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3.2.- On site trials and assessment by the Pontifical Catholic University of Chile.

I. Introduction

During the period 1996-97 and 1997-98 and at the request of the Harnois Chile S.A. (SOBITEC) company, the ESS® electrostatic aspersion system was tested on table grapes. During the 1996-97 season, the assessment was done at the Macaya vineyards, Placilla, VI Region and, during the 1997-98 season, it was carried out at the Agrícola Izquierdo Saa Ltda vineyards in Nancagua, VI Region.

Tests were carried out in order to evaluate the effectiveness of the application of giberelic acid for thinning and growth of Sultana grapes' berries, application of the Ipriodione fungicide to control botrytis in the Sultana and Ruby Seedless varieties, and the effectiveness of utilising Salut to control the mealybug in Sultana and Ruby Seedless grapes. In the three cases the ESS® was compared with the traditional aspersion system which, in this particular case, was a turbo sprayer.

The design, co-ordination and assessment of the trials was the responsibility of a professional team from the Pontifical Catholic University of Chile, Agronomy Faculty, under the directorship of professor in fruit culture Mrs. M. Pilar Bañados O. (M.Sc). Mr. Bernardo Latorre (PhD), professor of fruit pathology assisted during the effectiveness tests and Mr José Mery (Master) assisted in the machine calibration and application support. The assessment of the results were overseen by Mr Luis Barrales (PhD), statistics professor. On site trials were the responsibility of the Agricultural Graduates Mrs Cecilia Peppi (1996-97 season) and Mrs Patricia Valdés (1997-98 season)
This project was carried out due to the interest that Harnois Chile S.A. as well as the Agronomy Faculty of the P. Catholic University of Chile had in the potential influence that the ESS® electrostatic aspersion system could have on the national fruit growing industry.

II. Trials carried out

II.1 Results from using ESS® on the effectiveness and usage of giberelic acid (AG) for berry thinning on the Sultana grapes

II.1.1 Objectives y Methodology

The objective of this test was to compare the efficiency of ESS® over the giberelic acid applications for thinning Sultana grapes, against the commercial traditional applications carried out with a high volume (1.500 to 2.000 litres of water /ha) turbo sprayer.

For this purpose, 3 AG dosages treated with ESS were tested: R1=100% commercial dosage (51 g/ha/application), R2=75% commercial dosage (38,25 g/ha/application) R3=50% commercial dosage (25,5g/ha/application). Only R1 and R3 were tested during the 1997-98 period. Said applications were done with low water volumes of 42l/ha, at a tractor speed of 4,5km/h and 533rpm power take-off. These parameters sere set based on the first calibrations of the machine in the vineyard. This volume was used as a standard in all the applications. At the same time, a blank control or control application was tested, wherein the commercial dosage normally used in the vineyard was used, 15 ppm AG or 51 g/ha/application or in 1700 L/ha, using a traditional machine. Said assessments were carried out during two seasons. Also, bunches were left without AG in order to get an idea of the "natural" thinning that occurs in this variety. All the applications were carried out twice on 12/11 and 16/11/96 during the first period and on 18/11 and 20/11/97 during the second period. This corresponded to an approximate 5% and 80% blooming of the vines (commercial recommendation).

The design of the trials consisted of patches of 24 plants randomly distributed in the vineyard. Each treatment was repeated 9 times and, in each repetition, 10 bunches were marked wherein the thinning percentage was measured, expressed by the number of berries fallen up to 7 days after the second AG thinning application , based on the total number of berries in the bunch. To this effect, the bunches were covered with paper bags immediately after having applied AG and were subsequently evaluated after 7 days. In order to carry out the measurements, the bunches in paper bags were taken to the Fruit Physiology laboratory at the Agronomy Faculty of the Pontifical Catholic University in order to be counted and analysed.

The results underwent variance analysis, using the SAS statistical package.

II.1.2 Results

Table 1 depicts the berry thinning results (%) of the Sultana table grape corresponding to the two assessment periods, wherein it reflects that during the first period the thinning percentages fluctuated between 22% and 34% and that during the second period they fluctuated between 23 and 41%; without meaningful differences between treatments or the natural thinning during both periods.

Table 1. Effects of giberelic acid applied with ESS® electrostatic aspersion system over the thinning percentage of Sultana grapes. Placilla, 1996-97, Nancagua 1997-98.

Treatments	*Thinning 1996-97 (%)*	*Thinning 1997-98 (%)*
R1 (100% dosage AG, ESS®)	23,27	36,75
R2 (75% dosage AG, ESS®)	22,25	-
R3 (50% dosage AG, ESS®)	23,60	41,04
Sample (100% dosage AG, MH)	34,76	38,69
"natural" thinning	24,08	23,93
Significance (95%)	NS	NS
P	0,0715	0,129

ESS® : Electrostatic aspersion system
MH: Hydraulic machine. Turbo sprayer

Results indicate that the ESS® effectiveness in berry thinning of Sultana grapes at 50% or 100% of the AG dosage, is equivalent to 100% of the sample treatment. The natural thinning of this variety (without Giberelic Ac.), according to values found in literature, vary between 17 and 30%, therefore most values obtained during these trials would be within this natural thinning range, suggesting that the use of AG on these vines did not have an additional influence. However, when evaluating the bunches, a high variability among them was noted, where bunches with between 8 to 70% thinning were found within the same treatment, indicating that AG had an effect on some bunches, but not on the overall average.
This variability in the thinning percentages could be found in both trial periods and in both vineyards and it is attributable to the high des-uniformity of the phonological state of the Sultana grape bunches.
Taking into consideration the erratic thinning values obtained due to this high unevenness of the phonological states, it may be advisable to carry out 3 AG applications for thinning, with dosages of 50% with the ESS® equipment.

II.2 Effects from using ESS® in the effectiveness and use of giberelic acid(AG) applied for berry growth in Sultana grapes

II.2.1 Objective and Methodology

The objective of these trials was to compare the efficiency of ESS® in the applications of giberelic acid for berry growth in Sultana grapes, with the traditional commercial applications made with high volume(2.000 litres water /ha) turbo sprayer.

For this purpose, 2 AG dosages treated with ESS® were tested: C1=100% commercial dosage (240 g/ha/application), C2=50% commercial dosage (120 g/ha/application). Said applications were done with water volumes of 42l/ha. At the same time, a blank control or control application was tested, wherein the commercial dosage normally used in the vineyard was used, 40 ppm giberelic acid or 240 g/ha/application in 2000 L/ha, using a traditional hydraulic machine. The applications were carried out thrice on 23/11, 30/11 and 6/12/97 according to the Placilla vineyard schedule. This test was only done during the first assessment period.

The design of the trials consisted of patches of 24 plants randomly distributed in the vineyard. Each treatment was repeated 9 times and, in each repetition, 20 bunches were marked wherein the diameter, length, weight of the berries and soluble solid contents at harvest time were measured. Additionally, the evolution of the diameter and length of the berries was followed up, carrying out weekly measurements of 10 bunches per patch from the 24th of December 1996 until the 30th of January 1997.

In order to carry out the final measurements, the bunches were taken to the Fruit Physiology laboratory at the Agronomy Faculty of the Pontifical Catholic University to be analysed.

Moreover, during Spring 1997, after shooting, the fruit buds, vegetative buds and necrotic buds were counted on each patch in order to determine the possible effect of AG over these parameters. To this end, 10 loaders per patch were counted and the percentage of buds per type were determined.

The results obtained underwent variance analysis and Tukey statistical test (at 5%) in order to achieve a separation of the averages. The Dunnet test was used to establish differences between the treatments and the blank control.

II.2.2 Results

Table 2 depicts the results from using ESS® with different AG dosages for berry growth. As it can be seen, the length as well as the weight of the berries were higher when applying AG with ESS® regardless of the dosage (100% or 50% AG), compared with the blank control treated with hydraulic spraying machine. The Dunnett test established that the berries …/

…/ originating from bunches from C1 and C2 were longer and heavier than the berries from sample bunches. No significant differences berries' diameter were found between treatments. As expected, the soluble solids did not present any differences between the treatments.

Table 2. Effect of giberelic acid applied with ESS® electrostatic aspersion system on the diameter, length, weight and soluble solids of Sultana grape berries. Placilla, 1996.

Treatment	*Diameter berry (mm)*	*Length berry (mm)*		*Peso 10 berry (g)*		*Soluble Solids (ºBrix)*
C1 (100% dosage AG, ESS®)	20,34	28,8	**a**	70,73	**a**	15,91
C2 (50% dosage AG, ESS®)	20,22	28,8	**a**	70,80	**a**	16,12
Blank control (100% dosage AG, MH)	19,88	24,4	**b**	63,03	**b**	16,15
Significance (99%)	**NS**	**		**		**NS**
P	0,0908	0,0001		0,0053		0,6108

According to Tukey, same letters do not present any significant differences at 5%.

ESS®: electrostatic aspersion system

MH: hydraulic spraying machine

It is important to note the effect observed when reducing the AG dosage to 50%, as in this case no differences were found with the treatment using 100% dosage with ESS® and it exceeded the blank control dosage at 100% AG, applied with turbo sprayer. These results suggest that, due to the increase in efficiency of ESS® in applying AG, a dosage reduction of the product could be considered, thus reducing the direct costs of the applications.

Figure 1 shows the berry diameter evolution. Although it is true that the final diameter of the berries was not different enough, this figure indicates that from the beginning of the measuring, the berry diameter was higher on the treatments applied with the ESS®, increasing from 5th January onwards. A similar tendency was observed relating to the length of the berries, but the effect was considerable.

Additionally, the influence of the position of the bunches (between or on rows) was evaluated on the berry growth parameters (diameter, length and weight). Table 3 depicts that the berries of the bunches placed on the rows were significantly longer than those located between rows (2,86 cm on row and 2,79 cm between rows). There were no differences in the other evaluated parameters, suggesting that, generally, a uniform coverage of the bunches was achieved, regardless of its location.

Table 3. Effect on the diameter, length or weight of the Sultana grape berries of the position of the bunches between or on rows. Placilla, 1996.

Position	*Berry Diameter (mm)*	*Berry length (mm)*	*Weight of 10 berries (g)*	*Soluble Solids (ºBrix)*
Between rows	20,16	27,9	69,63	15,96
On rows	20,29	28,6	69,88	16,09
Significance(95%)	NS	*	NS	NS
P	0.3531	0.0335	0.9202	0.4054

Table 4 shows results of the analysis of budding shoots carried out after the shooting at the Placilla vineyard. No differences on the fertility and necrosis of the Sultana grape shoots were found between the AG applications with ESS® and the hydraulic machine. These assessments were carried out as it was feared that when carrying out more concentrated AG applications on the thinning and growth, it could affect the fertility and necrosis of the buds. However, this did not occur and bud fertility values obtained were of about 37% and near 20% of necrosis. These values are normal in the Sultana variety. In addition, this assessment was done once the vine was sprouting, so that the results correspond to direct assessments and not indirect ones as in the case of the buds' analysis.

Table 4: Percentage of fruit buds, vegetative buds and necrotic buds obtained from the different thinning and growth of berries at Placilla, 1997.

Treatment	*Fruit buds (%)*	*Vegetative buds (%)*	*Necrotic buds (%)*
R1C1	37,778	45,082	19,758
R1C2	35,163	44,529	23,615
R2C1	39,072	44,237	19,321
R2C2	39,543	44,318	18,513
R3C1	36,405	45,596	20,631
R3C2	35,074	45,610	22,726
Blank control	35,971	46,751	20,131
P	0,2549	0,9569	0,0507
Significance (95%)	NS	NS	NS

II.3. Effects of the use of ESS® on the effectiveness of the Iprodione application for the control of botrytis on Sultana and Ruby Seedless table grapes.

II.3.1 Objectives and Methodology

The objective of this test was to compare the effectiveness of the ESS® on the Iprodione applications to control botrytis and product residues on the bunches, compared with traditional commercial applications done with high volume turbo sprayers. This trial was carried out in two seasons (96-97 and 97-98), where 2 table grape varieties –Sultana and Ruby Seedless- were evaluated during the first season and only Sultana during the second season.

In both cases, 2 dosages of Iprodione applied with the ESS® were used: F1=100% commercial dosage (1,5 or 2,0 Kg/ha/application depending on the date of application), F2=50% commercial dosage (0,75 or 1,0 Kg/ha/application). These applications were made with water volumes of 42 L/ha. At the same time, a blank control or control application was evaluated wherein the normally used commercial dosage of 1,5 o 2,0 Kg/ha/application was used (depending on the date) in 2000 L/ha carried out with a traditional hydraulic machine. During the 96-97 season 4 applications per variety were made. In the case of Sultana, they were done on 13/11/1996 (flowering period), 10/12/96, 29/1/97 and on 13/2/97 (1 day before harvesting). In the case of Ruby Seedless, the applications were made on 18/11/96 (flowering) 10/12/96, 29/1/97 and on 25/2/97 (pre-harvesting). In the control treatment, and to avoid staining of the fruit, the last 2 applications per variety were made with powder sulphur as carrier, using a Parada sulphuring machine with a capacity of 15 kg sulphur/ha (Table 5).

In the case of the ESS® treatments, all the applications were done with fluids, including the last date –a day prior to harvest. This is due to that the equipment does not stain fruit, as it occurs with traditional aspersion systems, due to the drops' size.

The design of the trials consisted in patches of 24 plants randomly distributed in the vineyard. Each treatment was repeated 3 times and on each occasion 40 bunches were evaluated. This was done with both varieties.

The assessments were done during harvest and after a 22 day cold storage period. Botrytis was measured, in percentage, as the number of bunches in 20 presenting symptoms of the decease, and its severity, expressed as percentage in weight of the bunches presenting symptoms.

The incidence of botrytis was also evaluated in moisture chambers. This consisted in placing 100 berries per treatment inside moisture chambers at a 24°C temperature and to observe the development of the decease 14 days after. These tests were carried out at the Fruit Plants' Physiology laboratory at the Agronomy Faculty of the Pontifical Catholic University.

Moreover, in the case of Sultana variety, Iprodione residue analysis were carried out 1 day after the last application on site -one day prior to harvesting-. For this…/

/… purposes, 3 samples per treatment were taken, separating the inner and outer portions of the bunches. This analysis was carried out by high resolution liquid chromatography in the Fundación Chile laboratories.
The results obtained were subjected to variance analysis and to the Duncan (5%) statistical test in order to establish the average differences.

Table 5. Actual Iprodione Quantities (%), relating to blank control and applied in the different treatments to control botrytis in Sultana and Ruby Seedless grapes. Placilla 1996-97.

Sultana

Application date	*F1(100%ESS®)*	*F2(50%ESS®)*	*Blank control(%)*	*Blank control (g/ha)*
13/Nov (blooming)	100,00	41,32	100	1500
10/Dec	85,26	42,85	100	1500
29/Jan*	69,18	34,58	100	2000
12/Feb*(pre-harvest)	108,43	42,35	100	2000
Total (g)	6331	2801	7000	
Average(%)	***90,72***	***40,28***	***100***	

* = blank control treated with powder sulphur

Ruby Seedless

Application date	*F1(100%ESS®)*	*F2(50%ESS®)*	*Blank control (%)*	*Blank control (g/ha)*
18/Nov (blooming)	90,91	50,52	100.00	1500
10/Dec	85,26	42,85	100.00	1500
29/Jan*	69,18	34,58	100.00	2000
25/Feb*(pre-harvest)	69,45	37,70	100.00	2000
Total (g)	5415	2846	7000	
Average(%)	***78,70***	***41,41***	***100***	

* = blank control treated with powder sulphur

During the second stage of trials, the applications on Sultana variety were done three times, on the 20/11/97 (coinciding with blooming), 30/1/98 and 23/2/98 (1 day prior to harvesting. Dosages, experimental design and assessments were the same for the 96-97 season. During the second season, an additional assessment was incorporated in order to enable the growth of botrytis in moisture chambers. To this effect, 3 moisture chambers were injected with botrytis conidia (10^6 conidia/ml) and were subsequently evaluated after 14 days' incubation period.

II.3.2 Results

a) Residues' analysis

Table 6 depicts the Iprodione residue results, detected in Sultana grape bunches, after the last application of said product on 12 /2/97. according to these results, the higher quantity of residues was detected on treatment F1 (2,86 ppm), followed by F2 (1,53 ppm) and, lastly the blank control (0,39 ppm) which was 7 times higher than in the blank control. Table 7 shows the differences in residues, depending on the position of the bunch from which the sample was extracted. Hence, on average, the outer part of the bunch presented double the residues of the products compared with the inner ones. However, in the case of control treatment, this difference did not exist and the residues detected inside and outside the bunches were also low (0,44 vs. 0,34 ppm respectively). When comparing the quantity of residues near the rachis, it was found that the treatments with ESS® F1 and F2 allowed 5,6 and 3,3 higher residues than in the blank control respectively.

Table 6. Iprodione residues detected in Sultana grape bunches, 1 day prior to harvest, 1997

Treatment	*Iprodione (ppm)*	
F1 (100% ESS®)	2,86	**a**
F2 (50% ESS®)	1,53	**b**
Blank control	0,39	**c**
Significance (95%)	**	
P	0.0001	

According to Duncan, different letters indicate differences at 5%

Table 7. Iprodione residues detected in Sultana grape bunches, 1 day prior to harvest according to the location in the bunch, product dosage and application system used.

Position of the berries	*Iprodione residues (ppm)*
Outside of bunch	2,07 a
Inside of bunch	1,13 b
Significance (95%)	**
P	0.0075

Treatment	*Iprodione (ppm)*	*significance*
100% F1 external ESS®	3,80	**a**

100% F1 internal ESS®	1,92	**b**
50% F2 external ESS®	1,96	**b**
50% F2 internal ESS®	1,11	**b c**
external blank control 100%	0,44	**c**
internal blank control 100%	0,34	**c**

According to Duncan at 5%, equal letters do not have significance

In order to have an adequate control of botrytis and according to information furnished by professor Bernardo Latorre, there should be Iprodione concentrations of at least 10 ppm at grape cuticle level. In this case, and due to the analysis methodology used to detect residues, it is difficult what was the real concentration at cuticle level as the whole grape is crushed in order to do analysis. However, it can be estimated that the cuticle represents between 10% to 20% of the berry's weight, hence it could be indirectly concluded that the concentration in the cuticles were 5 times higher for each of the treatments, giving values exceeding 10 ppm for F1 and F2, but not for the blank control.
In addition, it is necessary to point out that the product has 7-9 days residual and that in most countries the Maximum Residue Limit (MRL) is 10 ppm (60 pm in US). The most strict country is Italy who requires 5 ppm maximum and 3 days clear. In this case, the highest absolute value found was 5,01 ppm in one of the F1 repetitions, which would be within the acceptable range.

b) Botrytis Incidence and Severity at harvest time

1996-97 Season

The harvest of Sultana variety was done on 13th February 1997 and that of the Ruby Seedless on the 27th February 1997. At the time of the harvest and for each variety, 40 bunches previously marked in each patch were evaluated. The quantity presenting the disease was recorded (botrytis incidence=bunches with botrytis 40/100) as well as the weight of berries infected with botrytis (severity= berries infected with botrytis/weight of the bunch x100).
Table 8 shows the analysis results corresponding to Sultana and ruby Seedless varieties. It can be seen that the botrytis incidence values corresponding to Sultana were between 5,8% and 9% of the bunches and 4,1 and 5,4% in the Ruby Seedless. No significant differences were found between treatments in any of the 2 varieties (P=0,81 y 0,63 respectively).

The severity of the disease was similar in percentages for both varieties and was around 0,5%, without significant differences between treatments (P=0,8 and 0,9). These results are attributable to the erratic appearance of botrytis within the vineyard where there some bunches had a high level and others a low level, even in the same vine.

Table 8. Botrytis incidence and severity found at harvest time in Sultana and Ruby Seedless subjected to dosage and application system trials. Placilla, 1997

Sultana

Treatment	*Botrytis Incidence (%)*	*Botrytis Severity (%)*
F1	8,17	0,69
F2	5,83	0,53
Blank control	9,17	0,45
P	0.8171	0.8028
Significance (95%)	NS	NS

Ruby Seedless

Treatment	*Botrytis Incidence (%)*	*Botrytis Severity (%)*
F1	4,16	0,56
F2	4,16	0,62
Blank control	5,42	0,50
P	0,6278	0,9032
Significance (95%)	NS	NS

Table 9 depicts the initial botrytis incidence and severity during the second trial season. In this case, there was also no difference between the treatments used, fluctuating between 0 and 2,6% botrytis in the bunches. With regard to the severity of the disease, this was quite low, without differences between treatments.

Table 9. Botrytis incidence and severity found at harvest time in Sultana subjected to dosage and application system trials. Nancagua, 1998

Treatment	*Botrytis Incidence (%)*	*Botrytis Severity (%)*
F1 100% ESS®	2,6	0,19
F2 50% ESS®	0,0	0,0
Blank control 100% MH	2,6	0,13
P	0, 30	0,33
Significance (95%)	NS	NS

c) Botrytis incidence in moisture chambers

Moisture chambers were used to evaluate the potential development of botrytis in bunches of both varieties at harvest time. This potential was expressed as the percentage of infected berries after 14 days' incubation.
Table 10 depicts the results of the assessment of the moisture chambers. It can be seen that there were no significant differences in the percentage of berries with botrytis in any of the 2 varieties observed during the first season. However, what did come to our attention was the high variability of the results in all the treatments.

Table 10. Botrytis incidence (%) in moisture chambers for Sultana and Ruby Seedless varieties originating from the Macaya Vineyard. Placilla, 1997.

	Botrytis Incidence (%)	
Treatments	***Sultana***	***Ruby Seedless***
F1	1,92	4,57
F2	0,41	9,79
Blank control	1,30	3,38
CV	124,11	143,03
P	0,4355	0,7583
Significance (95%)	NS	NS

The results of the second season of trials is shown in Table 11. in this case, the moisture chambers were divided into inoculated and non inoculated. The botrytis percentage was higher than the percentages detected during the first season in the moisture chambers without inoculation. However, there was no difference between treatments, giving average values of around 11%. In the inoculated chambers, the botrytis percentage was higher than the prior ones, without statistical differences between treatments. The lack of significant differences is due to the variability of the results obtained.

Table 11. Botrytis incidence (%) in moisture chambers with and without inoculum in Sultana variety originating from Nancagua, 1998.

	Botrytis Incidence (%)	
Treatments	***Without inoculum***	***With inoculum***
F1 100% ESS®	13,70	25,76 **a**
F2 50%ESS®	11,96	18,43 **a**
Blank control 100%MH	10,07	30,64 **a**
P	0,76	0,51
Significance (95%)	NS	NS

According to LSD test, the different letters indicate differences between treatments

d) Botrytis Incidence and Severity after a refrigerated storage period

During the first season and with both varieties, 20 packaged bunches per patch were stored: 10 pre-aerated and 10 without aerating at 0ºC in chamber for a 22 days period. After this period, the % of bunches with the disease was recorded as well as the % in weight that the infected berries represented within the bunch.
Table 12 shows the results obtained. In the Sultana case, the botrytis incidence fluctuated between 3% and 15% and its severity between 0,09 and 1,1% in the different treatments, however, no significant differences were observed between them. Again, this due to a high variability in the results.
Ruby Seedless showed a lower botrytis incidence(1,67%) in treatment F1, compared with F2 and the blank control, which resulted in values nearing 9%. However, no significant differences exist between them. The severity did not present significant differences between the treatments of this variety.
The aerated bunches had a lower botrytis incidence and severity than the bunches without aerating, resulting in significantly different values in the Sultana, and non significant in the case of Ruby Seedless.

Table 12. Botrytis incidence y severity after a 22 days refrigerated storage of Sultana and Ruby Seedless grapes, subjected to dosage and application system trials. Placilla, 1997

	Sultana		Ruby Seedless	
Treatment	**botrytis (%)**	**severity (%)**	**botrytis (%)**	**severity (%)**
F1	13,33	0,57	1,67 **a**	0,15
F2	3,33	0,09	10,00 **b**	0,35
Blank control	15,00	1,10	8,33 **b**	0,37
CV	86.86	144,01	71,77	119,.35
R²	0.496	0,529	0.595	0.,345
P	0.0988	0,1617	0.0293	0.,5005
Significance (95%)	NS	NS	*	NS

	Sultana		Ruby Seedless	
Aerating	**% botrytis**	**% severity**	**% botrytis**	**% severity**
WITH	16.66	1.07	8.88	0.34
WITHOUT	4.44	0.10	4.44	0.23
CV	86.86	144.01	71.77	119.35
R²	0.496	0.529	0.595	0.345
P	0.0331	0.0304	0.1434	0.5072
Significance (95%)	*	*	NS	NS

Table 13 depicts the results from the second trial season, which also did not have differences between treatments in incidence nor in severity.

Table 13. Botrytis incidence y severity after a 14 days refrigerated storage of Sultana grapes, subjected to dosage and application system trials. Nancagua, 1998

	Sultana	
Treatment	**botrytis (%)**	**severity (%)**
F1	4,66	2,7
F2	1,33	0,7
Blank control	0,66	0,2
P	0.155	0,24
Significance (95%)	NS	NS

e) Assessment of Botrytis resistance to Iprodione.

As the results obtained from the botrytis tests where it was not possible to obtain differences in the levels of control of the disease -in spite of having high residues in the fruit-, the second trial season was used to evaluate the botrytis resistance to Iprodione. This assessment was carried out with botrytis obtained from Sultana grapes originating from the Nangacua vineyard, which underwent resistance analysis at the Fruit Pathology laboratory of the Agronomy Faculty of the Catholic University of Chile.
Table 14 shows the results of this assessment wherein it can be seen that two of the four samples appear to be resistant to the fungicide, one moderately resistant and the other sensitive to it. This would indicate that botrytis has developed a resistance to Iprodione, which makes it difficult to have an adequate control if the levels in the cuticle do not exceed 5 to 10 ppm.
This could explain the high variability of the results obtained in the botrytis control tests and the lack of significant differences between treatments.

Table 14; Assessment of *Botrytis cinerea* laboratory resistance to Iprodione fungicide obtained from sultana grapes.

% botrytis inhibition with Iprodione (ppm)			**DE 50 estimated (ppm)**	**Observation**
1	**5**	**10**		
25.1	**43.8**	**86.7**	**5-10**	**R**
53.1	**79.8**	**100**	**1**	**S**
23.8	**48.9**	**83.2**	**5-10**	**R**
28.7	**51.7**	**95.3**	**1-5**	**MR**

S: Sensitive
R: resistant
MR: moderately resistant.

These results would indicate that in order to achieve an adequate botrytis control, it would be advisable to increase the Iprodione dosage normally used in this vineyard as the advantage of this product and its tolerances is that it is already registered in most of our countries of destination.

II.4. Effects of ESS® use on the Salut application effectiveness to control mealybug on Sultana and Ruby Seedless table grapes.

II.4.1 Objectives and Methodology

The objective of this test was to compare the effectiveness between the Salut applications to control mealybug and product residue in bunches using ESS® and the traditional commercial applications done with high volume turbo sprayers. This trial was done in 2 seasons. The first one was carried out on 2 table grape varieties, namely Sultana and Ruby Seedless and only on Ruby Seedless during the second season.

2 Salut dosages (dimethoate and chlorpyrifos) applied with ESS®: I1=100% commercial dosage (2.340 cc/ha/application) and I2=50% commercial dosage (1170 cc/ha/application) were tested. These applications were done with volumes of 42 L/ha water. Additionally, a blank control or control application was evaluated where the commercial dosage normally used of 2.340 cc/ha/application in 1.800 L/ha carried out with traditional hydraulic machine was utilised. Only 1 application per variety was done in the 96-97 season. In the case of the Sultana, this was done on 13/12/1996 and on 8/1/97 for the Ruby Seedless.

During the second assessment season, 2 applications were done on the Sultana variety (10/12/97 and 9/1/98)

The test design corresponding to the first season consisted of patches of 24 randomly distributed plants. Each treatment was repeated 3 times and 40 bunches were evaluated on each repetition. This was done for both varieties.

During the second season and before commencing the applications, the presence of mealybugs in areas of each patch was verified. In order to carry out the assessment where the insect was present, 8 vines per treatment were marked in each patch.

The assessment was done at harvest time.

In the case of the Sultana variety, analysis of dimethoate and chlorpyrifos residues. During the first season, the analysis was done one day prior to harvesting, together with the Iprodione residue. However, in view of the erratic results of that year, samples were taken 1 day after de application during the second season. The samples from the first year were taken per treatment, separating inner and outer portions of the bunches. During the second season, samples were leaves collected from the crown area of the plants as this is where the product was wanted at that time of the year. The residue analysis was done by high resolution liquid chromatography at the Fundación Chile laboratories.

In order to establish a difference between averages, the results obtained underwent a variance analysis.

II.4.2 Results.

During the first season, the comparisons expected could not be completed as the mealybug was not found in any of the plants, not even on those without application. As there was no plague, the level was zero and all the treatments resulted equal among them and with a zero level for both varieties.

On the other hand, the residue analysis of dimethoate as well as chlorpyrifos in Sultana was also not significant, but this was probably due to the fact that the sample gathering was 44 days after the application (application 31/12 and harvest 13/02). The product has a residual time of 10-15 days. For example the MRL for dimethoate is 1ppm and the highest value found was 0,33 (the average was 0,07). The most stringent MRL for chlorpyrifos is 0,20ppm(RFA, France) and the highest value found was 0,12 (and 0,03 average).

No significant differences between treatments were observed in the residues, nor were there any between the outer and inner part of the bunch. (Table 15).

Table 15. Dimethoate and chlorpyrifos residue detected in Sultana grape bunches, 1 day prior to harvest, according to the position of the bunch and the product dosage used.

Treatments	dimethoate(ppm)	chlorpyrifos(ppm)
I1	0.077	0.037
I2	0.083	0.022
Blank control	0.051	0.033
Significance(95%)	NS	NS
P	0.7882	0.6310

Position	dimethoate(ppm)	chlorpyrifos(ppm)
Outer bunch portion	0.084	0.028
Inner bunch portion	0.055	0.033
Significance(95%)	NS	NS
P	0.4913	0.6801

During the second trial season, it was possible to observe the plague at the Nancagua vineyard and, also, the residue analysis produced significant results.

Table 16 depicts results from the dimethoate and chlorpyrifos residues detected on Sultana leaves 1 day after the first application. As it can be seen, the treatment effect was significant for both products (P=0,01 and P=0,05 respectively), with differences among them. The applications made with the ESS® equipment resulted in higher residues on the leaves than the applications made with hydraulic machine. In the case of.../

/... dimethoate, the I1 treatment duplicated the residues detected in I2 and T. In other words, it was possible to duplicate the amount of product left on the vines (19,71 ppm vs. 8,28 ppm) with equal product dosage applied by ha,. Similar results were obtained in the case of chlorpyrifos, where the I2 treatment duplicated the blank control.
These results would indicate that it is advisable to apply Salut with the ESS® system in order to have a better control of mealybugs.

Table 16. Dimethoate and chlorpyrifos residues detected on Sultana grape leaves 1 day after the first application in Nancagua 11/12/97.

Treatments	dimethoate(ppm)	chlorpyrifos(ppm)
I1 100% ESS®	19,71 **a**	5,92 **a**
I2 50% ESS®	8,86 **b**	4,24 **ab**
Blank control 100% MH	8,28 **b**	2,49 **b**
Significance(95%)	**	*
P	0,011	0,05

According to LSD, different letters indicate difference between averages

Table 17 shows the results of counting mealybugs on Sultana grape bunches. As it can be seen, there was no statistical difference between treatments, with 1 to 3 mealybugs per bunch. In this case –same as in the botrytis case- it is difficult to obtain clear results starting from different populations, erratically distributed in the vineyard. Moreover, an adult female is capable of laying between 50 to 100 eggs per season; thus the initial differences of 1 to 2 female adults per vine could be translated into a final difference of 100 to 200 mealybugs per bunch. In any case, what was expected in this instance -taking into consideration the residue levels found- was to have better control of the plague in I1 than in I2 and T, and it did not happen.

Table 17. Number of mealybugs detected in sultana grape bunches at harvesting time and having undergone different Salut dosages and application systems. Nancagua, 1998

Treatments	*Mealybugs (n°/ bunch)*
I1 100 % ESS®	3,50
I2 50 % ESS®	4,53
Blank solution 100 % M.H.	1,10
Significance (95%)	NS
P	0,2020

III. Conclusions of the Assessment by P.U.C. Chile

The main conclusions of this research are the following:

1 . No differences were observed in the Sultana grape thinning between the treatments used in either of the 2 assessment seasons. The ESS® system with 50% or 100% of the thinning dosage is equal to the control treatment with 100% commercial dosage by hydraulic machine application.

2. With regard to the berry growth trials, an effect was observed in connection to the application system utilised. The ESS® showed better efficiency than the traditional application method, which translated into bigger and heavier berries, without differences in the diameter of the berries. Moreover, a reduction in AG dosage to 50% produced equal results to 100% dosage with ESS® and higher than the traditional system.

3. Fertility and necrosis of the Sultana grape buds were not affected by treatments applied or by the spraying method used.

4. In the fungicide application trials, Iprodione residue was found to be 7 times higher when applied with ESS®, compared to the traditional system. In addition, it was possible to introduce a higher amount of the product inside the bunch, even with lower dosage per hectare, to those traditionally utilised.

4.1. Despite the higher residue levels in treatments with ESS®, no differences between treatments were found regarding presence and severity of the disease during both assessment seasons; it was not possible to distinguish between treatments, even in moisture chambers with and without inoculums. This questions the effectiveness of the product used during the assessments.

5. In connection with the Salut insecticide trials, it was not possible to get to any conclusions as the plague was absent from the Placilla vineyard. During the second season, higher dimethoate and chlorpyrifos residues were found in applications made with ESS®, compared with the traditional hydraulic system. However, it was not possible to obtain differences between treatments when evaluating at harvesting time. All treatments produced equivalent presence of mealybugs in the bunches. A high variability between bunches was found and this influenced the results.

6. Based on the aforementioned results, it is possible to conclude that due to the high efficiency achieved with the ESS® electrostatic aspersion system, a product dosage reduction of at least 50% is viable in the giberelic acid applications for berry thinning and growth as well as in the pesticide applications. Thus, of the amount of product left on the plants and the effectiveness of the same, equivalent results were obtained -or higher in some instances- compared with traditional turbo sprayers.