocates them at night down to the roots and back up to various parts of the plants. Many are converted into amino acids which are the building blocks of the plant as well as hormones and vitamins. This is part of one of the most important processes on the planet. Phosphate is the catalyst for this process, and is why we will now address nutrient levels.

IMPROVING PHOTOSYNTHESIS BY IMPROVING PROPER NUTRIENT LEVELS

It's amazing how little regard many growers give to the process of photosynthesis and its importance in the ongoing health and vitality of crops. Indeed, photosynthesis is the most important biological process operating on the planet, upon which nearly all life is dependent. If you take apart a plant, 95% of the dry matter has been formed by photosynthesis and only 5% was provided by the nutrients that entered through the roots. Bearing in mind how monumentally important this is to all growers, we should wonder why we don't consider photosynthesis, or to try to improve the process. Even a small improvement in plant photosynthesis would give us great rewards both in quality and profitability.

So, how can we improve our rates of photosynthesis and therefore increase quality, yield and natural defenses of the plant? How do we improve the process?

When we consider the question, we need to look at how the plant is grown and how we can reduce nitrate and chemical input; both of which will reduce Brix levels.

> **N:** The big unknown today is Nitrogen. If you examine the molecule for chlorophyll it can be seen that N is essential for its' make up, but **excess N** can bring too much water into the plant if it's applied as NO3. It's important to remember this when we start to build Brix levels. We are always looking at various ways of applying different types of N to decrease water within the plant to increase Brix levels. We have recently reduced recommendations of NO3 and started to use urea and ammonium nitrate as foliar applications and are having great success.
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> **P:** As mentioned earlier, phosphate is essential to sugar movement within the plant.
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> **K:** K is important as it controls the opening and closing of the stomata. As with N, excess Potassium can also enter the plant in non-phosphate form along with water and cause problems.
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> **Ca:** Calcium is involved in many pathways in plant cells, including plant growth and development, resistance to environmental stress
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> **Mg:** Magnesium controls the amount of N in the leaf to avoid an excess building up.
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> Note that the chlorophyll also contains carbon, hydrogen, oxygen, nitrogen and magnesium.

We will use some form of a humic substance to partner up with magnesium that speeds up the metabolic process and makes sure there is enough magnesium for photosynthesis. We see that when coupled with a humic substance, this will help liberate C02 from the soil calcium carbonates thus making C02 available to the plant through the roots. The humic substances will also stimulate plant enzymes which further aid the production of sugars in the plant leaf.

Keeping high Ca levels along with humic substance will liberate the Ca and will increase cellular structure in plants that keep the Xylem and the Phloem moving freely with the plants system.

We typically will apply with our foliar spray applications a combination of Fulvic/electrolyte amino acid and EDTA plant foods that have a great ability to penetrate the cell membranes and translocate into the entire plant system within 25 minutes of application.

Using timely applications of **high-quality humic substances** has proven that they do a very important job of increasing Brix levels in plants.

So, we truly do have the ability to influence the plants own ability to defend itself during the growing season, and thus reduce use of chemical inputs to a level that ensures plant performance, but does not result in excess nutrients entering the soil.