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CALCIUM TRIAL IN KIWI

INTRODUCTION

The global competition has put severe pressure on the fruit production for better quality, specially for more shelflife, to access further markets.

Farmers must use their resources more rationally, manage risks to maximize their return on investment.

Fertilizers are an important investment and to maximize its return farmers must balance the applications with the plant demands. Without the right amount of each nutrient required it is not possible to get maximum potential from the crops.

Some nutrient absorption by the roots is related to the root surface in touch with the nutrients. In some stages of faster growth, the plants require more capacity to absorb and move the nutrients to the plant tissues. In these moments the foliar fertilizer applications can complement the root absorption.

Recently there has been a growing interest on the use of calcium foliars applications to improve quality and shelf life. Calcium is a very important element to maintain the physical structure of the plants. This nutrient also controls the nutrient absorption through the cell membrane. Calcium has a important role in cell division and elongation , structure and permeability of the cell, the metabolism of nitrogen and carbohydrates Calcium is not toxic, even in high concentrations, has a detoxification role and controls the anion-cation balance in the cell. Besides, calcium has a important role in the cell wall formation and integrity. This is one of the most important factors related to fruit firmness and storage. Calcium deficiency can be manifested during the fruit set when it can restrict the cell división and produce alterations in cell wall structure.

In kiwi, like most fruits, the durability is related to the calcium concentration. Studies show that during early fruit development occurs most of calcium absorption and at the stage where the fruit is half developed the absorption decreases. Studies conducted in New Zealand and China have shown that calcium improve firmness, especially in the end of ripening, acting delaying ripeninig decreasing softening of the fruit, increasing fruit shelf life.

The objective of this trial was to evaluate the effect of Metalosate Calcium application on the durability of kiwi fruits.

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MATERIAL AND METHODS

Metalosate Calcium was applied in two kiwi orchards.

Orchard 1: Agrícola Kiwi Sur, Cuartel 1, Localidad San Carlos de Arquen, Talca VII region.

Orchard 2: Agrícola El Peral, Cuartel 3, Localidad Yerbas Buenas, Talca VII region.

Farmer: Raúl Silva Quintero.

Application rate:

Metalosate Calcium: 1,5 litro/Ha

Metalosate Magnesium : 1,0 litro/Ha

Metalosate Boron : 0,5 L/Ha

Application date:

Agrícola El Peral: 22 December 2010 during morning

Agrícola Kiwi Sur: 22 December 2010 during afternoon

Full bloom date: Agrícola El Peral: 20 November 2010

Agrícola El Peral: 22 November 2010

Harvest (begining) date: 30 April 2011.

Evaluations: firmness, soluble solids, dry matter and mineral analysis.

Evaluation dates: at harvest, 45 days at normal atmosphere and 3 months in controlled atmosphere.

RESULTS AND DISCUTION

Firmness evaluation:

It was observed that there a better general firmness when Metalosate Calcium was applied. (Table 1).

Table1: Kiwi firmness (lbf) with and withut Metalosate Calcium, considering all evaluations.

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Orchard	Calcium	Average	Standar Deviation	Coefficient of Variation	Minimum	Maximum
Both	with	**10,175**	4,51	44,32	2	20,5
	without	9,44	5,228	55,38	1	22,5
El Peral	with	**10,688**	4,268	39,94	2	20,5
	without	9,605	5,326	55,45	2	22,5
Kiwi Sur	with	**9,663**	4,71	48,74	2	19
	with	9,275	5,156	55,59	1	21

At the first firmness evaluation it was not observed diferences between kiwis with and without calcium. However, in the other evaluations it was observed that fruit was firmer where Metalosate calcium was applied. (Tables 2 and 3) (graph. 1).

Table 2: Kiwi firmness (lbf) with and without Metalosate Calcium application, after 45 days of regular atmosphere storage. (14 June).

Orchard	Calcium	Average	Standar Deviation	Coefficient of Variation	Minimum	Maximum
Both	with	**8,343**	2,735	32,78	3	14
	without	7,65	2,164	28,29	4	13
El Peral	with	**8,86**	1,978	22,33	5,5	12,2
	without	7,55	2,151	28,5	4	11
Kiwi Sur	with	**7,825**	3,298	42,14	3	14
	without	7,75	2,227	28,74	4,5	13

Table 3: Kiwi firmness (lbf) with and without Metalosate Calcium application, after 3 months days of controlled atmosphere storage.

Orchard	Calcium	Average	Standar Deviation	Coefficient of Variation	Minimum	Maximum
Both	with	**9,685**	2,945	30,4	2	13,4
	without	7,423	2,201	29,65	1	12
El Peral	with	**10,12**	3,078	30,41	2	13,4
	without	8,495	1,835	21,6	5,6	12
Kiwi Sur	with	**9,25**	2,816	30,44	3,8	12
	without	6,35	2,037	32,09	1	10

Fig. 1. Kiwi firmness (lbf) with and without Metalosate Calcium application, after 3 months days of controlled atmosphere storage.

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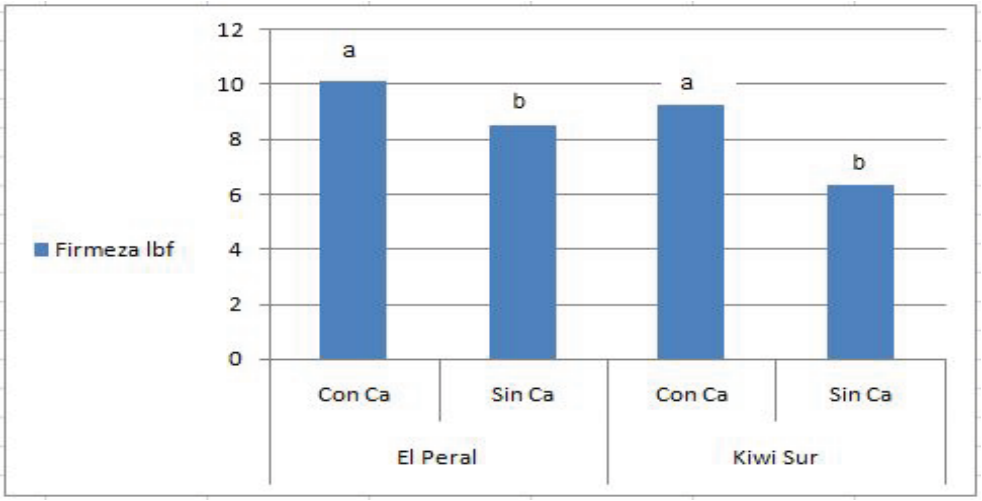
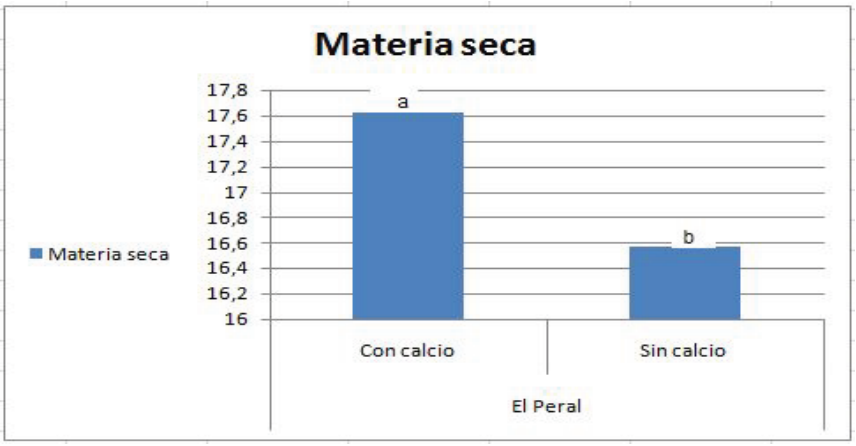


Soluble solids and dry matter evaluation:

At the evaluation after the regular atmosphere storage (14 June), there was observed no clear difference in soluble solids between the treatements. However there was observed significant differences in dry matter values, particularly at El Peral orchard (Table 4 and graph 2).

Table 4: Kiwi dry matter with and without Metalosate Calcium application, after 45 days of regular atmosphere storage. (14 June).

Orchard	Calcium	Average	Standar Deviation	Coefficient of Variation	Minimum	Maximum
Both	with	**17,002**	1,032	6,07	15,05	19,07
	without	16,672	0,808	4,85	14,98	18,61
El Peral	with	**17,618**	0,832	4,72	16,3	19,07
	without	16,574	0,546	3,29	15,36	17,39
Kiwisur	with	**16,386**	0,835	5,09	15,05	17,82
	without	16,769	1,014	6,04	14,98	18,61

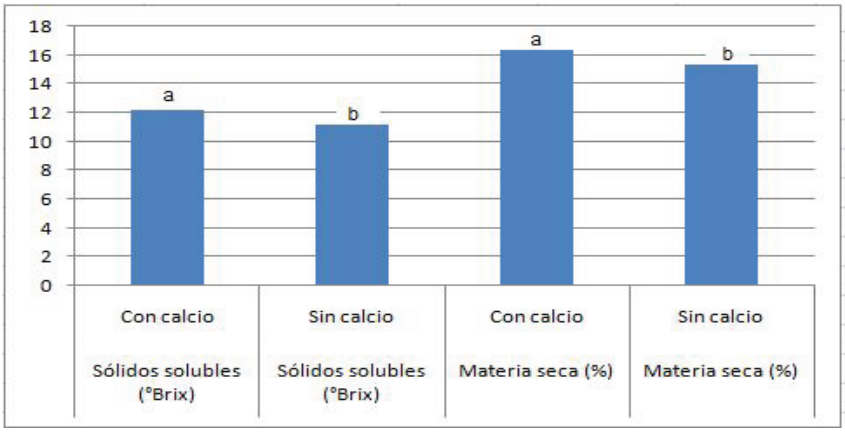


Graph 2. Orchard El Peral: Kiwi dry matter with and without Metalosate Calcium application, after 45 days of regular atmosphere storage. (14 June).

At the evaluation after 3 months of controlled atmosphere storage, there was observed significant differences between the treatments, specially at El Peral orchard (Table 5 and graph 3).

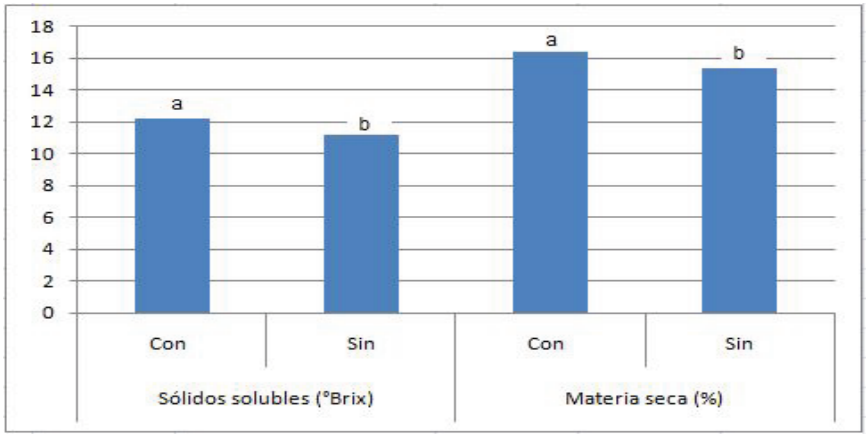
Table 5: El Peral orchard: kiwi soluble solids (°Brix) and dry matter (%), with and without Metalosate Calcium applications, after 3 months of controlled atmosphere storage. (29 July).

Orchard	Calcium	Average	Standar Deviation	Coefficient of Variation	Minimum	Maximum
Soluble solids	with	**12,179**	0,789	6,48	10,84	13,92
	without	11,191	0,806	7,21	9,54	12,92
Dry matter	with	**16,37**	0,555	3,39	14,95	17,49
	without	15,353	0,746	4,86	14,14	17,17



Graph. 3. El Peral orchard: kiwi soluble solids (°Brix) and dry matter (%), with and without Metalosate Calcium applications, after 3 months of controlled atmosphere storage. (29 July).

The same result could be observed analysing all soluble solids and dry matter data at all evalusations at El Peral orchard (grapf 4)



Grapf 4. El Peral orchard: kiwi soluble solids (°Brix) and dry matter (%), with and without Metalosate Calcium applications at all evaluations.

Observations: at Agrícola Kiwi Sur, the fruit presented low firmness due the location where the trial was established, which was lower, more humid and shading. This may had interfered on the low significant results obtained in this orchard.

Mineral analysis:

The mineral analysis was made by Agrolab and has shown a higher calcium level at the fruit treated with Metalosate calcium. (Table 6).

Table 6: Kiwi fruit mineral analysis results with and without Metalosate calcium application.

Identification			Control	Metalosate Calcium
Variety			Hayward	Hayward
Laboratory number			14091	14092
Calcium	(Ca)	mg/100 g	**27,3**	**40,5**
Soluble calcium	(Ca)	mg/100 g	**10,5**	**14,3**
Bound calcium	(Ca)	mg/100 g	**16,8**	**26,2**

Boron	(B)	mg/100 g	0,37	0,4
Soluble boron	(B)	mg/100 g	0,7	0,81
Bound boron	(B)	mg/100 g	0	0
Dry matter		%	14,8	15,9
Analysis of fresh fruit and expressed in mg/100g f.fresh				

CONCLUSIONS

Metalosate Calcium application retarded the softening of kiwi fruit after storage. The effect was more significant the more time of storage the fruit was submitted for. Metalosate Calcium treatment increases kiwi shelf life. This result is very relevant due the fact that other treatments to retard ripenig that are normally applyed is post harvest (E.g: modified atmosphere, controlled atmosphere, 1-MCP, sucrose esteres, etc.), have a positive effect, but only for a short period of time. After some time stored the differences between fruits that received these traditional treatments and fruits not treated reduces until disappear. At the same time these traditional treatments can generate adverse effects such as preventing the fruit to ripe correctly, not allowing the fruit to express all its flavor potential. (some adverse effects: hard columella, plain flavor, aqueous flesh, uneven softening, etc.).

Kiwi fruits treated with Metalosate Calcium have also shown significant higher dry matter than no treated fruits. This represent a very positive effect related to the better flavor of the fruit, which becomes more gradually more important in the market.

Metalosate calcium application is a very good option to increase kiwi shelf life, without having the adverse effects of the current post harvest treatments. This is the result of one season with one Metalosate Calcium application, so it is important to keep evaluating its effect with one or more applications per season.

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