Nutrient Uptake Trial: Determination of Nutrient Uptake in Grapevines

Compiled for Murray Valley Winegrowers Inc. June 2015.

In 2014, Pam Strange from SGS Australia compiled a preliminary report into a trial looking into different formulations of foliar fertilizers and their levels of absorption in grapevines. The project observed the different levels of uptake of three forms of zinc, ranging from sulphates to chelates and amino acids. The information obtained would allow Murray Valley grape growers to access independent information regarding the absorption of foliar fertiliser formulations under local conditions, and to assess suitability and efficiency of foliar fertiliser applications within their vineyards.

Further work was conducted to assess the foliar uptake of different foliar fertiliser formulations within the Murray Valley. A trial was conducted to measure the rate and timing of foliar absorption of the sulphate, chelate and amino acid form of the element zinc (Zn) under commercial conditions within a patch of Gordo grapevines.

To read the paper '*Preliminary determination of nutrient uptake in grapevines'* compiled by Pam Strange, visit the Murray Valley Winegrowers Inc website – mvwi.com.au

Introduction

A number of foliar fertilisers are available to grape growers in different formulations including sulphates, chelates and amino acids. Different fertiliser companies claim benefits attributed to their products as to their effectiveness, timing and rate of absorption. This is evident in Figure 1, which demonstrates the uptake of different formulations of an unknown element.

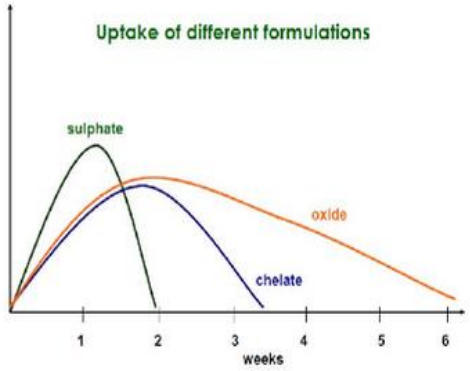

Figure 1, Uptake of different formulations. Agrichem (2015).

It is common practice for winegrape growers within the Murray Valley to apply foliar fertilisers to correct nutrient deficiencies. Results from independent trials into foliar nutrient absorption have provided information on responses to foliar applications of fertilisers under local conditions.

Aim

This trial aims to provide information on absorption of three formulations (chelate, oxide and sulphate) of zinc (Zn) when applied to Gordo grapevines within the Murray Valley. A comparison of the graph produced by Agrichem will be made.

Materials and methods

Prior to the trial, no foliar fertiliser was applied during the current growing season. The Gordo vines are five years old and the trial was conducted over an area of 1.2 Ha.

Four treatments were applied on November 8, 2014 – these consisted of three replicates with a control (water), an oxide treatment, a sulphate treatment and a chelate treatment. The treatments were applied using a two-row Green tec spray cart. Ground speed was recorded at 3.7 km/h with application pressure recorded at 8 Bar, resulting in an application rate of 1000 L/Ha. The size of each treatment for the different formulations of zinc was 0.4 Ha and was further divided into three replicates. One thousand litres per hectare was deemed to be the point of runoff as a dilute spray. This was consistent with the method of the work conducted by Pam Strange '*Preliminary determination of nutrient uptake in grapevines'* where potted vines were dipped in the treatment and deemed to be at the point of runoff.

Again to be consistent with the work of Pam Strange, the element zinc (Zn) was applied in the three different formations. The different forms of zinc were all applied at the rate of 25g of zinc per 100L of water, resulting in a rate of 250 grams of actual zinc in 1000L applied over 1 Ha.

Two, 200 metre rows were sprayed for each of the three different replicates of the four treatments. Treatments and replicates were marked with tags for identification and sampling purposes.

After each treatment, the Green tec spray tank was double rinsed, pump run to wash out spray nozzles, drained and a further rinse applied prior to filling and new application applied.

A total of 12 samples were collected from the four treatments with the three replicates on 12 sampling dates. Samples of 250 grams of leaves were collected and sent for lab analysis. At the lab, leaves were washed in a 1% hydrochloric acid solution and rinsed in tap water and allowed to dry to ensure any unabsorbed zinc remaining on leaf surface would not be measured.

Treatments

Product	Zinc Concentration
Control	Water
Zinc Chelate (Biostim)	13% Zn as Zinc Chelate
Zinc Oxide (Twin Zinc)	70% Zn as Zinc Oxide
Zinc Sulphate (Hepta)	21.5 % Zn as Zinc Sulphate.

*All treatments were applied with a wetting agent.

Treatment	g or ml / 100L
Control Water + Vitiwet.	Water + Vitiwet 10ml / 100L
Zinc Chelate (Biostim) + Vitiwet	25g per Ha Zn / 13% Zn = 192g per 100L + Vitiwet 10ml / 100L
Zinc Oxide (Twin Zinc) + Vitiwet	25 g per Ha Zinc / 70% Zn = 36g per 100L + Vitiwet 10ml / 100L
Zinc Sulphate (Hepta) + Vitiwet	25 g per Ha Zinc / 21.5% Zn = 117g per 100L + Vitiwet 10ml / 100L

Leaf sampling dates

Date	Days after treatment.
Nov 8 2014	0
Nov 9 2014	1
Nov 10 2014	2
Nov 11 2014	3
Nov 12 2014	4
Nov 13 2014	5
Nov 14 2014	6
Nov 15 2014	7
Nov 19 2014	11
Nov 25 2014	17
Nov 29 2014	21
Dec 7 2014	28

Results:

The raw results for the different zinc treatments can be viewed in Attachment 1. The results of the individual replicates were combined to give the results shown in Figure 2.

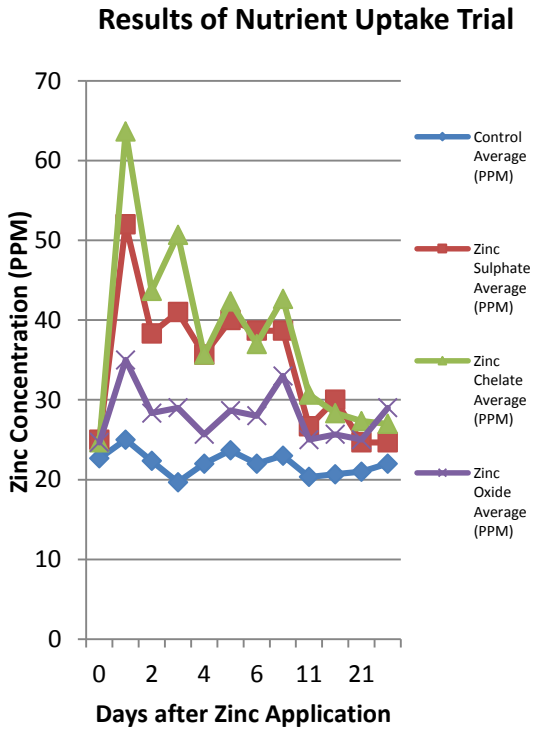

Figure 2, results of Nutrient Uptake Trial.

Key points of the results include:

- There is a greater initial increase in the zinc concentrations of the leaves treated with zinc sulphate and zinc chelate compared to the zinc oxide treatment.
- The zinc chelate treatment delivered the greatest initial response until day four, from where it was comparable with the zinc sulphate treatment.
- The zinc oxide treatment results were the most consistent through the trial but showed the lowest level of absorption of zinc into the vine leaves.
- After day 11 all treatments showed comparable zinc levels in the grapevine leaves compared to control treatment.
- All treatments showed an increase in zinc levels in comparison to the control treatment.

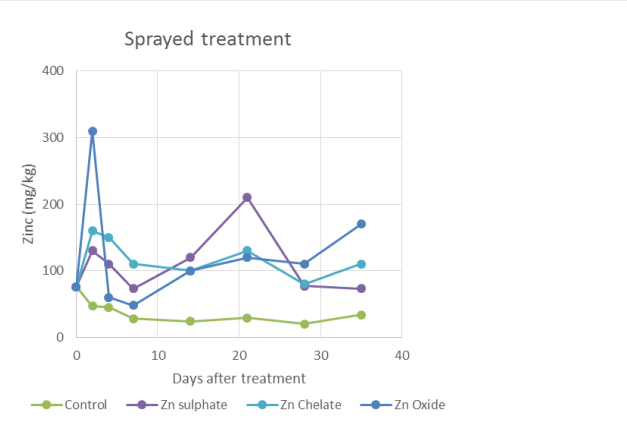

Figure 3, Pam Strange nutrient uptake results

Discussion and Conclusion

In the preliminary determination of nutrient uptake in grapevines, Pam Strange's results (Figure 3) demonstrated that grapevine leaves treated with the zinc products showed zinc oxide had a higher and quicker uptake than the zinc sulphate and zinc chelate. The zinc

sulphate and zinc chelate treated leaves had higher zinc levels for longer periods.

In the field trial, the same observations were not made. There was a higher and sharper response to the application of zinc chelate followed by zinc sulphate during the initial phase of the trial. The zinc oxide treatment showed the least initial response over the first 11 days. Between day 11 and 28 there were negligible differences between the zinc levels of all treatments.

The trials showed different uptake of the formulations 1 to 14 days after application as shown from all graphs. The higher and shorter length response to the zinc sulphate treatment was not observed as shown in the Agrichem graph. Zinc sulphate started to decline 14 - 21 days after application in 2 of the 3 data sets. The zinc chelate showed low levels at 21 days across the 3 graphs. The zinc oxide observation were similar across the three data sets up to 21 days from application. Pam Strange data set showed an increase in sulphate after 21 days which is not consistent with the two other data sets.

Sulphates can be very quickly absorbed by the leaves, particularly under favourable weather conditions. Chelates absorption by foliar application mean fewer applications are required during the growing period. Oxides generally release nutrients much more slowly than sulphates or chelates extending the release as they are not readily plant available (they need to be broken down or metabolized by the plant first).

CRC for Viticulture (2006) reports on the importance in mature vineyards for the application of foliar fertilisers such as zinc. The report outlines vineyard deficiencies of

zinc, should be treated with an application 10 days before flowering. This will maximise the cropping potential through ensuring there is no limitation on fruit set from zinc availability to flowers.

For further advice on foliar application of fertilisers for use in vineyards, engage a local agronomist with local knowledge to conduct leaf and / or soil analysis to determine a vineyard`s specific requirement.

Attachment 1:

Days After Treatment	0	1	2	3	4	5	6	7	11	17	21	28
Control 1 PPM	24	27	25	20	23	22	22	23	21	22	22	29
Control 2 PPM	22	21	20	19	19	27	21	22	20	19	22	16
Control 3 PPM	22	27	22	20	24	22	23	24	20	21	19	21
Control Average PPM	**23**	**25**	**22**	**20**	**22**	**24**	**22**	**23**	**20**	**21**	**21**	**22**
Zinc Sulfate 1 PPM	25	55	36	43	35	41	36	34	26	29	23	24
Zinc Sulphate 2 PPM	23	58	41	33	33	39	35	44	24	32	25	24
Zinc Sulphate 3 PPM	27	43	38	47	39	40	45	38	30	29	26	26
Zinc Sulphate Average PPM	**25**	**52**	**38**	**41**	**36**	**40**	**39**	**39**	**27**	**30**	**25**	**25**
Zinc Oxide 1 PPM	25	35	30	29	25	31	34	32	25	25	26	29
Zinc Oxide 2 PPM	22	34	28	30	25	27	26	33	26	25	22	31
Zinc Oxide 3 PPM	27	36	27	28	27	28	24	34	24	27	27	27
Zinc Oxide Average PPM	**25**	**35**	**28**	**29**	**26**	**29**	**28**	**33**	**25**	**26**	**25**	**29**
Zinc Chelate 1 PPM	25	70	43	50	32	37	36	38	29	25	26	26
Zinc Chelate 2 PPM	23	61	42	44	37	45	35	43	31	28	26	26
Zinc Chelate 3 PPM	26	60	46	58	38	45	40	47	32	32	30	29
Zinc Chelate Average PPM	**25**	**64**	**44**	**51**	**36**	**42**	**37**	**43**	**31**	**28**	**27**	**27**

Attachment 1. Raw Data from Nutrient Uptake Trial.

Resources

P. Strange (2014) *Preliminary determination of nutrient uptake in grapevines.* SGS Australia for Murray Valley Winegrowers Inc. Mildura.

CRC for Viticulture (2006*). Viti Note: Grapevine Nutrition 7; Trace Elements.* Cooperative Research for Viticulture. www.crcv.com.au/viticare/vitinotes.

Agrichem (2015). www.agrichem.com.au

Murray Valley Winegrowers' Inc

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