THE IMPORTANCE OF CALCIUM IN APPLE PRODUCTION SYSTEMS

BIOMIN CALCIUM v's STANDARD

Conducted by Zadco for Quality Gro P/L and Mr. Ian Bolitho

Supervised by Mr. Colin Little

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INTRODUCTION

Calcium nutrition has become more important in Australian orchards with the increasing demand for large fruit. Essentially the fruit uses the Calcium that is absorbed through the waxy cuticle. Other benefits from Calcium are increase fruit firmness in storage and increased storage life. There may also be some benefit in disease resistance from increasing cell wall strength and cell membrane integrity. Raising the Calcium content of the fruit is not easy, but here is how it was achieved using **BIOMIN CALCIUM**.

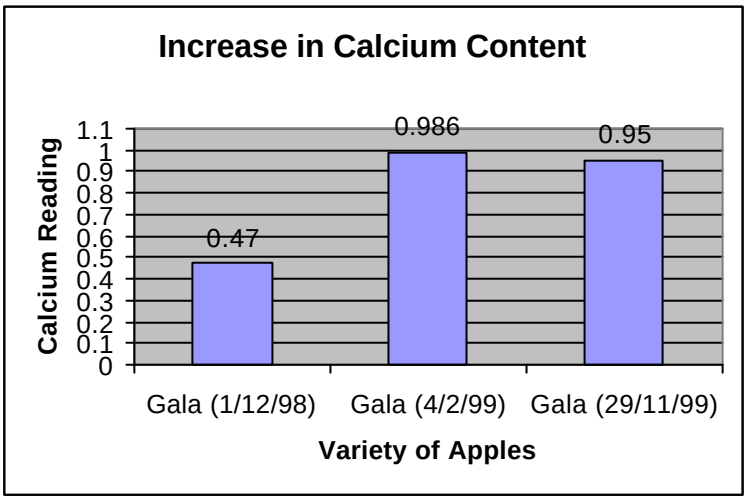
Several Apple varieties were trialed to test the efficacy of **BIOMIN CALCIUM**. The soil Calcium status is important when looking at the uptake of Calcium by the trees. Root growth occurs in 2 cycles in apples, in early spring and again in the autumn. Roots stop growing towards the end of spring and throughout the summer. This means that Calcium uptake from the soil during the summer is severely limited.

ABOUT BIOMIN CALCIUM

Biomin Calcium is a bio-available plant nutrient resulting from a unique chelation of mineral nutrients with a blend of Glycine and other organic amino acids. This unique chelation process enables nutrients to be better utilised by plants. **Biomin Calcium** is a straight calcium product with a 15% Calcium concentration. There are no additional elements such as nitrates, or sulphates, and this enhances the performance of the product.

INITIAL TRIAL WORK

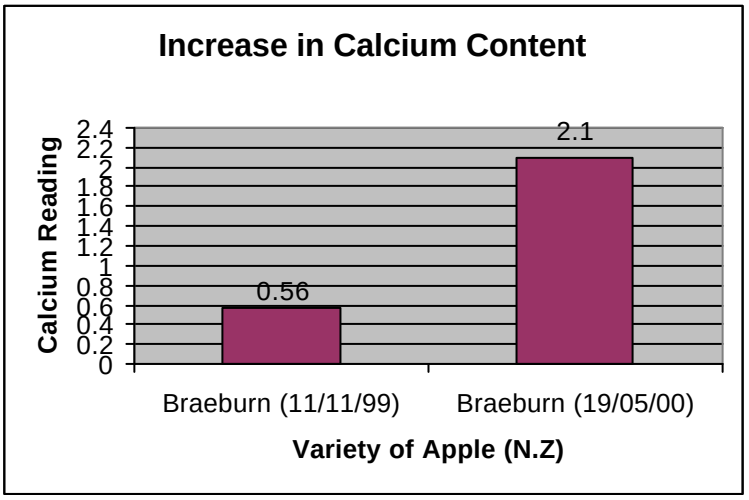
Foliar applications of **BIOMIN CALCIUM** were made at several different locations. Graph 1 indicates the changes in Calcium levels across the season. Gala apples sampled in Bilpin (NSW) were tested before an application of Calcium (1/12/98), where the initial soil status was 1340mg/kg. As mentioned above, Calcium uptake from the soil during the summer is severely limited therefore foliar applications were made.



GRAPH 1: Gala Apples, 1 application of Biomin Calcium.

BIOMIN CALCIUM was applied at a rate of 2kg/ha, just one application. The Calcium application was made in the first week of January and levels doubled, from 0.47% to 0.986%. Furthermore, the levels of Calcium remained higher than the previous year, almost 12 months later.

Graph 2 shows results on Braeburn apples done in New Zealand. The grower is an organic grower whereby no additional Calcium was applied throughout the season. Three applications of **BIOMIN CALCIUM** were done; the first immediately after fruit set, the second 7 weeks before harvest, and the final application was made 2 weeks before harvest. The graph shows how there as a 350% increase in the level of Calcium over that 12 month period. The initial soil status was 1170mg/kg.

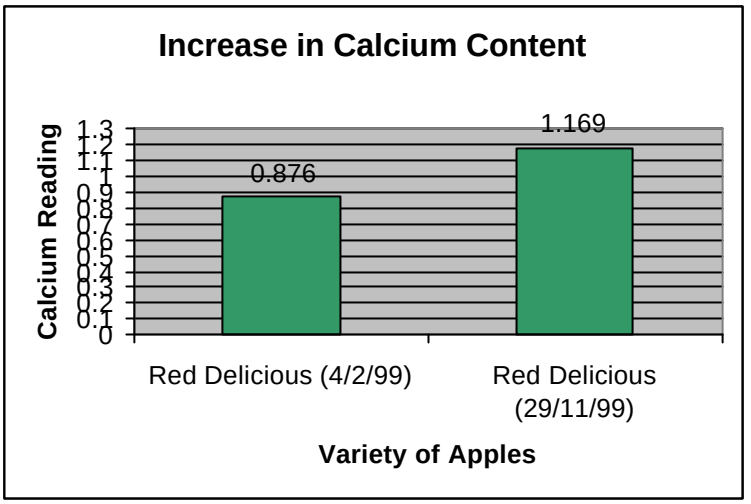


GRAPH 2: Braeburn Apples, 3 applications of Biomin Calcium.

Graph 3 shows the changes in Calcium levels after one application of **BIOMIN CALCIUM** at a rate of 2kg/ha on red delicious apples. The initial soil status was 1015mg/kg.

The preliminary results indicated that Biomin Calcium is a systemic form of Calcium being taken in by the trees and positively increasing the calcium content of the trees.

These results instigated a second season of trial work extending the results to fruit analysis as well as a comparative trial comparing **Biomin Calcium** with a well known Calcium formulation in the market place.



GRAPH 3: Red Delicious Apples, 1 application of Biomin Calcium.

BACKGROUND FOR TRIALS CONDUCTED IN 2000-2001

Traditionally, apples have a high demand for Calcium as the fruit can easily bruise at harvest, and requires the potential to endure C.A (controlled atmosphere) storage. Calcium has also been linked to colour of fruit and fruit finish, not to mention the integrity of epidermal tissue. The aim of this trial is to test the efficacy of Biomin Calcium on Pink Lady apples, a variety which has a high demand for Calcium due to having skin and flesh that easily bruise.

BALANCED NUTRITION IN APPLES

Balanced nutrition plays a major role, if not the biggest role in the production of quality produce and the regulation of tree growth. The aim of the grower should always be to optimise fertiliser practices and never cut costs by cutting out on fertilisers. All tree crops have nutrient demands and these demands vary among the many crops. Over the years, growers have had the tendency to use larger amounts of Nitrogen, which can lead to nutrient imbalances and even promote the onset of pests and diseases.

A lot has been said recently about balanced nutrition, but little is done to achieve it. Balanced nutrition can only be achieved when all nutrients are looked at simultaneously. The old methods of interpreting analytical data regard one mineral at a time and this is unable to take interactions and lock-ups into account. Zadco can offer the right tools to improve production and management of apples and pome fruit.

The effects of fertiliser management can be tough to gauge, even when you suspect the program is working. The changes are very subtle and very slow. As the famous saying states, “It won’t happen overnight, but it will happen.” Regular leaf analysis, and the use of the right fertilisers, including those supplied by Zadco, at critical stages of production ensured that the trees were receiving all the necessary elements required for optimum production.

WHAT DO APPLES REQUIRE?

The optimum soil pH for apples lies between 5.8-6.8. A pH above 6.5 is preferable for increased Calcium uptake. Common deficiencies in apples are Nitrogen, Magnesium, Calcium, Manganese, Zinc, Potassium, Phosphorous and Boron. This further illustrates the requirement for balanced nutrition in the trees and the fruit. Adequate Nitrogen is required before flowering and fruit set to ensure these stages proceed well (especially green skinned varieties such as Granny Smith Apples).

Calcium is the most underestimated element! Growers appreciate that there is a high demand for Calcium, and that the inputs throughout the season are quite high relative to many other tree crops, but why is Calcium so important?

WHY IS CALCIUM SO IMPORTANT?

Calcium is an important constituent of the cell walls and membranes. When it is in short supply, cell membranes become leaky, and cell division is disrupted causing abnormalities in the growing points and root tips, as well as fruit. Calcium appears important in protecting the cell from toxins, in slowing the aging process of plant tissues and in promoting longer storage life and resistance to tissue breakdown in many fruit, as well as promoting pest and disease resistance.

High Potassium and Magnesium levels may induce a Calcium deficiency. Calcium uptake can also be retarded by high Nitrogen levels. Calcium deficiency occurs at the shoot tip, with either loss of the growing tip, or the formation of stunted, pale yellow leaves. Calcium deficiency can cause the following:-

I. Associated with die back of shoots and roots.

II. Delays and may even inhibit bud burst in the following season.

III. Irregular cropping is also caused by Calcium deficiency.

IV. Affects the post harvest quality (keeping quality) of fruit, primarily the fruit skin quality.

V. Induces fruit splitting and cracking.

VI. Trees become susceptible to pests and diseases due to weaker cells from a lack of Calcium.

VII. It is important to apply Calcium after fruit set because it will assist in the cell division process and reinforce the fruit cell membrane. Continuously re-apply Calcium throughout the season to ensure levels remain adequate.

Deficiencies are less likely if the right form of Calcium is used. Inadequate Calcium levels in apple fruit may result in disorders such as bitter pit, internal breakdown, or premature softening.

THE TRIAL:- METHOD

The trial was begun on the 22nd November 2000.

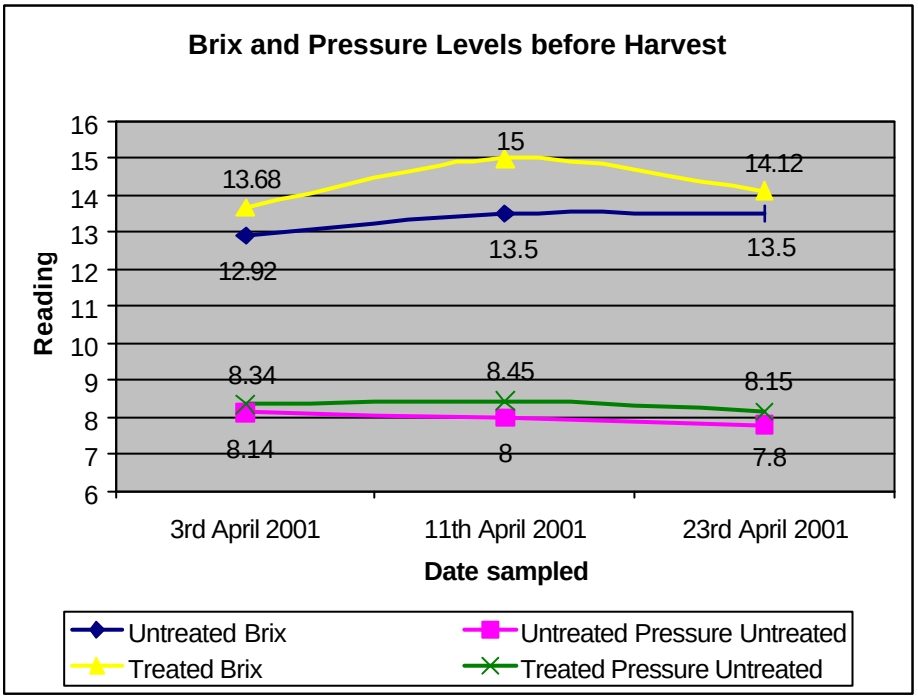
- One bock of Pink Lady apples was split in two and a composite leaf analysis was taken from the whole paddock as it had been treated the same previous to the trial commencing.
- Initial Calcium level was 1.091% dry matter across whole block
- Standard Trees then received 45L/ha of a popular commercial foliar Calcium Chloride, applied at 10L/ha per week.
- Treated Trees then received 2kg/ha of Biomin Calcium with 2L/ha of Mobilizer at fruit set.
- Another leaf sample was taken on the 7th February 2001.
- Standard 1.674 % dry matter ➔ received 45L/ha total of foliar Calcium
- Treated 1.588 % dry matter ➔ received only 2kg/ha of Biomin Calcium
- Another leaf sample was taken 5 weeks before harvest
- Standard 1.828 % dry matter
- Treated 2.711 % dry matter
- The final leaf analysis was taken on the 17th May 2001. (After fruit was harvested)
- Standard 2.109 % dry matter ➔ received 100L/ha total of foliar Calcium
- Treated 1.968 % dry matter ➔ received 6kg/ha of Biomin Calcium

RESULTS

STANDARD (Total of 100L/ha of Calcium Chloride formulation 16%)
Cost per Litre = approx $3.00 **Total Cost** for 1 hectare each season = approx **$300**
Calcium content in tree rose from 1.091 to 2.109
Brix rose from 12.92 to 13.5
Pressure dropped from 8.14 to 7.8

TREATED (Total of 6kg/ha of Biomin Calcium (15%))
Cost per kilo = approx $32.00 **Total Cost** for 1 hectare each season = approx **$192**
Calcium Content rose from 1.091% to 2.71%, then fell to 1.968%
Brix rose from 13.68 to 15, then fell to 14.12 (after 3" of rain)
Pressure rose from 8.34 to 8.45, then dropped to 8.15

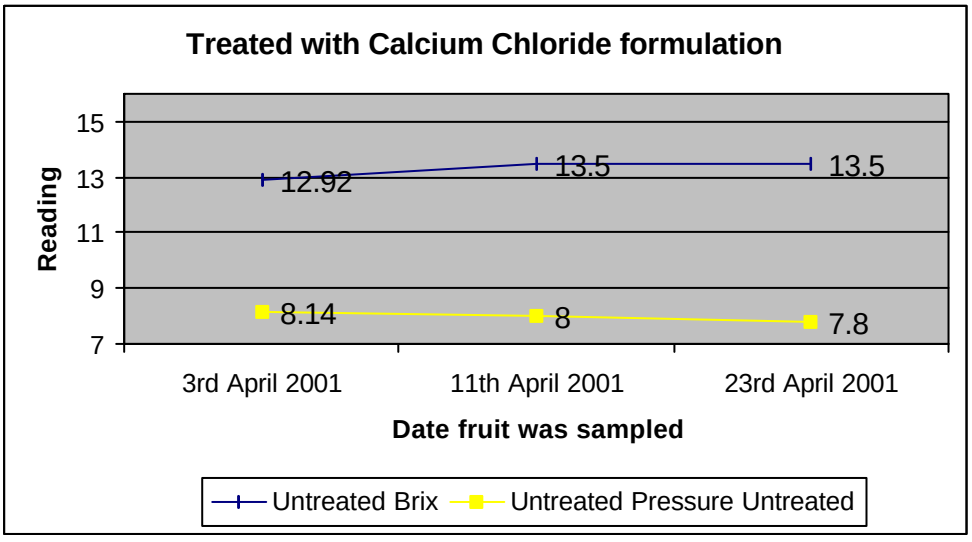
(See graph below for graphic results of apples before harvest)



TRENDS:-

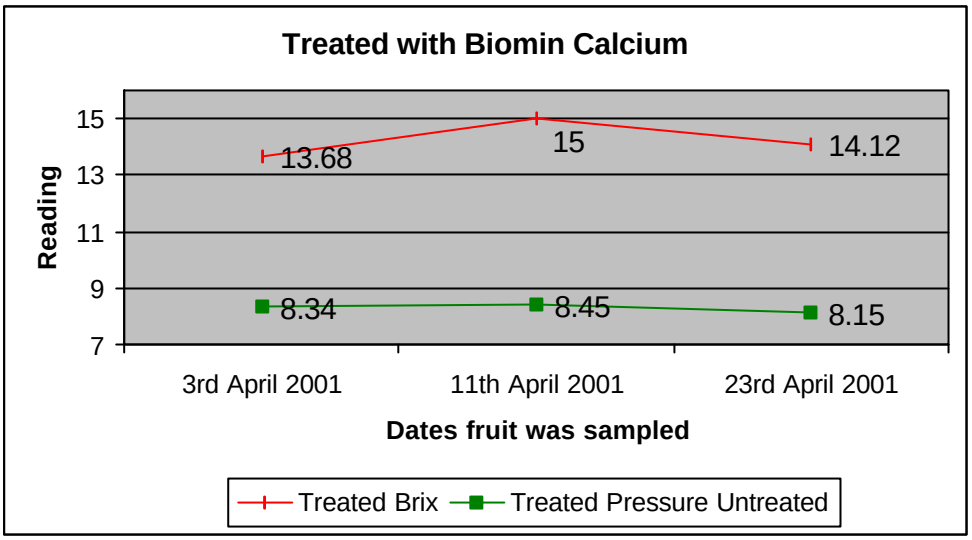
Commercial Calcium

As Brix increased, pressure decreased. This is typical of fruit quality changes throughout the season in almost all apple production systems.



Biomin Calcium

As Brix increased, pressure increased. This is not typical of fruit quality changes throughout the season Biomin Calcium helped fruit retain firmness even though Brix kept increasing



INDEPENDENT SURVEY

The trial undertaken in Shepparton was supervised by Mr. Colin Little, an advisor in the Shepparton region. Samples were taken of the fruit throughout the season and assessments were made in mid December, Mid January and at harvest. Below is the table of the final results at harvest for the standard program and the Biomin Calcium treated block.

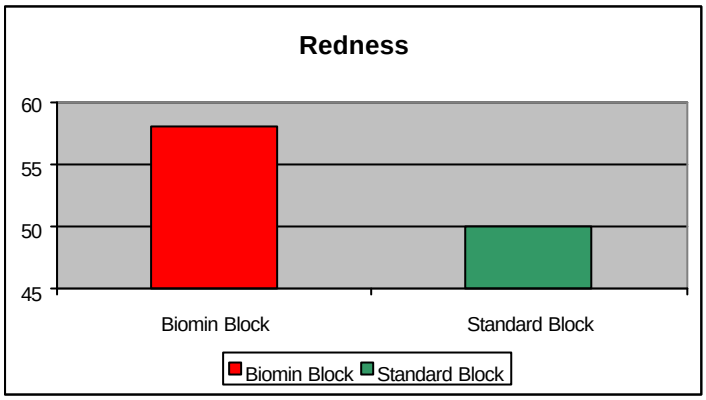
	BIOMIN BLOCK		STANDARD	
Mineral	**Value**	**Score**	**Value**	**Score**
N	0.267	HL	0.245	HL
P	0.064	AL	0.051	LH
K	0.796	HL	0.749	AH
Ca	0.026	L	0.028	LH
Mg	0.029	AL	0.028	AL
S	0.017	LH	0.016	L
Cu	2.37	LL	2.11	LL
Mn	2.49	LL	2.73	L
Zn	0.49	LL	0.74	LL
B	19.2	AL	18.6	AL

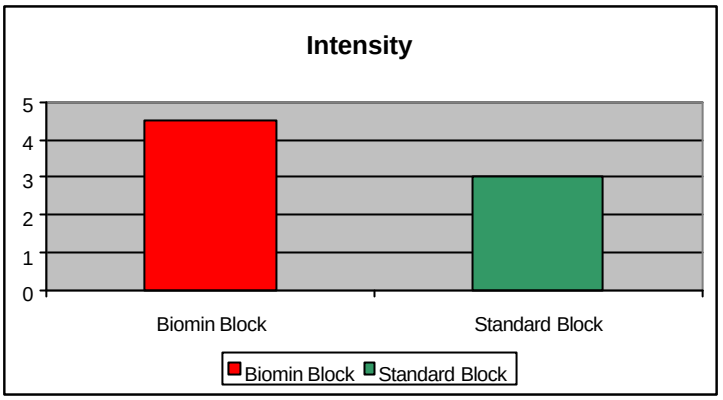
L = Low A = Average H = High AH = Average to high AL = Average to low

This particular block which the trial was conducted on has a history of high Nitrogen levels and this is due to the location of the paddock, drainage and cover cropping. Nitrogen can affect Calcium uptake and this was seen in the fruit analysis. When comparing the figures above, Nitrogen was slightly higher in the Biomin Block and this may have contributed to the factionally lower levels of Calcium (0.026 Biomin versus 0.028 Standard). Levels of all other elements such as Potassium, Phosphorous, Magnesium, Copper and Boron were higher in the fruit in the Biomin Block.

Potassium and Phosphorous levels were important for sugar and colour formation and as the graphs indicate, the Biomin block was more coloured and had higher sugar levels than the Standard block. Applications of **K-FORTE, SYNERGIZER** and **PHOSCARE** were made at critical stages to help improve the levels of these elements as well as improve sugar and colour.

The sugar and redness levels were measured by Mr. Colin Little and the results indicate that the Biomin Block displayed greater redness in colour as well as a higher intensity of redness compared to the Standard Block (as can be seen below). These two attributes are quite important to the consumer, as, quite often fruit is purchased based on colour and other aesthetic features.





CONCLUSION

Preliminary trials have paved the way for more extensive research to be undertaken with regard to the use of Biomin Calcium in apple production systems. Trial work is being done this season 2001-2002 to further the accuracy of the data over a few seasons as there are many variables which can affect the results, and continuous trial work will help reduce the associated variables.

Overall, Biomin Calcium has made its mark in the horticultural sector as one of the leading products in the market place based on cost effectiveness as well as efficacy. It has stood against many other forms of Calcium before and the results speak for themselves.