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## **Walnut Report from Chile:**

### **Applying monosilicic acid and catalysts to walnut trees to enhance the quality and out-put of walnuts.**

#### **I. Introduction**

2011, Agricultural Los Nogales, located on the road to Vicuña, owned by Mr. Marcelo Ancarola, producer of Pisco grapes, lemons and walnuts, I learned that an interesting trial was conducted by Mr. Ancarola on some of his grapevines.

They were testing among other things the effects of: ZumSil, a monosilicic acid, ComCat, a bio-stimulant of German origin and Lithovit, a micronized calcium which is applied via foliar, also from Germany.

At the end of the season they had very good feedback from the application of these Products, and the following year, season 20122013 the above Products were included in the management of the entire farming areas of: walnuts, lemons and vines.

During the season we paid special attention to the walnut orchard, since the area was –and still is- affected by drought, limiting the amount of irrigation and with water having a high salt content.

To our surprise, we noticed that these limitations (limited irrigation with salty waters) had neither an effect on the production or on the

vegetative growth of the walnut trees. We were also amazed to see how large and deeply green the leaves of the trees were.

As a consequence of these observations, we decided to test these same Products in other Regions; to observe what would be the behavior in different types of soils, climatic and agronomic conditions.

## II. Tests performed

Based on the program implemented in Agricultural Los Nogales, the following programs were applied:

### Program 1

Aplicación	Producto	Pre Brotación	Brotación	Cuaja	Llenado de Pulpa	Total
Riego	ProGrow 908	0,5 L		0,5 L		1 L
Foliar	ProGrow 908			0,5 L	0,5 L	1 L
	CombiPlus			0,1 Kg	0,1 Kg	0,2 Kg
	LithoVit				1 Kg	1 kg

### Program 2

Aplicación	Producto	Pre Brotación	Brotación	Cuaja	Llenado de Pulpa	Total
Foliar	ProGrow 908			0,5 L	0,5 L	1 L
	CombiPlus			0,1 Kg	0,1 Kg	0,2 Kg
	CleanVita-KO 56				1 Kg	1 kg

Program 1 was applied in the area of Salamanca and the Los Andes.

Program 2 was applied in the areas of Mulchen and San Esteban

In Salamanca and Los Andes, we noticed a better vegetative expression, bigger and deeper green leaves, more vigorous growth, a lower effect of heat stress due to the high temperature and an increase in walnut size was also observed.

As to the quality indicators, greater weight per unit (nut) and better color was observed. After harvesting, it was observed that the test plants had greener leaves than the untreated plants. This means that the treated trees were in much better physical conditions.

In the Garden of Los Andes, nutritional monitoring was also conducted, which evidenced significant differences in the uptake of macro and micro elements as outlined in the following Table of foliar analysis:

### **Table No. 1 Control Area**

Elemento	Interpretación del análisis foliar		Observaciones
<b>Nitrógeno</b>	Niveles de referencia: % Nivel analítico: 3,03 %		Contenido normal en nitrógeno.
<b>Cloruros</b>	Niveles de referencia: ppm Nivel analítico: 3438 ppm		Contenido excesivo en cloruros, la planta acumula cantidades muy elevadas de este elemento. Riesgo de fitotoxicidad.
<b>Fósforo</b>	Niveles de referencia: % Nivel analítico: 0,16 %		Contenido normal en fósforo.
<b>Calcio</b>	Niveles de referencia: % Nivel analítico: 2,85 %		Contenido en calcio excesivo.
<b>Magnesio</b>	Niveles de referencia: % Nivel analítico: 0,65 %		Contenido normal en magnesio.
<b>Potasio</b>	Niveles de referencia: % Nivel analítico: 2,58 %		Contenido normal en potasio.
<b>Sodio</b>	Niveles de referencia: ppm Nivel analítico: 152 ppm		Contenido en sodio normal, la planta acumula muy bajas cantidades de este elemento.
<b>Azufre</b>	Niveles de referencia: % Nivel analítico: 0,17 %		
<b>Boro</b>	Niveles de referencia: ppm Nivel analítico: 294,9 ppm		Contenido en boro excesivo.
<b>Hierro</b>	Niveles de referencia: ppm Nivel analítico: 297,37 ppm		
<b>Manganeso</b>	Niveles de referencia: ppm Nivel analítico: 632,2 ppm		Contenido en manganeso excesivo.
<b>Cobre</b>	Niveles de referencia: ppm Nivel analítico: 13,5 ppm		Contenido normal en cobre.
<b>Zinc</b>	Niveles de referencia: ppm Nivel analítico: 58,5 ppm		Contenido en zinc excesivo.

**Table No. 2 Test Area**

Elemento	Interpretación del análisis foliar	Observaciones
<b>Nitrógeno</b>	Niveles de referencia: % Nivel analítico: 3,25 % 	Contenido normal en nitrógeno.
<b>Cloruros</b>	Niveles de referencia: ppm Nivel analítico: 3332 ppm 	Contenido excesivo en cloruros, la planta acumula cantidades muy elevadas de este elemento. Riesgo de fitotoxicidad.
<b>Fósforo</b>	Niveles de referencia: % Nivel analítico: 0,14 % 	Contenido normal en fósforo.
<b>Calcio</b>	Niveles de referencia: % Nivel analítico: 3,06 % 	Contenido en calcio excesivo.
<b>Magnesio</b>	Niveles de referencia: % Nivel analítico: 0,65 % 	Contenido normal en magnesio.
<b>Potasio</b>	Niveles de referencia: % Nivel analítico: 2,03 % 	Contenido normal en potasio.
<b>Sodio</b>	Niveles de referencia: ppm Nivel analítico: 264 ppm 	Contenido en sodio normal, la planta acumula bajas cantidades de este elemento.
<b>Azufre</b>	Niveles de referencia: % Nivel analítico: 0,16 % 	
<b>Boro</b>	Niveles de referencia: ppm Nivel analítico: 231,5 ppm 	Contenido en boro excesivo.
<b>Hierro</b>	Niveles de referencia: ppm Nivel analítico: 275,20 ppm 	
<b>Manganeso</b>	Niveles de referencia: ppm Nivel analítico: 289,8 ppm 	Contenido normal en manganeso.
<b>Cobre</b>	Niveles de referencia: ppm Nivel analítico: 14,9 ppm 	Contenido normal en cobre.
<b>Zinc</b>	Niveles de referencia: ppm Nivel analítico: 66,4 ppm 	Contenido en zinc excesivo.

7% more nitrogen, 4% less chlorides, 13% more zinc, 23% of potassium,

0.02% phosphorus.

In trials at Mulchen and San Esteban, changes in leaf color were very evident besides vegetative growth.

Given the obtained results, we concluded that in order to achieve the desired effect of the Products on the metabolism of the trees, the ideal program should incorporate both irrigation and foliar applications. Also according to the harvest results, expressed in tons/ha. , what were the needs of this crop for each of the Products in the Program.

During the 2013 - 2014 seasons, the following program was applied in orchards located in the 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and Metropolitan Region.

### Program 3

Aplicación	Producto	Brotación	Cuaja	Crecimiento de calibre	Llenado de Pulpa	Total
Riego	ProGrow 908	1 L		1 L		2 L
	ProGrow 908			2 L		2 L
Foliar	CombiPlus			0,1 Kg	0,2 Kg	0,3 Kg
	CleanVita KO 56			1 Kg	2 Kg	3 kg

This program was structured according to the synergistic effect of the combination of the products; focusing on strengthening the plant's

physiology during its growth stages thus mitigating climatic factors that deteriorate the final quality of the walnuts.

The initial stage is very important because by enhancing the increase of nut's caliper, a positive 20 % increase in output weight can be obtained, which is a decisive and important final outcome of the production unit.

This stage occurs from October to January where walnuts develop mainly in size, which also affect the physiological fibers of the wood and its buds, readying them for the following season. These processes will determine the number of flowers per bud and / or their quality.

The stage of nut filling is the stage in which an additional increase between 2 and 4 % of the final weight of the walnut can be influenced by the effect of the Products.

At this stage the color of the nuts is also determined, that is a very important selling element. However, exposure to excessive temperature, combined with limited irrigation with poor quality water, can seriously damage the quality of the nuts.

### Optimal conditions

Photographs No. 1- 2 show walnuts, Chandler variety, expressing a very good development: 7 walnuts for each flowering point and excellent color. This is achieved in productive sectors with low temperature stress load, resulting in good vegetative expression.

Picture No. 1 Picture No. 2



### **General Conditions of the test area**

When there are adverse conditions, not only does the quality of the current season decrease, but the quality and differentiation of flowers for the next season can also decline. In picture No. 3, the color condition shown is of a walnut that was shaded, yet was still negatively impacted by high temperatures. Photo No. 4 shows the color effects suffered by walnuts exposed to the sun.



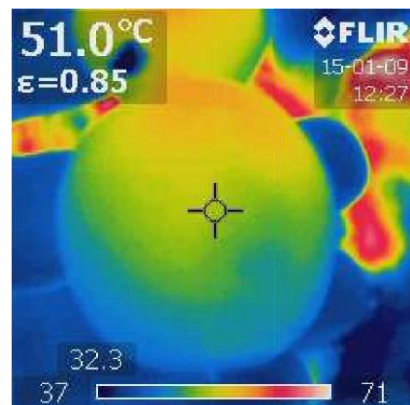
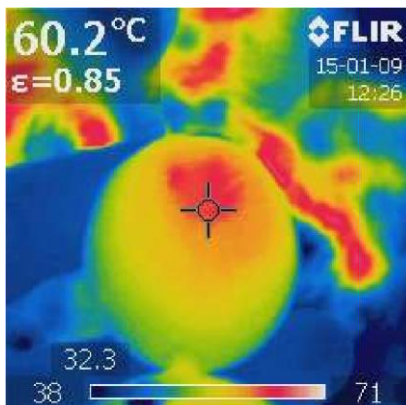
**Photo No. 3 Picture No. 4**



It is proven that high stress conditions, like those effecting these trees, such as prolonged high temperatures and water shortages cause decreases the quality of color and quantity of production.

Photo No. 5 and 6 are thermal images of nuts exposed to sunlight.

**Picture #5 Picture #6**



Due to drought conditions, the gardens have been irrigated by approximately 30% less than normal, due to the drought irrigation than normal. Data obtained via a Cholander pump showed that it ranged between 13.5 and 16 bars. Confirming the levels of hydric stress, the trees were under.

Picture No. 7 shows the worst physiological stress scenario with abortion units, approximately 200-300 kg per ha, corresponding to tree nuts that are not able to be maintained due to overheating.

**Photo No. 7**



Photo No. 8 walnut high degree of dehydration in embryo, thus it begins to abort, as the tree can't withstand the high temperature stress. Photo No. 9 Walnut with sun exposure, completely dehydrated.

### Photo No. 8 Photo No. 9



### North Verde Agricultural Results

Located in Salamanca, Region IV, a drought has effected the area for 10 years. Program No. 3 (page No. 5) was applied with the main objective of maintaining desired quality factors, while decreasing stress levels, i.e., increasing cell wall thickness, improving photosynthesis via increased CO<sub>2</sub> concentrations, thereby increasing foliar efficiency thresholds during this period, even with closed stomata. The catalyst, which operates during energy synthesis is extremely important, because it could advance the phonological cycle of the plant by approximately 15%.

In Salamanca it was concluded broadly that the harvest had normal results in terms of size and quality, however during the season 20% of hydric loss was recovered. It should be considered though, that these are light soils with constant prevailing winds, which are very negative in hydric terms.

Table No. 1 Average demand for water evaporation in the sector for growing walnuts and the percentage of water replenishment:

	Salamanca	Demand	REP
2014	October	7,59	26%
	November	9,48	21%
	December	10,2	20%
2015	January	11,1	18%
	February	10,84	18%
	March	7,5	27%

## Photos of the Garden:

Picture No. 10 Picture No. 11



The trees have good color and vigor, large leaves, without second vegetative growth, without loss of yellow leaves, and not physically showing effects of water stress.

Nuts harvested photos 12 and 13, show good commercial factors considering the irrigation regime the trees had:

Caliper size ranged from medium to large, averaging 57% filled pulp/shell ratio. For the variety (Serr), it is equal to 570 grams of pulp per kilo of walnut shell, which observing table No 1, is absolutely unthinkable.

**Picture No. 12 Picture No. 13**



Picture 14 corresponds to harvested nuts which are uniform in color and caliper size.

### **Remarks Post Harvest**

Photo No 14, 15 and 16 product structures that did not diminish its vigor despite water stress, excess soil temperature and light.

**Photo N ° 14**



**Photo No. 15**



**Photo No. 16**



**Comments:**

The results described above were obtained via the North Green company for the trial in the worst conditions, in the other orchards similar results and/or better ones were observed.

Producers that used the strategy, commented that they did not remember having had similar experiences before, with such good results or with agents who were so visible and provided answers on such short notice.

## **CONCLUSION:**

The joint use of monosilicic acid (ProGrow 908) in conjunction with a bio stimulant (CombiPlus) and a CO<sub>2</sub> foliar (CleanVita KO56), decreases the effect of water stress and high temperatures on the quality of the nuts harvested in orchards suffering under these conditions; achieving quality harvests showing size, color and orchards fill similar to those produced by trees growing under normal conditions.

When taking into account the lack of water, soil type, the average extraction degree by the weather station of the field and the result of export quality product; the strategic application of the synergistic products, ProGrow 908, CombiPlus and CleanVita KO 56 can be considered a resounding success.

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Los Andes, August 8, 2015