CALCIUM APPLICATIONS TO DELAY SOFTENING OF KIWI FRUIT 2011-2012

In kiwi fruits, like most of fruits, firmness in storage is related to the fruit calcium concentration and some other disorders associated to its deficiency in the fruit.
Previous studies have demonstrated that during the early development stages of the fruit, there is a calcium increment that soon decreases until the middle of fruit development, where the calcium upward movement it is completely ceased, however the fruit keeps growing until the harvest (Dichio *et al.*, 2003).

In several studies it is established that calcium has a significant role in the cell wall firmness and cell cohesion, what occurs in a large number of species, including kiwi (Hopkirk *et al.*, 1990).

Calcium transportation to the fruits is exclusively through xylem transpiration flow and it is not mobile in the phloem (Xiloyannis *et al*., 2001; Dichio *et al.*, 2003).
Consequently fruits are tissues that are not well supplied with calcium, because its transpiration rate is lower compared to the leaves (Ferguson y Watkins, 1989; citados por Gil 2000).

Calcium applications in post harvest:
Previous studies have demonstrated that CaCl2 post harvest applications, in kiwi variety Hayward, increase the calcium content at the pericarp, columella and skin up to 200%, what have decreased the softening rate compared to the control (0%). The shelf life was also significantly increased in the treated fruits.

Applications:
Three Metalosate products, calcium, magnesium and boron based, were applied:
Orchard: Señor Alberto Correa (Fundo Miraflores s/n Codegua)
Fulll bloom date: 13-14 of November.

Aplication rates:
Metalosate Calcium: 1,5 lt/ha
Metalosate Magnesium: 1,0 lt/ha
Metalosate Boron: 0,5 lt/ha

Application dates:
1º Application: November 19th
2º Application: November 26th
3º Application: December 03rd
The plot 4 received the treatment between the row 1 and 14. The rest of the plot was the control.
The fruit evaluations were made every month starting at December 1st. Firmness, soluble solids and dry matter were evaluated.

Results

In the first three evaluations there were no significant differences between the treatment and the control, but from the March evaluation, it was observed significant differences in firmness:

Fruit treated with Calcium + Magnesium + Boron

March 2012	Soluble solids ºBrix	Dry Matter %	Firmness pounds
Treatment	4,5	14,3	21,1
Control	4,4	14,7	19,1

In April evaluation, there was not observed differences in firmness, but it was observed effect on dry matter.

Fruit treated with Calcium + Magnesium + Boron

April 2012	Soluble solids ºBrix	Dry Matter %	Firmness pounds
Treatment	6,1	15,7	16,9
Control	5,5	14,9	16,9

The evaluations made in May and after demonstrated higher firmness of the treated fruits, what is confirmed by the statistics analysis. There were no differences in soluble solids and dry matter.

Fruit treated with Calcium + Magnesium + Boron

May 2012	Soluble solids ºBrix	Dry Matter %	Firmness pounds
Treatment	9,0 a	16,2 a	13,5 a
Control	9,9 a	16,8 a	12,4 b

Fruit treated with Calcium + Magnesium + Boron

June 2012	Soluble solids ºBrix	Dry Matter %	Firmness pounds
Treatment	9,5 a	15,9 a	12,8 a
Control	9,8 a	15,8 a	11,9 b

Fruit treated with Calcium + Magnesium + Boron

October 2012	Soluble solids ºBrix	Firmness pounds
Removal of CA		
Treatment	11,53 a	12,81 a
Control	11,63 a	11,63 b

After the fruits left the controlled atmosphere, they were left at ambient temperature for 20 days. The following table demonstrates that the treated fruits were firmer and with less incidence of post harvest rots, lateral and peduncular.

Fruit treated with Calcium + Magnesium + Boron

After 20 days ambient Tº	Soluble solids ºBrix	Dry Matter %	Firmness pounds
Treatment	10,6 a	4,9 a	18 a
Control	11,8 b	1,5 b	31 b

Conclusions

Base on the results, it can be concluded that calcium (associated to magnesium and boron), keep the kiwi fruit firm for longer. The softening rated was reduced by 20% compared to the control. This can be observed at 0ºC and ambient temperature.
It was observed less post harvest rots, lateral and peduncular, in the fruits kept in the ambient temperature. No se observó un efecto claro sobre la materia seca o los sólidos solubles.
Definitively, the application of this Calcium, Magnesium and Boron has an effect comparable to the ripening blocker such as 1-MCP, retarding the softening of the kiwi fruits at 0ºC and at ambient temperature, besides it reduces the post harvest rots.

Literature

DICHIO, B.; REMORINI, D. and LANG, S. 2003. Developmental changes in xylem functionality in kiwifruit fruit: implications for fruit calcium accumulation. Acta Horticulturae. 610: 191-195.
GIL, G. 2000. La producción de fruta. Universidad Católica de Chile. Santiago. 583 p.
HOPKIRK, G.; HARKER, F. and HARMAN; J. 1990. Calcium and the firmness of kiwifruit. New Zealand Journal of Crop and Horticultural Science. 18(4): 215-219.
XILOYANNIS, C.; CELANO, G.; MONTANARO, G.; DICHIO, B.; SEBASTIANI, L. and MINNOCCI, A. 2001. Water relations, calcium and potassium concentration in fruits and leaves during annual growth in mature kiwifruit plants. Acta Horticulturae. 564: 129