THE CONTROL OF IRON CHLOROSIS IN CITRUS TREES BY THE USE OF METALOSATE IRON IN COMBINATION WITH DIFFERENT WETTING AGENTS

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Introduction

Iron chlorosis, sometimes severe enough to cause citrus trees to die, occurs in many orchards in the Sundays River Valley (Skinner Report 1 of 2002). Soil drenches of iron EDDHA chelate usually give consistently good results but the treatment is expensive and may cost as much as 25% of the value of the crop. The news that Albion Advanced Nutrition had produced a product for soil application based amino acid chelated iron was received with great interest as this development seemed to offer a potential of a more economic method for controlling chlorosis in citrus. Eric Holmden compared this new material with foliar applications of Metalosate Iron in 2001. Iron EDDHA chelate applied as a soil drench was used as a standard for comparison in this work. The results of this trial were negative in all respects as all treatments failed to affect the chlorosis in the slightest. As a last resort Holmden injected the trunks of two trees with Metalosate Iron diluted with water, applying the same dose per tree as applied by a single foliar spray. Response to this latter treatment was very dramatic as trees which were 80% chlorosis became 90% re-greened within a few weeks of the treatment.

It is generally considered that citrus would react negatively to trunk injections and Holmden's results do therefore not seem to offer much promise in a commercial sense. They do however demonstrate in a very clear fashion that Metalosate Iron can be extremely effective in curing iron chlorosis provided it can be applied in an effective way. His results also confirm that normal foliar sprays are not effective.

In this project attention is paid to the role that spray adjuvants might play in improving the response to foliar sprays of Metalosate Iron on severely chlorotic citrus trees.

Key words: amino acid chelated iron, wetting agents, iron deficiency, and citrus

Summary

Chlorotic two-year old Midknight Valencia oranges in the Sundays River Valley were treated with a programme of three sprays of Metalosate Iron. These sprays were applied with and without adjuvant. Of the seven adjuvants tested, only Silwet® at 0.05% produced a strong reduction in the level of

chlorosis. Further work is now required to determine the optimum spray concentrations at which Silwet and Metalosate Iron should be used.

Materials and Methods

Trial site. The trial was conducted in the summer of 2002/03 on a Midnight (Valencia type) citrus orchard at Skinner farming situated in Kirkwood in the Sundays River Valley, Eastern Cape, South Africa. The trees used in this trial are planted on Swingle citrummelo and have a spacing of 5m x 3m (16.40 ft x 9.84 ft.) i.e. 666 trees per hectare (269 trees/acre). The $pH_{(water)}$ of the soil was measured at 8.98 on the 24th of April 2002 and the $pH_{(water)}$ of the water was measured at 7.3 on the 5th of November 2002. The soil pH analysis was done at CAL analytical laboratories in Somerset West and the water pH analysis at Matrocast Laboratories in Wellington. Both laboratories are situated in the Western Cape, South Africa.

Materials. The trial consisted of eight treatments including the untreated control; Metalosate Iron at 4 litre/hectare (55 fluid ounces/acre) applied alone and in combination with Silwet (organic silicone wetting agent) at 0.05%; N-Sure (glutaric acid compound) at 5 litre/hectare (68 fl oz/acre); Orchex oil (mineral oil wetting agent) at 0.3%; Li 700 (mineral oil wetting agent) at 0.05%; Nutrivant (potassium phosphate product containing a wetting agent) at 1.0% and Terraful (fulvic acid) at 1.0%.

Method. Foliar spray applications were made by means of a knapsack sprayer. The foliar sprays were based on a total volume of 1332 litre/hectare (18241 fluid ounces/acre) or 666 trees x 2 L (68 fluid ounces) per tree. Eight litres (271 fluid ounces) of mixture were made up for each treatment and two litres (68 fluid ounces) measured and sprayed on each tree. All spray treatments were buffered with Kynobuff at 1 ml/L (ratio of 1/1000). The treatments were applied on the 30th of October, 28th of November and 26th of December 2002.

Experimental design. A randomised block design with single tree plots and four replications was used. There was only one main effect namely wetting agent.

Results

Trees were rated for the percentage of chlorotic foliage prior to and after the final treatment. These ratings are shown in Appendix 1 which also shows the mean percentage change, if any. Figures 1 to 3 are photographs taken of the most important treatments during mid January 2003.

On 26th of February 2003 (three months after final treatment) leaf samples were picked from some of the treatments for analysis of iron (Appendix 2). Sampling was done as per the traditional method used by the SA citrus industry. This entails picking leaves from behind terminally borne fruit. This ensured that all leaves picked were about 6 months old. Each sample was a composite of the four replicates of that treatment.

Discussion

The use of the organic silicone wetting agent, Silwet at 0.05% dramatically increased the efficacy of Metalosate Iron in reducing iron chlorosis. The other wetting agents that were tested did not have any significant effect on the efficacy of Metalosate Iron, except for the fulvic acid product Terraful which showed some promise, but not to the extend of the organic silicone wetting agent, Silwet.

Although there appear to be no correlation between the chlorosis ratings of the trees and the iron content of their leaves (appendix 2), the level of iron was higher in all the treatments compared to the untreated control.

Conclusions

Foliar applications of Metalosate Iron show promise provided it is used with an organic silicone wetting agent like Silwet. If foliar applications of Metalosate Iron are to be recommended on a commercial scale it is important that the spray volume is established based on tree size.
The application of Metalosate Iron can be as effective as the soil applied chelates if it is applied as a maintenance spray on a frequent basis throughout the season. Higher application rates will have to be investigated to bring it to the same standard as the soil applied drenches. Lastly and most importantly cost comparisons will have to be made.

Acknowledgements

We would like to thank Eric Holmden, who has been involved in the development of Metalosate Iron for almost 4 years, for his advice and active participation in this project.

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APPENDIX I

Table 1
The Amount of Chlorotic Foliage Before and After Foliar Spray Treatment

Treatment	Time Rated	Replicate A	B	C	D	Means
Untreated control	Pre	90	90	90	90	90
	Post	90	80	90	90	87.5
	Difference	0	10	0	0	2.5
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) alone	Pre	80	90	80	90	85
	Post	90	70	70	90	80
	Difference	-10	20	10	0	5
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 0.05% Silwet	Pre	90	90	80	90	87.5
	Post	30	10	40	50	32.5
	Difference	60	80	40	40	55
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 5 litre/hectare (68 fl oz/acre) N-Sure	Pre	90	80	90	90	87.5
	Post	90	80	90	90	87.5
	Difference	0	0	0	0	0
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 0.3% Orchex oil	Pre	90	90	90	90	90
	Post	90	80	90	90	87.5
	Difference	0	10	0	0	2.5
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 0.05% Li 700	Pre	80	90	80	90	85
	Post	80	90	80	40	72.5
	Difference	0	0	0	50	12.5
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 1.0% Nutrivant	Pre	90	80	90	90	87.5
	Post	80	80	90	90	85
	Difference	10	0	0	0	2.5
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 1.0% Terraful	Pre	90	80	90	90	87.5
	Post	90	30	80	60	65
	Difference	0	50	10	30	22.5

APPENDIX II

Table 2
Leaf analysis report

Treatment	Fe mg/kg
Untreated control	73
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) alone	264
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 0.05% Silwet	200
Fe Metalosate at 4 litre/hectare (55 fl oz/acre) 1.0% Terraful	204

Figure 1. Metalosate Iron Foliar with Silwet

Figure 2. Metalosate Iron Foliar with Terraful

Figure 3. Untreated Control