

# ALBION<sup>®</sup>

*Metalosate<sup>®</sup> Plant Nutrition News*

A Compilation of Technical Information and Essential Plant Research Projects

OCTOBER 2000

VOLUME 1, No. 3

## Calcium Deficiencies and Metalosate<sup>®</sup> Calcium

Recently there has been increasing interest in the use of calcium foliar sprays because of the effect calcium has on fruit quality and shelf life. In this issue of Albion's newsletter, we will explain the functions of calcium in plants, deficiency symptoms and why calcium deficiency symptoms occur in fruit and vegetables in even seemingly perfect conditions. We will also explain why, in the past, solving a calcium deficiency problem has been so difficult and how you can effectively and economically solve your calcium deficiency problem using Albion's calcium amino acid chelate, Metalosate Calcium.

### *Function of Calcium in Plants*

Calcium is a divalent cation that is extremely important in maintaining the strength of stems and stalks of plants. This mineral also regulates the absorption of nutrients across plasma cell membranes. Calcium functions in plant cell elongation and division, structure and permeability of cell membranes, nitrogen metabolism, and carbohydrate translocation<sup>1</sup>. Many agronomists consider calcium to be a secondary or even a micronutrient, even though the concentration of calcium in the plant

is as great as nitrogen or potassium<sup>3</sup>. Calcium is nontoxic, even in high concentrations, and serves as a detoxifying agent by tying up toxic compounds and maintaining the cation-anion balance in the vacuole<sup>1</sup>. Since calcium is part of the cell wall and acts as the cement that binds the cell walls together it is one of the most significant factors of firmness and storage life of fruit. Furthermore, the viability of seeds is directly related to their calcium concentration.

### *Deficiency Symptoms*

Deficiency symptoms are most pronounced in young tissues – meristematic zones of roots, stems, and leaves – where cell division is occurring. If a calcium deficiency is present, it will result in twisted and deformed tissues, and the meristematic zones die early as in the case of blossom end rot of tomatoes<sup>1,6</sup>. You will see calcium deficiencies manifested as death of the growing points including buds, blossoms and root tips. Examples are deformed watermelons, bitter pit in apples, blossom end rot in tomatoes and chilies, leaf tip burn in lettuce, internal brown spot in potatoes, and softer, non-marketable fruit in general.

*Why calcium deficiency symptoms appear on fruit when the soil and weather conditions seem to be perfect.*

There are several reasons that cause a calcium deficiency symptom to show up in fruit and vegetables when the soil and weather conditions seem to be perfect. One is the application of nitrogen fertilizers. Nitrogen is translocated through the plant approximately 20 times faster than calcium. Calcium is the slowest moving element in the plant. We frequently apply unnatural amounts of nitrogen in an attempt to maintain yields. This large nitrogen boost causes the plant to grow faster than the calcium can move within the plant, thus inducing calcium deficiencies in growing points and fruit. A second reason for a calcium deficiency is that calcium is passively moved through the xylem (water conducting tissue). This movement is caused by transpiration. Leaves have a much higher rate of transpiration than fruit. Because of the low transpiration rate of the fruit, the calcium concentration is lower than in the leaves. Leaf calcium concentrations and leaf appearance usually are a poor indication of a calcium deficiency in fruit<sup>1</sup>. One can have adequate or even high concentrations of calcium in leaf

tissue analyses and still have calcium deficiencies in the fruit. For example, “in calcium deficient fruit of watermelon and cucumber, it has been shown that the blossom end of the fruit wall becomes thinner, and water-soaked, brown necrotic spots develop.”<sup>1</sup> Cooler weather further exacerbates the problem of calcium moving to fruit as seen in late fall melons in the U.S. or winter grown melons in Central America. Extreme heat negatively affects calcium movement in lettuce and other vegetable crops. ☺

*Is it possible to get sufficient calcium into the fruit and other growing points of the plant?*

Yes!!! But there is only one product on the market that can effectively and economically do so without the risk of phytotoxicity: Albion’s patented Metalosate Calcium. There are a myriad of calcium products on the market, all but one of which, do little to get calcium into the fruit where the plant needs it the most and where you as a grower can increase the quality of your crop. One can apply gypsum, or calcium nitrate to the soil, which will marginally reduce a calcium deficiency, but once again we return to the problem of the speed at which that absorbed part of that calcium can move into and within the plant compared to other elements. All but one of the foliar sprays that have been introduced into the market lack the ability to effectively penetrate the surface of the leaf or skin of the fruit, and some can even have devastating phytotoxic effects on plants, such as calcium chloride.

The EDTA calcium chelated compounds can penetrate the leaf

but hold the calcium so tightly that it cannot be translocated within the plant to the points of greatest demand<sup>8,9</sup>.

*Why Metalosate® Calcium Works*

So what is the answer? As was stated earlier, calcium moves in the xylem, and the passive movement in the water is caused by transpiration. We also stated that nitrogen could translocate about 20 times faster than calcium. Why can nitrogen move so fast? It is because nitrogen and its compounds, such as amino acids and proteins, can move along with carbohydrates in the phloem. The sugars and proteins move from cell to cell and migrate to where the plant has the greatest demand for photosynthates, the growing tips and the fruit. Albion has created a patented way for calcium to also move in the phloem of plants and for calcium to move with the same speed as nitrogen. Every calcium ion in Metalosate Calcium is bonded to two amino acids, creating the Metalosate Calcium molecule. The plant recognizes the molecule as a proteinaceous molecule allowing it to travel in the phloem instead of forcing it to use the xylem route. For the first time, in the Metalosate form, this allows the calcium to be a mobile element. Not only is Metalosate Calcium mobile but it will also move to the areas of greatest need of photosynthates in

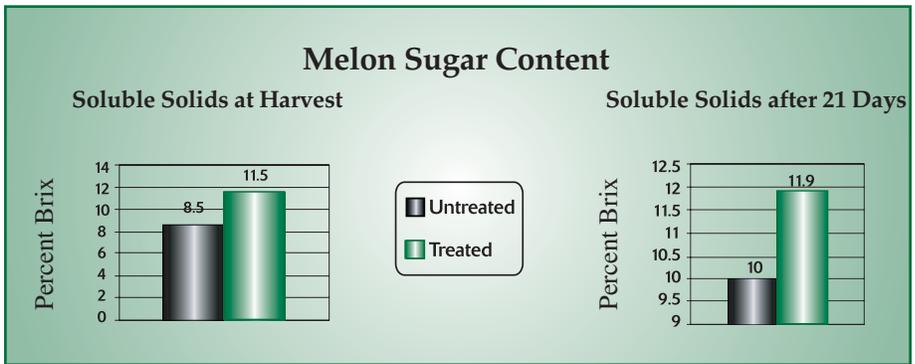
the plant such as the meristematic tissues and fruit<sup>2</sup>. Fifty percent of the calcium in Metalosate Calcium will be translocated and moving within the plant in two hours.

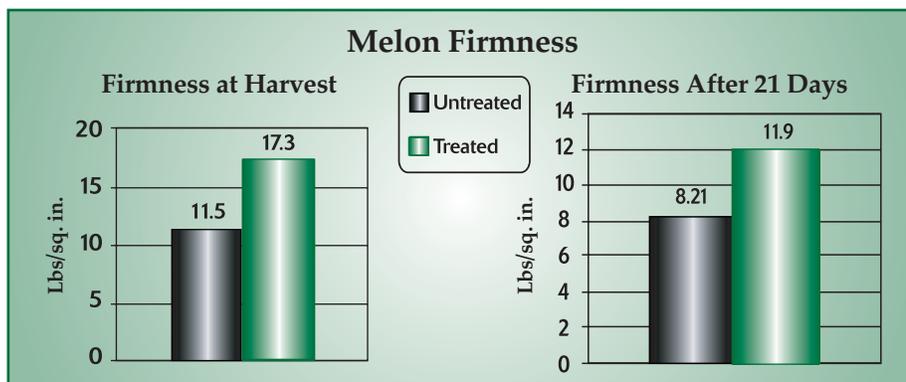
Studies across the world have proven that Metalosate Calcium is the most effective way to increase calcium concentrations inside of fruit and meristematic tissues without any phytotoxic side effects.

*Melon Research*

Dr. Gene Lester, one of the world’s leading post harvest physiologists on melons who works at the USDA subtropical research center in Weslaco, Texas conducted an experiment dipping honeydew melons post harvest in a solution of Albion’s calcium amino acid chelate. The melons were dipped, for 20 minutes and the shelf life of the treated melons was extended by 2.4 fold (i.e. to 24 days), (p<0.05)<sup>4,5</sup>.

Many growers heard or read of this experiment but could not dip their melons because they field-packed the melons. To those individuals we recommended applying 1 quart Metalosate Calcium at first commercial flowering, the same application two weeks later and the same application 10 to 14 days before



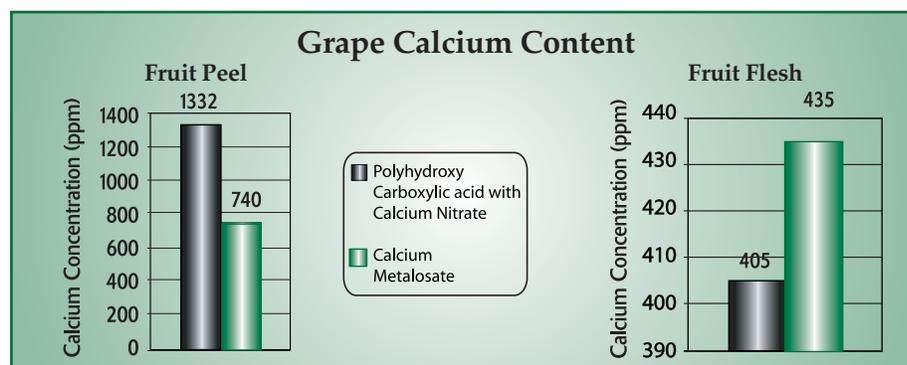


Notice that the peel concentrations are higher for calcium chloride and calcium acetate than Metalosate Calcium but in the flesh of the apples the Metalosate Calcium is the highest. Considering the volume of peel versus the volume of the flesh, significantly more of the Metalosate Calcium penetrated the flesh and did not stay on the peel, as was the case for calcium chloride or calcium acetate.

harvest. Growers reported their best quality ever with increases in pack outs of 30% due to the firmness of melons. A replicated field study in Texas (below) showed that not only were there increases in firmness but also increases in sugar.

concentration is to peel the fruit and measure the calcium concentration of the flesh.

An interesting note is that the melons treated with Metalosate Calcium generally had firmer flesh after 21 days than the non-treated did at harvest. The treated melons have greater shipping capabilities and shelf life.



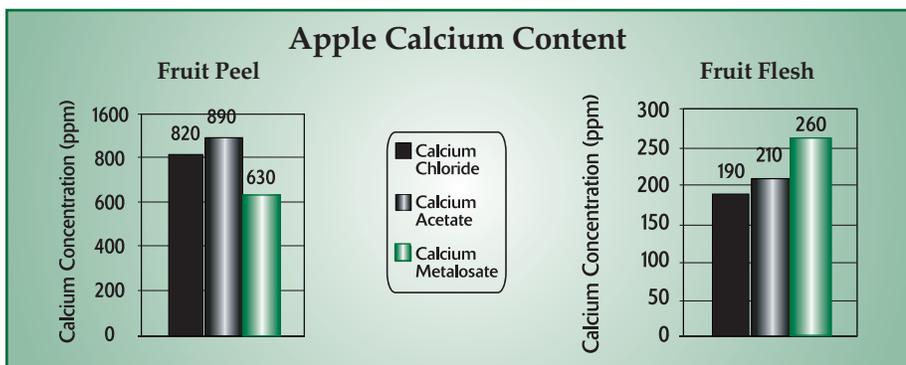
*Grape Research*

Albion has seen the same thing in Thompson Seedless table grapes. In Southern California a Thompson grape vineyard was split. Two quarts polyhydroxy carboxylic acid with calcium nitrate was applied to one half of the vineyard and the other half received 1 pint Metalosate Calcium. This application was repeated 3 times during the growing season. In spite of using one fourth of the amount of calcium compared to the other product, Metalosate Calcium had 30 ppm more calcium in the fruit.

*Apple Research*

In South Africa use of Metalosate Calcium has reduced bitter pit in apples to less than 1%.

During the 1997 growing season, an orchard of Fuji apples in Washington State was divided into three blocks. The first was treated with eight pounds of calcium chloride per acre, the second was treated with two quarts per acre of a liquid calcium acetate



Studies have shown the ability of Metalosate Calcium to penetrate through the peel. Most calcium foliar just stick to the peel of the fruit. A true test of calcium

material, and the third was treated with one quart per acre of Metalosate Calcium. Each block received three applications at these rates<sup>7</sup>.

The calcium from the other product just stayed on the peel. Metalosate Calcium has reduced shatter and increased shelf life in table grapes. Growers have also noticed a decrease in botrytis

bunch rot because of a strong skin on the berries Metalosate Calcium can be added with gibberillic acid sprays, insecticides and fungicides and has been shown to have a synergistic effect with many of these products.

All of the results from applications of Metalosate Calcium on various crops are too numerous to cover in this newsletter. Results similar to those summarized above have been found in over 300 agricultural and ornamental crops.

For increased quality, longer shelf life, disease resistance and increased profits please give us a call or contact us at our website to find a dealer near you. ☺

## References

1. Bennett, W.F., *Nutrient Deficiencies & Toxicities In Crop Plants*, (St. Paul, MN:APS Press) 1996.
2. Buettner, M.A., "Biotechnology of Albion Metalosates." Proc. Albion Conference on Plant Nutrition, 1989.
3. Dickinson, K., "Metalosates and T.E.A.M. Use Them To Produce Healthier Crops," Proc. Albion's International Conference on Plant Nutrition, 149-154, 1999.
4. Hardin, B. and Lee, J., "Melons Are On A Roll," p.18-19, Agricultural Research, February 1999 (Agricultural Research Service, USDA).
5. Lester, G.E. and Grusak, M.A., "Postharvest Application of Calcium and Magnesium to Honeydew and Netted Muskmelons: Effects on Tissue Ion Concentrations, Quality, and Senescence," J. Amer. Soc. Hort. Sci. 124(5): 545-552. 1999.
6. Salisbury, F.B., and Ross, C.W., *Plant Physiology*, (Belmont, CA: Wadsworth Publishing Company) Fourth Edition 1992.
7. Voet, L., "The Effect of Calcium Metalosate and Potassium Metalosate Foliar Applications on Nutrient Levels in Tree Fruit Production," Proc. Albion's Conference on Plant Nutrition, 35-49. 1998.
8. Wallace, A., *A Decade of Synthetic chelating Agents in Inorganic Plant Nutrition*. (Los Angeles, CA: UCLA Arthur Wallace) 1962.
9. Wallace, A., *Solute Uptake by Intact Plants*. (Los Angeles, CA: UCLA Arthur Wallace) 1963.

**ALBION**<sup>®</sup>  
*Metalosate® Plant Nutrition News*

October 2000  
Volume 1, No. 3

Metalosate<sup>®</sup> Plant  
Nutrition News is a  
publication of  
Albion Advanced Nutrition  
101 North Main Street  
Clearfield, Utah 84015-2243  
USA

www.albion-an.com

Phone: (801) 773-4631

(800) 453-2406

FAX: (801) 773-4633

E-mail: info@albion-an.com

©Copyright 2000-2004 by  
Albion Laboratories, Inc.

## Local Representatives

Kevin Dickinson  
(Intermountain US, Africa,  
Middle East, Europe, UK)  
e-mail: kdickinson@albion-an.com  
mobile: (801) 540-6035

Jeremy O'Brien  
(Washington and Oregon)  
e-mail: jobrien@albion-an.com  
mobile: (801) 725-4197

Ludwig Voet  
(California, Far East)  
e-mail: lvoet@albion-an.com  
mobile: (801) 726-4004

Todd Edwards  
(Southwestern US, Latin America)  
e-mail: tedwards@albion-an.com  
mobile: (801) 726-7618