JH Biotech, Inc.

Biotechnologies for Safer Agriculture

The Effects of Biomin Calcium Applied Through Drip Irrigation on Strawberries in the Santa Maria Valley

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Abstract

Biomin calcium an amino acid chelate produced by J.H. Biotech, Inc. was applied to strawberries (*Fragaria* × *ananassa*) cv. 'Camarillo' grown in the Santa Maria Valley through the drip irrigation weekly starting at bloom initiation. The Initial rate was 3 gallons/acre at bloom followed by weekly 1 gallon/acre applications. Strawberry fruit weight was significantly higher in the plants treated with biomin calcium. The strawberry plants that received biomin calcium had significantly higher sugar levels in the fruit. Strawberry plants treated with biomin calcium had significantly higher plant tissue levels of calcium, zinc and boron.

Introduction

In strawberry plants Ca uptake occurred essentially through the root system (Norton and Wittwer, 1963). Factors such as increased (more negative) soil water potential , increased xylem water potential at night, nitrogen form (NO_3- generally preferred to NH_4+), or high soil K concentration reduced Ca uptake into strawberry plants (Bradfield and Guttridge, 1981; Chiu and Bould, 1976; Ganmore-Neumann and Kafkafi, 1985; Guttridge et al., 1981). Heavy soil texture and high fertilizer applications reduce Ca uptake (Bradfield and Guttridge, 1984).

Calcium has been shown to ameliorate the adverse effects of salinity on plants (Ehret et al., 1990). Calcium is well known to have regulatory roles in metabolism, and sodium ions may compete with calcium ions for membrane binding sites (Cramer et al., 1986). High NaCl concentrations in nutrient solution can strongly affect strawberry plant growth, fruit yield and quality, plant water use and membrane permeability (Kaya et al., 2002). Soils with high levels of NaCl can induce Ca deficiencies in strawberry leaves

(Kaya et al., 2002). Supplementary Ca can ameliorate the parameters affected by high salinity (e.g. plant growth, water use and membrane permeability) and can also correct Ca deficiency in strawberry plants (Kaya et al., 2002).

Strawberry fruit are highly susceptible to bruising and post harvest decay (Clarkson and Hanson, 1980). During ripening Ca participates in maintaining the integrity of the middle lamella (Clarkson and Hanson, 1980). Cytoplasmic Ca also participates in a broad range of plant functions that could influence fruit decay, including regulation of camodulin, Ca-dependent ATPases, protein kinases, and several glucanohydrolases (Gilroy, 1989; Poovaiah and Reddy, 1987). Activity of some of these enzymes, such as B1, 4-glucan synthase, can be increased 30-fold by increasing tissue Ca from 0 to 10-6M, and have been implicated in host-plant disease resistance (Gilroy, 1989; Poovaiah and Reddy, 1987). Cell membrane leakage and tissue senescence are reduced or delayed by adequate or elevated tissue Ca levels, and Ca ions can inhibit the action of intra- and extracellular polygalacturonase (Gilroy, 1989).

MATERIALS AND METHODS

Biomin calcium is an amino acid chelate produced by J.H. Biotech, Inc.. Biomin calcium contains 5.0% chelated calcium and 2.0% water soluble organic nitrogen derived from glycine. The Biomin Calcium trial was conducted during the fall strawberry growing season of 2005. The field site was located in the Santa Maria Valley (Section 7, Town 09N, Range 32W, and Meridian S). The site was a square 20 acre field planted with strawberries (*Fragaria* × *ananassa*) cv. 'Camarillo'. The field was broken up into four irrigation control valves each watering five acres. The test was conducted on the

five acre southwest corner irrigation control valve (Fig.1a.). The control block was the five acre irrigation block that bordered the north side of the test block (Fig.1b.).

The first biomin calcium application was on August 24, 2005, during the initiation of the first bloom (Fig.2.). The first application of the biomin calcium was applied at three gallons/acre through the drip irrigation in the five acre test block. After the first application biomin calcium was applied weekly at one gallon/acre through the drip irrigation. The last application of biomin calcium to the test block was on November 30, 2005.

The field site was concluded to be uniform in soil type and land preparation from multiple soil analysis tests conducted by SaferGro Laboratories, Inc.. The soil was a sandy loam with a pH of 7.4. The test plot received an equal amount of irrigation water and fertilization as the control block. Leaf and petiole samples were taken randomly every week in the test and control block. The total sample size was 15 leaf and petiole samples each week for 17 weeks. Leaf and petiole sampling started on August 3, 2005. The last leaf and petiole samples were collected on November 30, 2005. SaferGro Laboratories, Inc. conducted the leaf and petiole analysis. The test and control block micronutrients were balanced by using the weekly plant analysis reports to determine what micronutrients were needed to be applied each week. The test and control block both received the equal amounts of foliar applied Biomin micronutrients.

In both treatments red strawberry fruit were randomly picked and weighed every two weeks for 12 weeks. The fruit were weighed individually on a scientific scale to the nearest tenth of a gram. The total sample size taken bi-weekly in each treatment was 40

red strawberry fruit. The first fruit samples were collected on September 14, 2005. The last fruit samples were taken on November 30, 2005.

Red strawberry fruit from each treatment were tested for sugar levels. The fruit sugar levels were measured in percent sugar. The sample size for each treatment was 10 red strawberry fruit. The samples were taken randomly from each treatment every two weeks for 10 weeks. The first sample was collected on October 5, 2005. The last sample date was on November 30, 2005. The sugar analysis was conducted by SaferGro Laboratories, Inc..

The fruit weight, fruit sugar, leaf and petiole analysis data was compared using the t-test in SAS. Each treatment passed the test of normality and tested equal for variances. Results were significant when p-value < 0.05. The points at each sample date represent the mean in the percent fruit sugar and the percent calcium in plant tissue graphs. In the fruit weight graph the points at each sample date represent the mean and the bars represent the standard deviation. Means $\pm$ standard deviation are provided through out.

Figure 1a. The 5 acre block treated with biomin calcium in 2005.

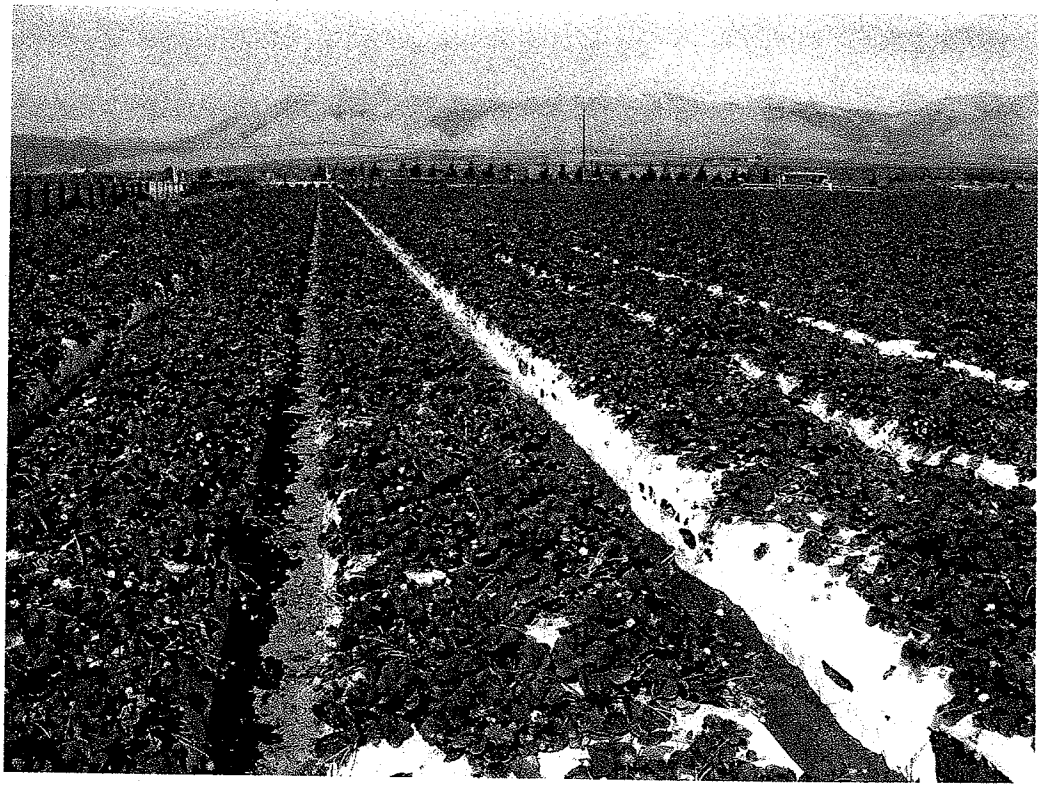

Figure 1b. The 5 acre control block not treated with biomin calcium in 2005.

Figure 2. The day of the first application on August 24, 2005.

Results

Strawberry plants treated with biomin calcium had significantly higher fruit weight (treatment mean fruit weight 26.5 ± 6.57g., control mean fruit weight 23.2 ± 5.82g., n = 240, p-value = 0.00072)(Fig.3). Plants that received biomin calcium tested significantly higher in Ca tissue levels (treatment Ca tissue level mean 0.90 ± 0.11%, control Ca tissue level mean 0.86 ± 0.20%, n = 17, p-value = 0.00019)(Fig.5). Plants treated with biomin calcium tested significantly higher in Zn tissue levels (treatment Zn tissue level mean 34.18 ± 3.89 ppm., control Zn tissue level mean 33.12 ± 8.16 ppm., n = 17, p-value = 0.0017).

Strawberry plants treated with biomin calcium had significantly higher B tissue levels (treatment B tissue level mean 62.65 ± 7.62 ppm., control B tissue level mean 59.72 ± 15.14 ppm., n = 17, p-value = 0.041). The strawberry plants treated with biomin calcium had significantly higher fruit sugar levels (treatment fruit sugar level mean 10.66 ± 0.55%, control fruit sugar level mean 10.3 ± 0.58%, n = 50, p-value = 0.0042)(Fig.4). There were not any significant differences in the soil analysis tests taken through out the season.

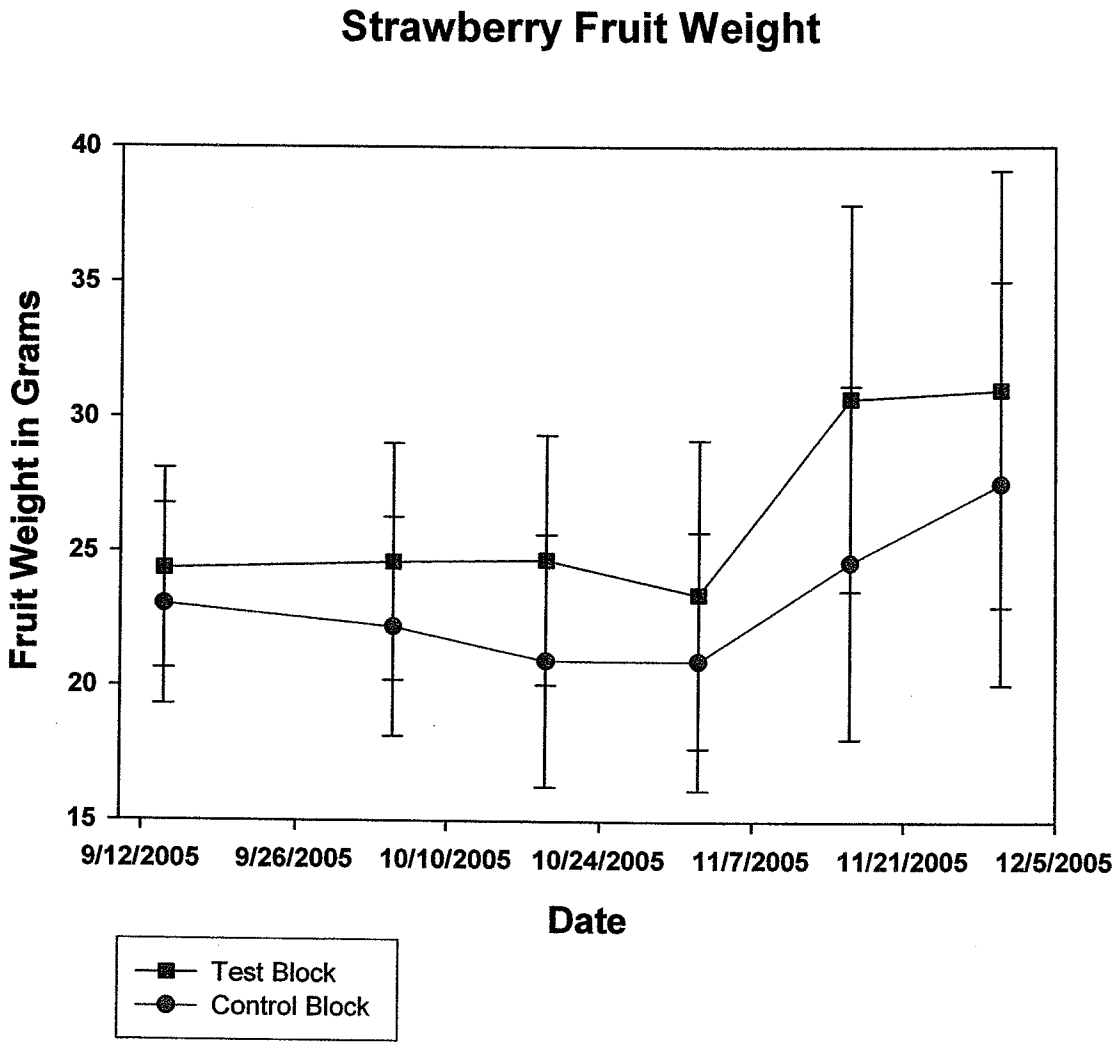

Figure 3. Strawberry fruit weight in grams.

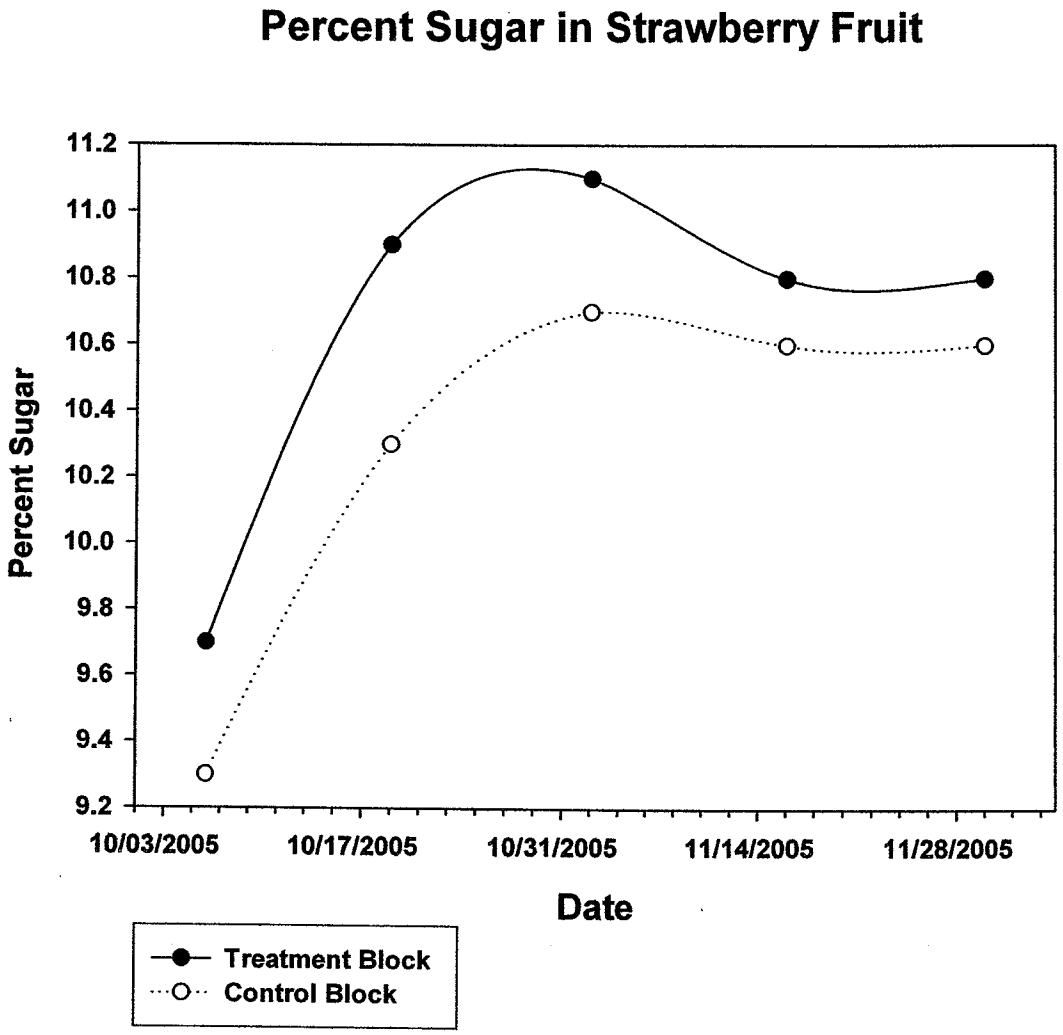

Figure 4. Percent sugar in strawberry fruit.

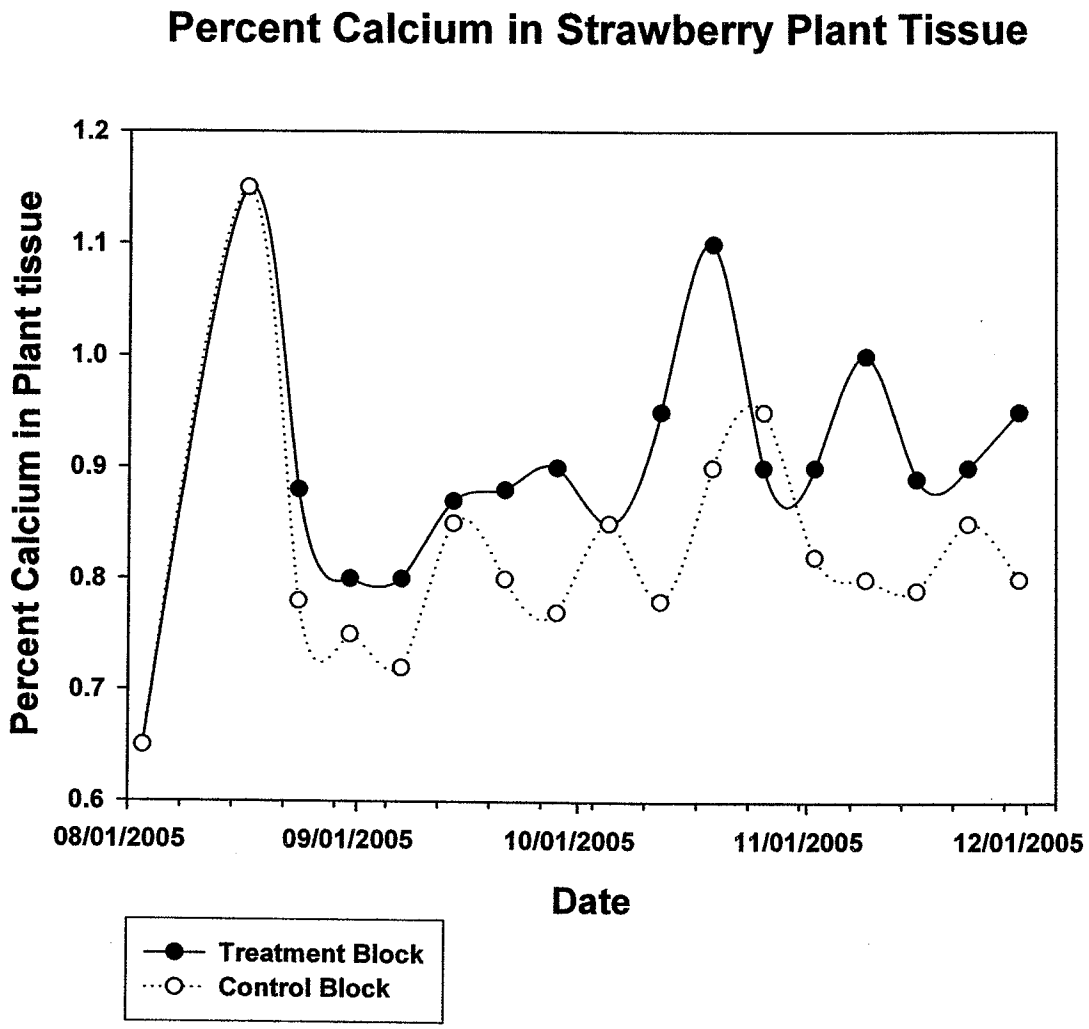

Figure 5. Percent calcium in strawberry plant tissue.

Discussion

The rates of biomin calcium applied through the drip irrigation should be adjusted for different soil types, fertilizer rates, irrigation rates and varieties. Plant tissue samples should be taken throughout the season to monitor nutrient levels for biomin calcium rate adjustments. Biomin calcium has shown good results as a foliar spray during heavy fruiting periods in strawberries at 2 quarts/acre. Biomin calcium is registered for organic strawberry production. Biomin calcium is 100% water soluble and will not burn like EDTAs and lignosulfonates.

Literature Cited

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