METALOSATE® TRIALS IN CHILE

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Tattersall Comercial S.A., based in Santiago Chile, became an official distributor for Albion® Metalosate® products during the 2006-2007 growing season. This paper will give a brief overview of Tattersall and its relationship with Albion®, the market conditions and potential of Chile as a country, and a few field trials that Tattersall conducted on blueberries, artichoke, table grapes, cherries, processing tomatoes, and peaches.

Tattersall was founded in 1913 and today is a holding company with investments in livestock trading, agricultural inputs and equipment, vehicle leasing, capital goods, real estate, and heavy machinery. The agricultural division sells agrochemicals, fertilizers, seeds and farm implements, and has branch offices in several regions covering most of the central and southern agricultural districts.

Due to the highly competitive nature of this industry, many companies have disappeared from the market. One of the survival strategies is to develop specialty lines of products with exceptional service and product support that allow companies to charge an attractive margin in order to stay in business. Tattersall was starting to develop a department of specialty products in 2005 when they were approached by Albion® as a possible distributor.

The concept of the Metalosate® products and T.E.A.M.® analysis was very appealing. After seeing some of the results of the initial trials, Tattersall incorporated the Metalosate® products as its flagship of specialty products.

Tattersall has 4 agronomists dedicated exclusively to the development of Metalosate® products, and technical support for the more than the 60 in-house sales agronomists and several sub-distributors throughout the country. The first season, Tattersall was able to sell 25,000 liters (6,614 gallons). Tattersall is a little more than half way through its second season and has sold more than 60,000 liters (15,873 gallons) to date.

Table 1
Chile's Agricultural Sector and Market Potential

	Million Hectares	Million Acres
Total land surface area	75.0	185.3
Land Use		
Arable	5.1	12.6
Forestry	15.9	39.3
Livestock	8.5	21.0
Protected wild lands	14.6	36.1

Total agricultural exports including forestry products and salmon exceed 7 billion US dollars.

Table 2
The Cultivated-Land Break Down in Chile

Crops	Hectares	Acres
Annual Crops	727,210	1,796,209
Fruits	221,915	548,130
Vegetables	120,000	296,400
Vineyards	144,571	357,090
TOTAL	**1,213,696**	**2,997,829**

Table 3
Principle Agricultural Crops
Agriculture Area by Main Species in Chile
2005-2006

Annual Crops	Hectares	Acres	Fruit	Hectares	Acres
Wheat	290,000	716,300	Table Grape	50,000	123,500
Corn	135,000	333,450	Apples	36,000	88,920
Oats	80,000	197,600	Avocados	30,000	74,100
Potato	56,000	138,320	Berries	18,000	44,460
Sugar Beet	31,000	76,570	Plums	16,000	39,520
Rice	25,000	61,750	Peaches	14,000	34,580
Lupine	25,000	61,750	Olives	12,000	29,640
Beans	24,000	59,280	Nuts	11,000	27,170
Barley	22,000	54,340	Pears	9,000	22,230
Canola	15,000	37,050	Oranges	9,000	22,230
Tobacco	2,800	6,916	Lemons	8,000	19,760
			Cherries	8,000	19,760
			Kiwis	7,000	17,290
			Nectarines	7,000	17,290
			Almonds	7,000	17,290

Table 4 shows how Chile ranks in the Southern Hemisphere and in the world with a few of the fresh fruit crops.

Chile has tremendous potential for high-quality products that can help this industry increase yields, quality, and shelf life.

Table 4
How Chile is Ranked in Production of Fresh Fruit Species

Species	Southern Hemisphere	World
Table Grapes	1st	1st
Apples	1st	4th
Plums	1st	1st
Peaches/Nectarines	1st	5th
Pears	1st	6th
Kiwis	2nd	2nd
Avocados	1st	2nd
Blueberries	1st	5th
Raspberries	1st	3rd

Blueberry Nursery Trial

Normally, blueberry plants take 7 months to be large enough to be transplanted into the field. This trial was designed to see the effect of multiple applications of Metalosate® Crop-Up®. The objective was to see if the time required to produce a plant could be reduced with better root and foliage development.

Three beds were selected and received an application of Metalosate® Crop-Up® in a 1% solution on Dec 5th, 2006. On Dec 12, 2007, a second application was made on beds 2 and 3, and on Dec 19th, a third application was made to bed #3. Pictures of the beds were then taken on January 15, 2007.

Figure 1. Bed #1 with One Application of Metalosate® Crop-Up® in a 1% Solution.

Figure 2. Bed #2 with 2 Applications, One Week Apart, of Metalosate® Crop-Up® at a 1% Solution.

Observations and Discussion

The time required to produce a plant was reduced from 7 months to 3 months. This allows the greenhouse to produce 2 crops per year in the same amount of space.

The 3 applications caused some plants to grow so fast that they shaded other plants. Separation of plants according to size during this rapid growth is necessary to avoid shading. It was observed that any cutting with green tissue responded to the Metalosate® Crop-Up® applications.

It is interesting to note that leaf analyses showed high levels of manganese, and yet Metalosate® Crop-Up® contains a significant amount of manganese (2.5%). Studies have shown that manganese has several valences from Mn +2 to Mn +5. The only biologically available form of Mn is the +2. It is theorized that the Mn shown in the leaf analysis is not available, thus the response observed in this trial. Similar observations have been made in mango and kiwi crops. This same phenomenon has been observed with iron. There are 2 forms, the ferrous +2 and the ferric +3. A leaf analysis cannot distinguish between the ferric and

ferrous forms, yet the plant can only use the ferrous form. There is still a lot of research that needs to be done. The empirical observations show that Metalosate® Crop-Up® greatly improves root growth, foliage development, and plant growth.

Figure 3. Bed #3 with 3 Applications of Metalosate® Crop-Up®, One Week Apart, at a 1% Solution

Figure 4. Root Development of 3 Different Applications, Starting from Left to Right, 1 Application, 2 Applications, and 3 Applications of Metalosate® Crop-Up® in a 1% Solution.

Processing Peach Trial

Farmers are constantly looking ways to improve shelf life and firmness of fruit. At times, the processing plant cannot keep up with the volume of peaches picked during the day and the peaches have to wait until there is space available. Often the fruit that has to wait more than 24 hours is rejected.

In this trial, three applications of Metalosate® Calcium were applied at 1 L/Ha (14 fl. oz./acre) per application 40 days, 30 days, and 20 days before harvest on the Ross variety processing peach. This was compared with the grower standard applications of 2 L/Ha (27 fl. oz./acre) of a calcium carboxylic acid product that was applied 3 times at 40 days, 30 days, and 20 days before harvest.

Fruit calcium levels were measured at harvest, and fruit was randomly selected from bins from the grower standard treatment and from the Metalosate® Calcium treatment. This fruit was placed in a warehouse without cooling, and pictures were taken 1 week and 2 weeks after harvest to compare rates of breakdown between the 2 treatments.

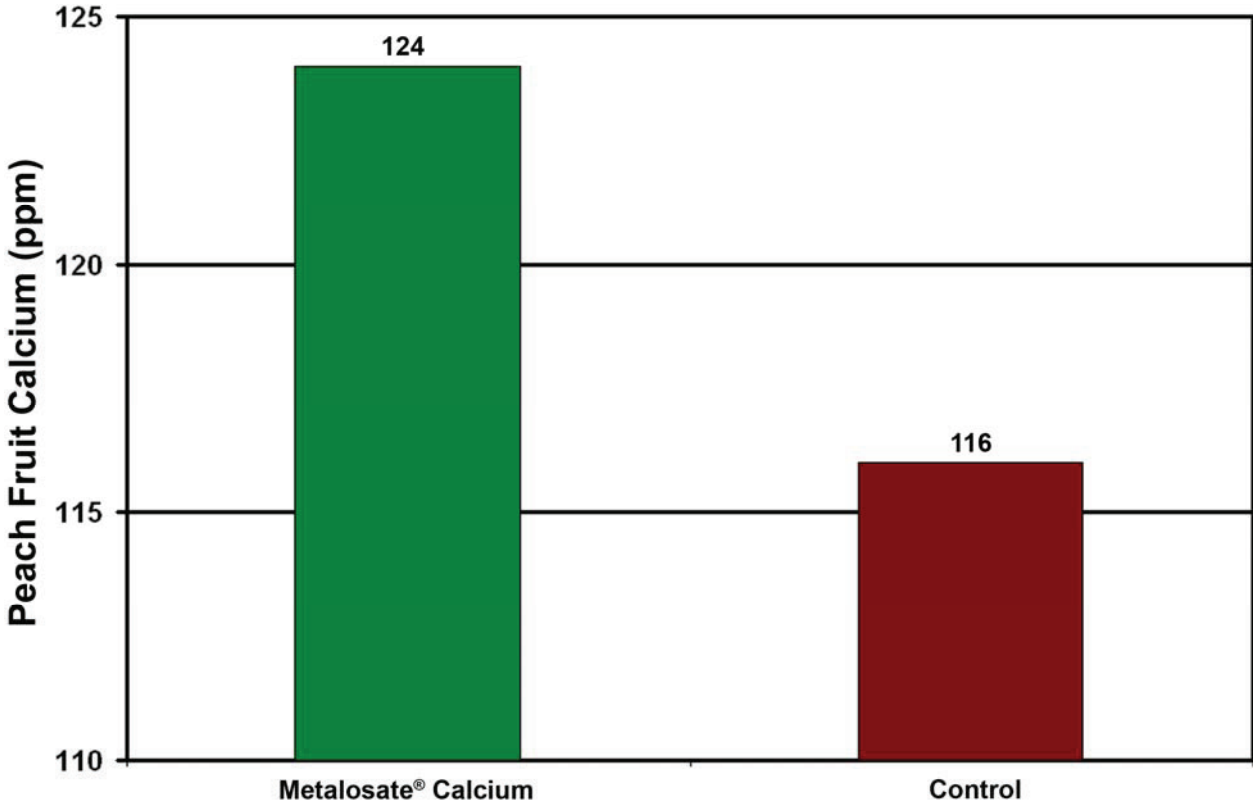


Figure 5. Peach Fruit Calcium Levels. Effect Of Metalosate® Calcium Spray On Total Calcium Fruit vs Control Treatment in Processing Peaches. Farmer: Agrícola Cerro Mauco Ltda., (Location: San Felipe - V Región)

The Metalosate® Calcium trials showed an increase in fruit calcium levels, which resulted in slower breakdown, compared to the carboxylic acid calcium treatments. Similar trials have been conducted on fresh eating peaches in Mexico where shelf life has been doubled.

Figure 6. Peach breakdown after one week: Metalosate® Calcium (left), Treated Control (right). Farmer: Agrícola Cerro Mauco Ltda., Harvest date: 13 Feb 2007, Picture date: 19 Feb 2007

Figure 7. Peach breakdown after 2 weeks: Metalosate® Calcium (left), Treated Control (right). Picture date: 1 Mar 2007

Calcium Trial in Artichoke

Floral head damage in industrial artichokes from lack of calcium causes significant losses to the industry. This trial was conducted to measure the effect of Metalosate® Calcium on the calcium content in the floral heads. Table 5 shows the effect on calcium levels in the artichoke floral heads with one application of Metalosate® Calcium and Metalosate® Magnesium

Figure 8. Damage From Lack Of Calcium in Floral Heads
Farmer: Agricola HyC Ltda, **Location:** La Serena, **Variety:** Argentino

Table 5
Field Trial on Artichokes

Treatment	Ca %	Mg %
Metalosate® Program	1.40	0.26
Control	0.42	0.25

Metalosate® Program: *One spray of 1 L/Ha (14 fl. oz./acre) each of Metalosate® Calcium and Metalosate® Magnesium*
Control: *EDTA*

Figure 9. Artichokes

Floral-head calcium levels significantly increased from one application of Metalosate® Calcium and Metalosate® Magnesium, compared to the growers' standard practice.

Metalosate® Trial with Processing Tomatoes

One of the largest tomato processors in Chile (Corpora Ltda) allowed Albion® and another company to present a foliar program and compare it with its standard practice in a commercial field trial. The other company has a line of carboxylic acid foliar nutrients. Table 6 shows the Metalosate program incorporated with the regular fungicide and pesticide program.

The company made several laboratory and field measurements as summarized in Table 7.

The more important difference is shown the financial analysis as summarized in Table 8.

Discussion

Even though the Metalosate® program was more expensive per hectare, the net return to the grower was US $1,653 per hectare ($669 per acre) more than the standard program and $1,510 more per hectare ($611 per acre) than the program with carboxylic acid.

Table 6
Albion® Metalosate® Foliar Program Applications on Processing Tomatoes

Application	Days between Applications	Days after Transplanting	Name	Dose		Function
				cc/Ha	fl. oz./acre	
1	8 days	8 days	Tamaron	200.00	2.74	Insecticide
			Mastercoop	150.00	2.05	Fungicide
			Metalosate® Multimineral	300.00	4.11	Nutrient
			Induce	25.00	0.34	Surfactant
2	12 days	20 days	Baythroid	75.00	1.03	Insecticide
			Tatoo	750.00	10.26	Fungicide
			Metalosate® MZ	500.00	6.84	Nutrient
			Induce	40.00	0.55	Surfactant
3	15 days	35 days	Tamaron	300.00	4.11	Insecticide
			Fosfimax	500.00	6.84	Fungicide
			Metalosate® Multimineral	500.00	6.84	Nutrient
			Metalosate® Tropical	500.00	6.84	Nutrient
			Induce	50.00	0.68	Surfactant
4	17 days	52 days	Confidor Forte	150.00	2.05	Insecticide
			Citocur	300.00	4.11	Fungicide
			Metalosate® Zinc	300.00	4.11	Nutrient
			Metalosate® Calcium	500.00	6.84	Nutrient
			Induce	50.00	0.68	Surfactant
5	17 days	69 days	Vertime C	300.00	4.11	Insecticide
			Amistar	100.00	1.37	Fungicide
			Metalosate® Multimineral	500.00	6.84	Nutrient
			Metalosate® Calcium	500.00	6.84	Nutrient
			Induce	75.00	1.03	Surfactant
6	17 days	86 days	Baythroid	300.00	4.11	Insecticide
			Bravo	1500.00	20.53	Fungicide
			Metalosate® Multimineral	300.00	4.11	Nutrient
			Metalosate® Calcium	500.00	6.84	Nutrient
			Metalosate® Potassium	500.00	6.84	Nutrient
			Induce	75.00	1.03	Surfactant
7	17 days	103 days	Vertime C	500.00	6.84	Insecticide
			Amistar	125.00	1.71	Fungicide
			Metalosate® Potassium	1000.00	13.68	Nutrient
			Induce	100.00	1.37	Surfactant
8	17 days	120 days	Methomex	400.00	5.47	Insecticide
			Bravo	2000.00	27.37	Fungicide
			Metalosate® Potassium	1000.00	13.68	Nutrient
			Induce	100.00	1.37	Surfactant

Table 7
Effect of Metalosate® Foliar Spray Program on Processing Tomatoes

Laboratory Measurement	Carboxylic Acid	Metalosate®	Control
Brix (soluble solids)	4.9	4.7	4.6
Color	2.39	2.12	2.27
pH	4.42	4.43	4.4
Weight (g)	86.7 g (3.1 oz)	82.1 g (2.9 oz.)	86.4 g (3.0 oz.)
Field Measurement			
Yield	75.6 metric ton/Ha (33.7 ton/acre)	101.2 metric ton/Ha (45.1 ton/acre)	73.2 metric ton/Ha (32.7 ton/acre)
Green harvest	13.6 %	5.3%	11.2%
Brix	3,702 kg/Ha (3,303 lbs./acre)	4,753 kg/Ha (4,240 lbs./acre)	3,366 kg/Ha (3,003 lbs./acre)

Table 8
Financial Result of Metalosate® Foliar Spray Program on Processing Tomatoes

Treatment	Yield MTon/Ha (Ton/Acre)	Differential MTon/Ha (Ton/Acre)	Metalosate® Program US$/Ha US$/Acre	Harvest Cost US$/Ha US$/Acre	Total Cost US$/Ha US$/Acre	Income US$/Ha US$/Acre	Additional Income US$/Ha US$/Acre
Control	73.2 (32.7.)	0	0	1,537 (622)	1,537 (622)	4,335 (1,754)	0
Carboxylic acid program	75.6 (33.7)	2.4 (1.1)	42 (17)	1,629 (659)	1,629 (659)	4,478 (1,812)	143 (58)
Metalosate® program	101.2 (45.1)	28.0 (12.5)	169 (68)	2,123 (859)	2,292 (928)	5,988 (2,423)	1,653 (669)

** Harvest Cost : US$ 21/MTon ($19/Ton)*
*** Price Ton processing tomato: US$ 59.23 MTon ($53.73/Ton)*

Metalosate® Cherry Field Trial Copefrut Export Season 2006-2007

Copefrut is the largest sweet cherry cooperative in Chile and has a full research department dedicated to improving cherry qualities and yields for its members.

Copefrut allowed Tattersall to implement a Metalosate® program two different growers and then measured the results against the growers' standard program. Copefrut also measured stem and fruit levels of nutrients to see if there is a correlation between levels of microelements in these structures and quality. This is an ongoing trial that will be repeated for three seasons.

Size is one of the most important factors on the price the grower receives.

The Metalosate® program was designed to fulfill the different nutrient demands at different phenological stages of growth.

Table 9
Metalosate® Cherry Program

 Figure 10. Green tip	Metalosate® Magnesium 300 cc/ha (4.11 fl. oz./acre) + Metalosate® Zinc 250 cc /ha (3.42 fl. oz/acre)
 Figure 11. Pre-Bloom	Metalosate® Calcium 500 cc/ha (6.84 fl. oz./acre) + Metalosate® Boron 250 cc/ha (3.42 fl. oz/acre)
 Figure 12. Petal Fall	Metalosate® Calcium 700 cc/ha (9.58 fl. oz./acre) + Metalosate® Boron 250 cc/ha (3.42 fl. oz/acre)
 Figure 13. Shuck Fall	Metalosate® Magnesium 500 cc/ha (6.84 fl. oz./acre) + Metalosate® Zinc 250 cc/ha (3.42 fl. oz/acre)
 Figure 14. Straw	Metalosate® Calcium 700 cc/ha (9.58 fl. oz./acre) + Metalosate® Boron 250 cc/ha (3.42 fl. oz/acre)+ Metalosate® Potassium 1000 cc/ha (13.68 fl. oz./acre)

Size Shift with Metalosate® Program

The first year's results show a significant shift to the larger size fruit.

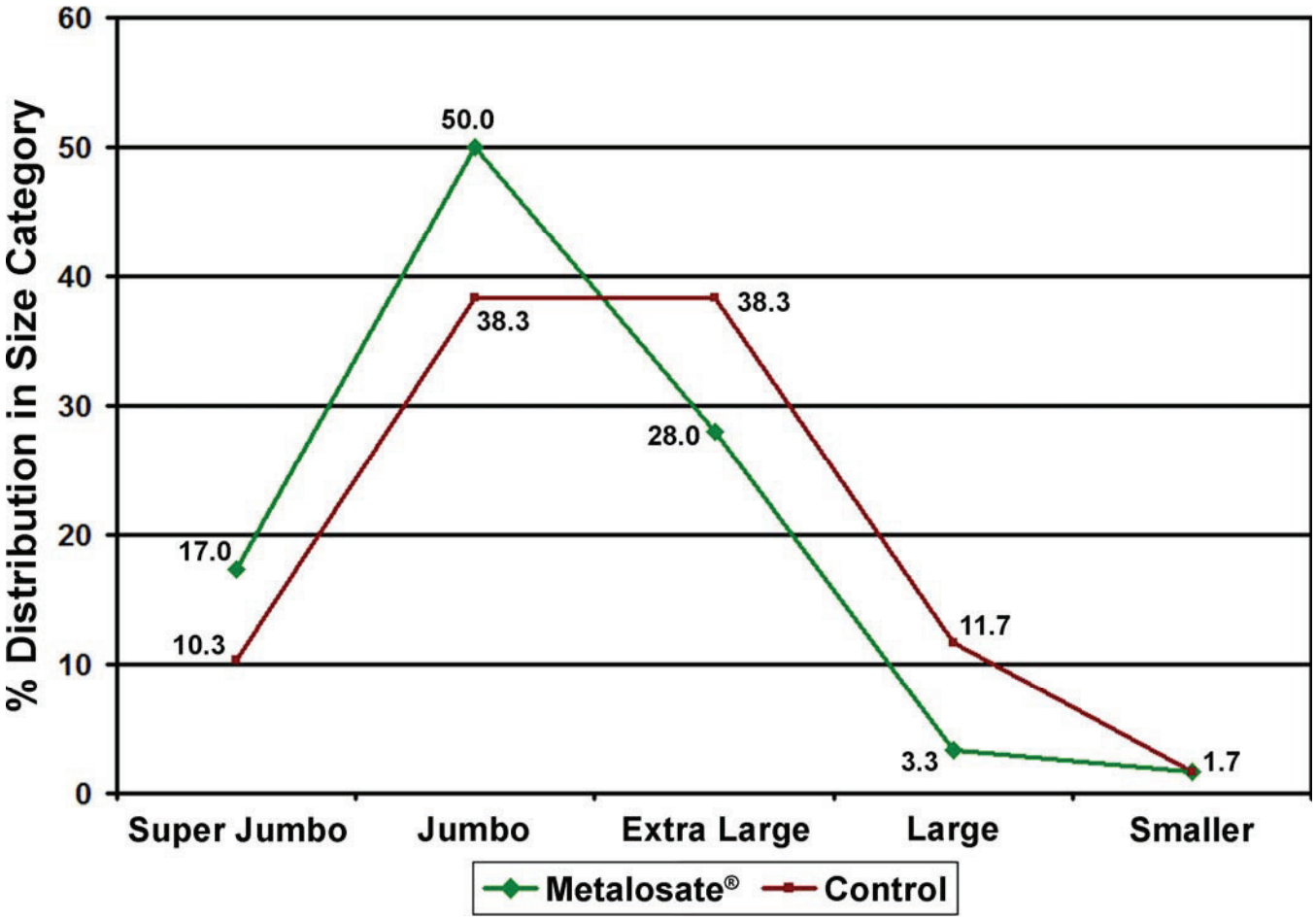


Figure 15. Cherry Fruit Size Distribution—Farmer: Patricia Correa

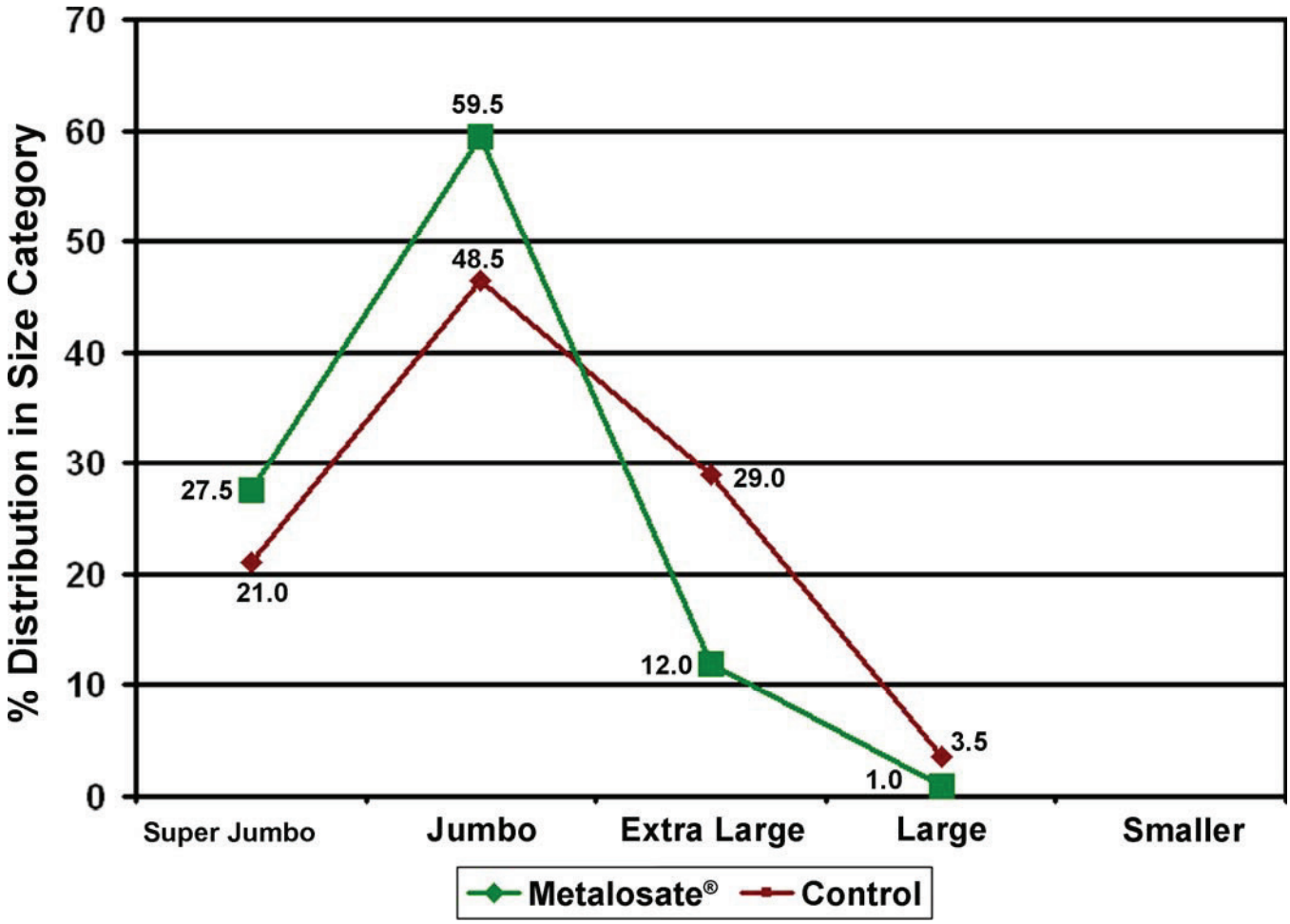


Figure 16. Cherry Fruit Size Distribution—Farmer: Jose Soler

Trials with Table Grapes

Chile is the number 1 exporter in the world for table grapes. One of the challenges is the distance Chile is from the export markets. The long distance necessitates having grapes of extremely high quality that can endure the trip and have a long shelf life. Several trials were done with Metalosate® products to look at the effect on shelf life, calcium content in the fruit, and fruit color.

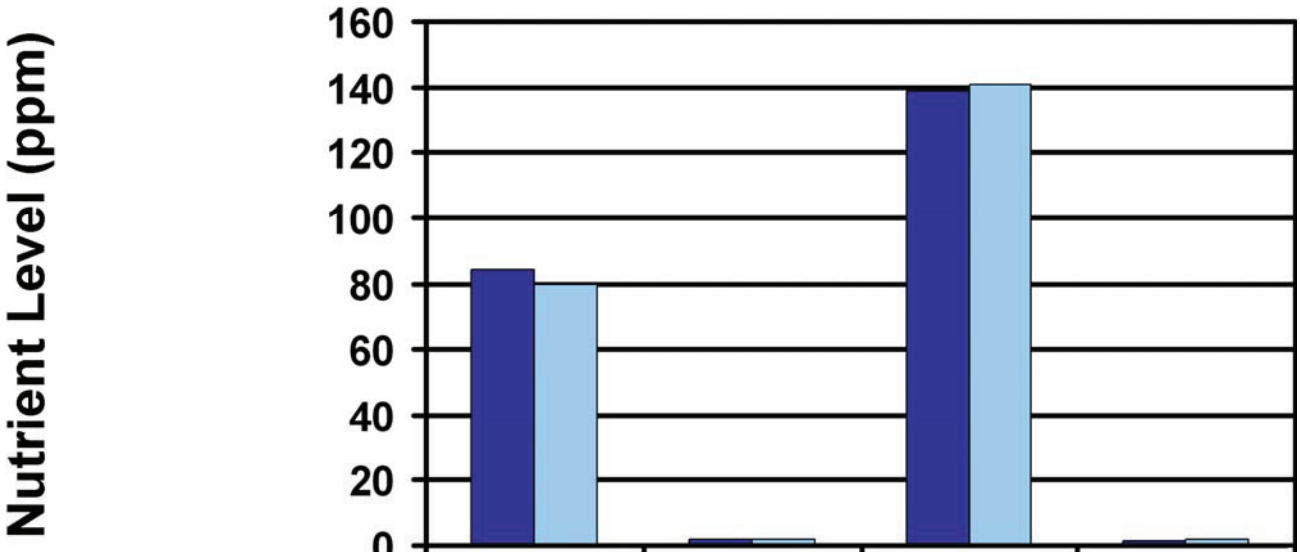
Dole implemented a program to measure the effect on calcium content in the fruit.

Figure 17. Thompson Seedless Grapes growing in the 5th region, San Felipe, Chile

Table 10
Metalosate® Program on Thompson and Flame Seedless.
Grower: Inversiones del Pacífico, Fundo San Felipe
Thompson Seedless
Season 2006-2007

Stage of Growth	Program	Rate	
		L/Ha	fl. oz./acre
2-mm Fruit Diameter	Gibberellic Acid +		
	Metalosate® Calcium	1.5	20.5
	Metalosate® Zinc	1.5	20.5
4-mm Fruit Diameter	Gibberellic Acid +		
	Metalosate® Tropical	3.0	41.1
6-mm Fruit Diameter	Gibberellic Acid +		
	Metalosate® Calcium +	1.5	20.5
	Metalosate® Zinc	1.5	20.5
8-mm-Veraison	Metalosate® Tropical (3 times 7 days apart)	2.0	27.4
30 Days Before Harvest	Metalosate® Boron	1.0	13.7
	Metalosate® Calcium	1.0	13.7
20 Days Before Harvest	Metalosate® Boron	1.0	13.7
	Metalosate® Calcium	1.0	13.7
10 Days Before Harvest	Metalosate® Boron	1.0	13.7
	Metalosate® Calcium	1.0	13.7

The calcium content in the fruit was significantly increased and the grower said he had better quality fruit.



	Control		Treated	
	Calcium	Boron	Calcium	Boron
Thompson Seedless	84.0	2.0	139.0	1.7
Flame Seedless	80.0	1.8	141.0	2.0

Figure 18. Nutrient Level in ppm on Grape Flesh

A Metalosate® program was implemented to see the effect on fruit color in the Crimson variety. In the warmer regions of Chile there is a general tendency to have poor color on this variety.

The only measurement was visual and once again there was a significant difference in color between the Metalosate® program and the grower standard.

Figure 19. Treated on the Left, Control on the Right. Grower: Inversiones del Pacifico Ltda, Species: Table Grapes, Variety: Crimson Seedless, Date of photograph: 26 Jan 2007

Table 11
Metalosate® Program on Table Grapes for Color

Treatment	Products	Rate	
		L/Ha	fl. oz./acre
Fruit Set	Metalosate® Tropical™	1.5	20.5
	Metalosate® Potassium	1.5	20.5
	Metalosate® Boron	0.5	6.8
15 Days after Fruit Set	Metalosate® Tropical™	1.5	20.5
	Metalosate® Potassium	1.5	20.5
	Metalosate® Boron	0.5	6.8
30 Days after Fruit Set	Metalosate® Tropical™	1.5	20.5
	Metalosate® Potassium	1.5	20.5
	Metalosate® Boron	0.5	6.8
45 Days after Fruit Set	Metalosate® Tropical™	1.5	20.5
	Metalosate® Potassium	1.5	20.5
	Metalosate® Boron	0.5	6.8

Another larger exporter of table grapes, Subsole Export, completed a trial that consisted of implementing a Metalosate® program at the same cost as the grower standard.

Subsole Export then measured calcium content and studied pressure in the grapes which were stored for a total of 8 weeks.

Table 12
Metalosate® Program on Table Grapes at the Same Cost as the Grower Standard

Stage	Product	Rate		Repetitions
		L/Ha	fl. oz./acre	
15-30 cms of Growth	Metalosate® Multimineral™	1.0	13.7	1
	Metalosate® Zinc	1.0	13.7	1
Before Flowering	Metalosate® Boron	0.5	6.8	1
With GA3 (Gibberellic Acid)	Metalosate® Crop-Up®	1.0	13.7	4
Veraison	Metalosate® Potassium	1.0	13.7	1
	Metalosate® Calcium	1.5	20.5	1
After 7 days	Metalosate® Calcium	1.5	20.5	1

Note: Kamab 26 was used in both the grower standard and the Metalosate® program.

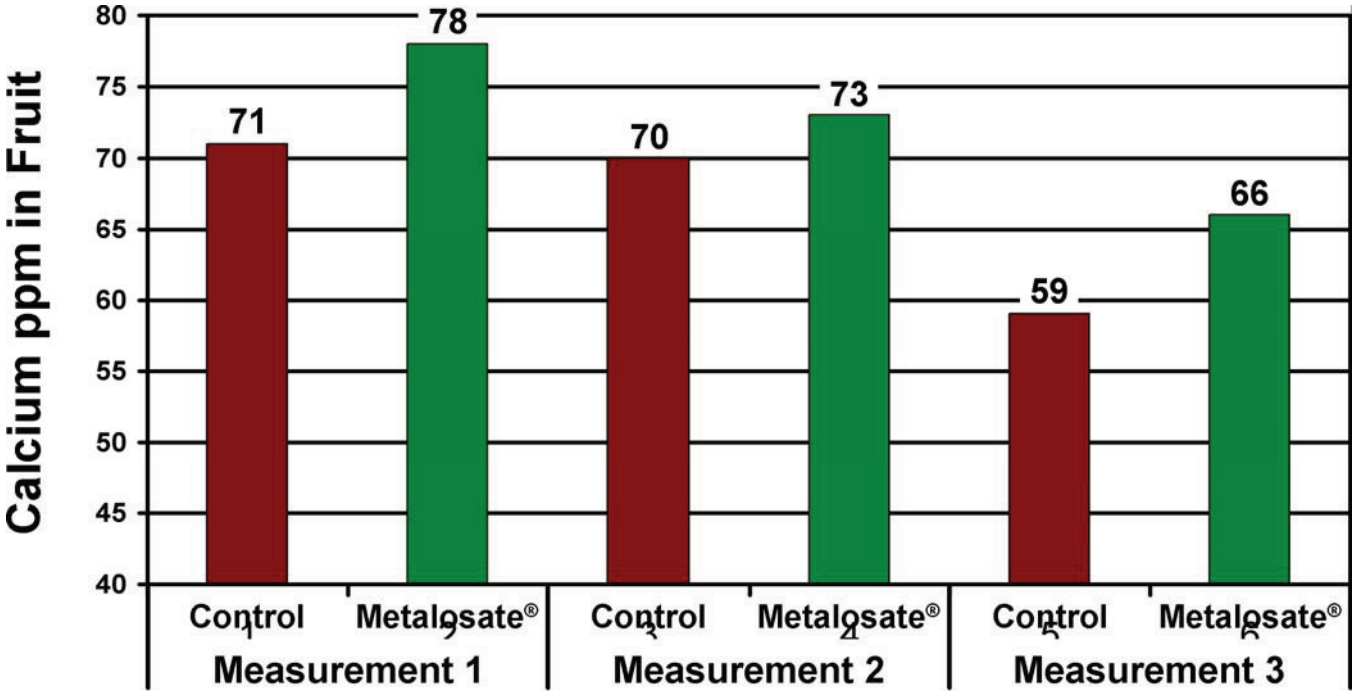


Figure 20. Calcium Content in Fruit. Inversiones San Miguel Ltda. Variety: Thompson Seedless Grapes.

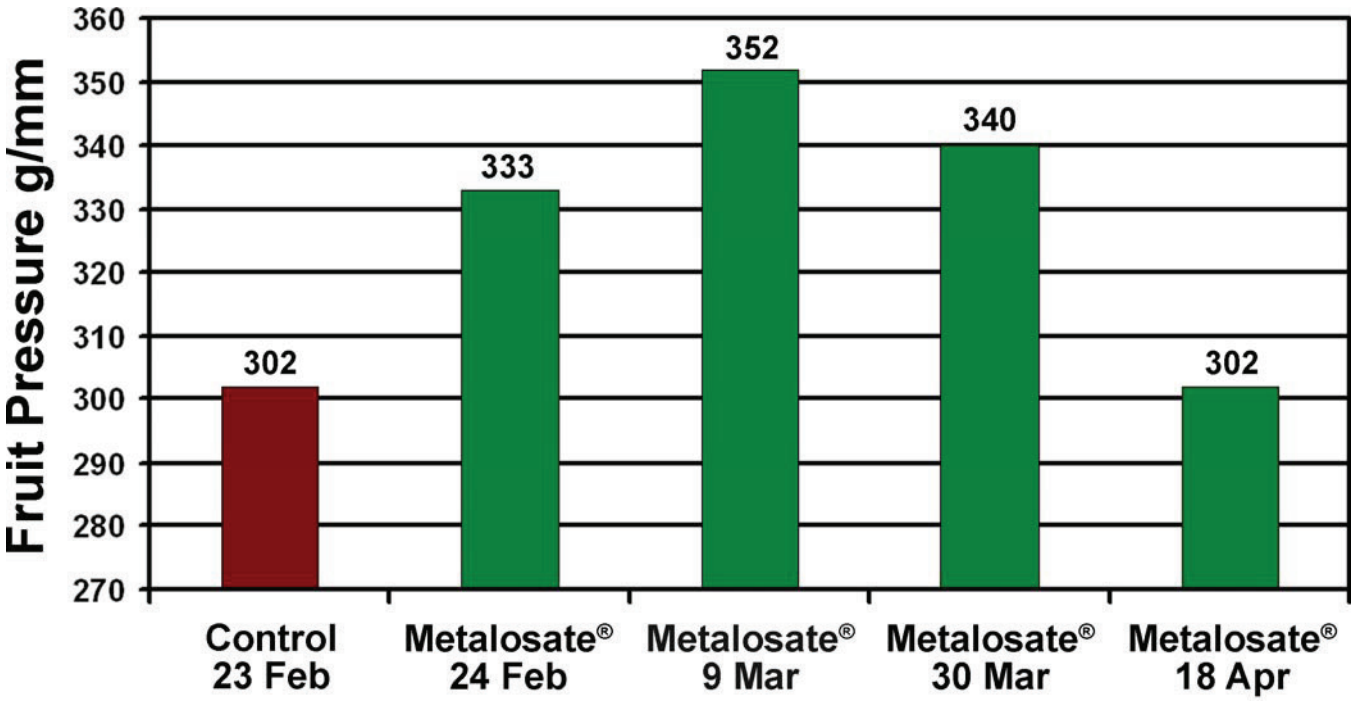


Figure 21. Fruit Pressure over Time

It is interesting to note that it took 8 weeks of storage for the grapes with the Metalosate® program to equal the day of harvest pressure from the grower standard. It shows that for the same cost, one can have better shelf life and quality.

Summary

These field trials represent just a small fraction of the field trials that have been done and that are currently under way in Chile. Several replicated studies are now under way.

The results that are being observed have caught the attention of industry leaders, universities and other research institutions. The unique Albion® technology, quality, and service have given Chile a powerful tool to increase yields and quality for a very important part of the Chilean economy.