Evaluation of The Efficiency of Re-Leaf® for Improving the Salt Tolerance and Yield of Almonds

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Salinity causes numerous problems for plant growth and development which results in abnormal normal physiological functions. This include root functions which can affect nutrient uptake which can ultimately results in yield loss[1]. Many horticultural regions of Australia are affected by salinity, including a number of regions that produce almonds[2]. Amino acids are well known bio-stimulants which positively impact plant growth and yield[3]. Exogenous application of amino acids has been reported to improve salt tolerance, nutrient status and growth in many plant species

Key words: Salinity, abnormal tissue growth, amino acids**,** bio-stimulants

Introduction

In this study, the effect of exogenous application of a formulation containing a mixture of 17 different amino acids and biologically active organic molecules (BAOM- Patented product) on salt stressed almonds is investigated. Testing the reduction of salinity damage in almonds by using a mixture of amino acids to improve plant nutrient status and yield.

Transit Re-Leaf® is a formulation containing 17 amino acids (50%) and biologically active organic molecules – BAOM (5%). This study assesses the effectiveness of Transit Re-Leaf® in improving salt stress tolerance in almonds.

Objectives

The specific objectives of this study are:

1. Evaluate the effect of fertigation with Transit Re-Leaf® on improving the nutrient status of salt stressed almonds.
2. Evaluate the effect of Transit Re-Leaf® on improving crop vigour and canopy growth of almonds grown in highly saline soil.
3. Evaluate the effect of fertigation with Transit Re-Leaf® on the yield parameters of almonds; nut weight, kernel weight and total yield.

Materials and Methods

Site Selection and Trial design

This trial was conducted in an almond orchard within the Sunraysia region of Victoria. The selected block in the orchard had severe salinity issues. The area chosen had been replanted due to the loss of older almond trees as a result of salinity issues.

Soil injection of Transit Re-Leaf® was applied across the sample site, with ten trees from three rows isolated using drip line taps. These where considered the control plants. Ten trees from three adjacent rows were considered the treated trees.

Table 1: Application rate and timing of Re-Leaf®

Treatment	Rate/ha	Application timing
Control	0	
Transit Re-Leaf®	30 L/ha	After Flowering Fruit Development Stage

Table 2: Trial design layout for applications of Re-Leaf as the treatment with designated control rows

Control	**Tree 1**	**Tree 2**	**Tree 3**	**Tree 4**	**Tree 5**	**Tree 6**	**Tree 7**	**Tree 8**	**Tree 9**	**Tree 10**
Treated	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6	Tree 7	Tree 8	Tree 9	Tree 10
Control	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6	Tree 7	Tree 8	Tree 9	Tree 10
Treated	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6	Tree 7	Tree 8	Tree 9	Tree 10
Control	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6	Tree 7	Tree 8	Tree 9	Tree 10
Treated	Tree 1	Tree 2	Tree 3	Tree 4	Tree 5	Tree 6	Tree 7	Tree 8	Tree 9	Tree 10

Observations

Soil analysis

Soil samples were taken prior to the trial and analysed by Phosyn Analytical, Queensland.

Leaf nutrient analysis

During the active growth stage, leaf samples were collected from each tree in both the control and treatment groups. These leaves were washed and analysed at Analytical Laboratories and Technical Services Australia, Victoria - for the presence of: Nitrogen, Phosphorus, Potassium, Sulfur, Calcium, Magnesium, Sodium, Aluminium, Boron, Copper, Iron, Magnanese, Zinc, Silicon and Molybdenum.

Kernel Weight, Hull weight and Nut Weight

A 0.50 metre transect of whole nuts was collected from each row, and the resulting nut weight and kernel weight measured and recorded.

Statistical Analysis

Analysis of variance was performed using Prism 7 (Graph Pad Software). Significant difference between the treatments was determined by comparing the replicate means using Tukey's test ($P<0.05$). A t-test was performed to determine the significant difference between the control vs treated. A P value <0.15 was considered to be significant.

Results and Discussion

Figure 1. A) control trees at harvest. B) control nuts at harvest

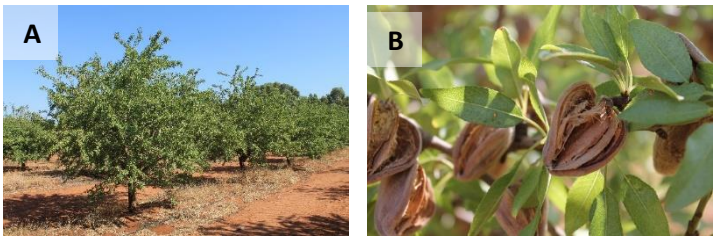

Figure 2. A) Treated trees at harvest. B) Treated nuts at harvest

Figure 3 shows that the whole nut weight collected from the trees treated with Re-Leaf® was significantly higher than the nuts collected from the control trees. There was a difference of 1% in the weight.

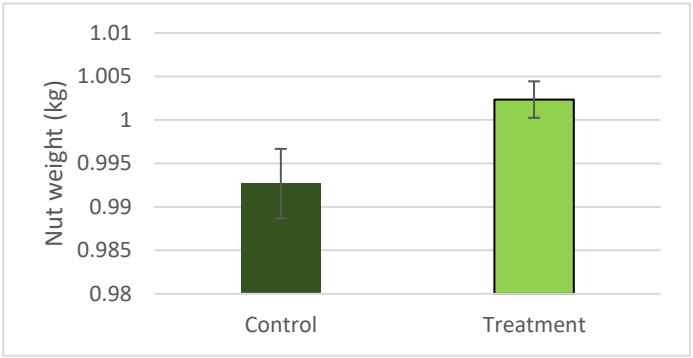

Figure 3. Whole nut weight collected from trees with reference to Control vs Treatment. Each bar represents mean ± SE. A t-test was performed to determine the significant difference between the control Vs treated, different superscripts show significant difference ($P<0.15$). The t-test was performed with Prism 7

Figure 4 shows the kernel weight of the nuts collected. It shows that plants treated with Re-Leaf® had an increase kernel weight by 32.6% compared to that of the control, this change was considered to be statistically significant.

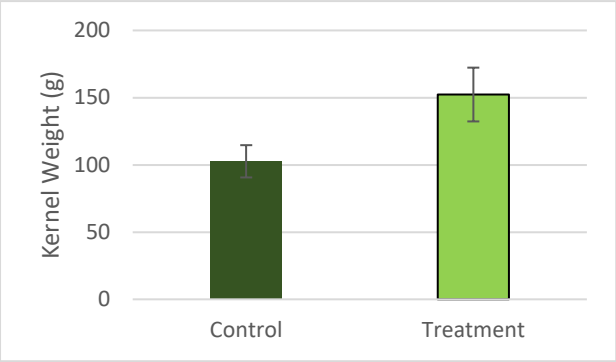

Figure 4. Kernel weight collected from trees with reference to Control vs Treatment. Each bar represents mean ± SE. A t-test was performed to determine the significant difference between the control vs treated, different superscripts show significant difference (P<0.15). The t-test was performed with Prism 7 (Graph Pad Software).

Figure 5 shows the weight of whole nuts collected in a 50 cm transect from the ground. The plants treated with Re-Leaf® saw an increase of 40% of the whole nut weight compared to that of the control, this result was considered significant.

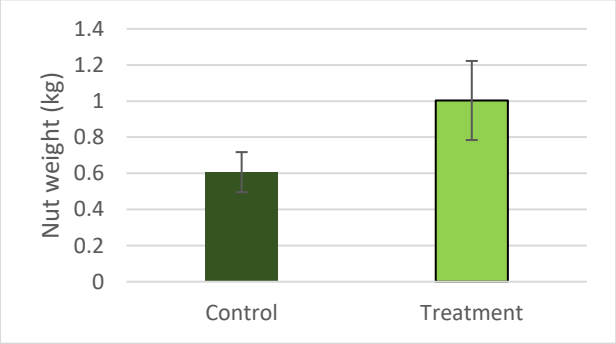

Figure 5. Whole nut weight collected from ground (50cm) with reference to Control vs Treatment. Each bar represents mean ± SE. A t-test was performed to determine the significant difference between the control vs treated, different superscripts show significant difference (P<0.15). The t-test was performed with Prism 7 (Graph Pad Software).

One hundred (100) kernels were collected from both the treated and the control samples. There was a weight increase of 10.9% in the weight of the 100 treated kernels as compared to that of the control (Figure 6)

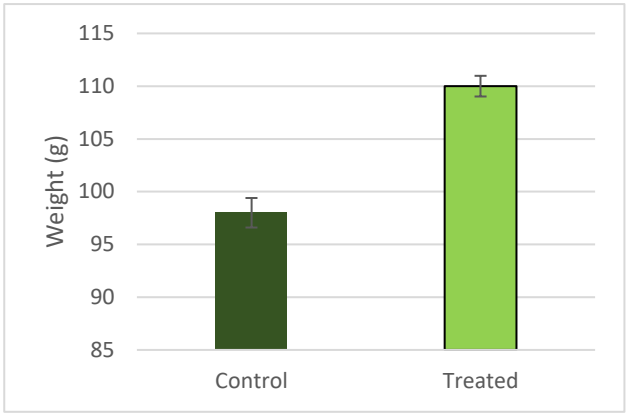

Figure 6. The weight (grams) of 100 kernels, comparing treated plants to control. Each bar represents mean ± SE. A t-test was performed to determine the significant difference between the control vs treated, different superscripts show significant difference (P<0.15). The t-test was performed with Prism 7 (Graph Pad Software).

The outturn was 33.7% for the treated plants and 30.3% for the control plants (Figure 7). It was found that outturn increased by 3.1% through application of Re-Leaf®. Outturn was calculated as the percentage of kernel weight to whole nut weight.

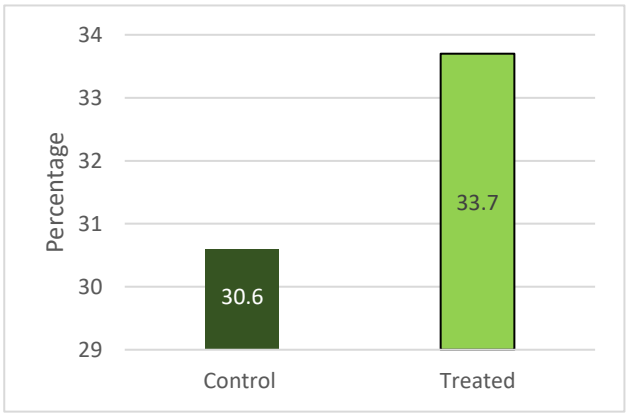

Figure 7. The outturn for Re-Leaf® treated plants, compared to that of the control.

Figure 8 (A and B) displays the nutrients levels found in the leaves of the plants treated with Re-Leaf® compared to the control plants. Nitrogen, Copper, Sodium and Iron all showed a significant increase in the treated plants compared to the control. Graph C shows the percentage change in nutrient levels between the control and the treated plants.

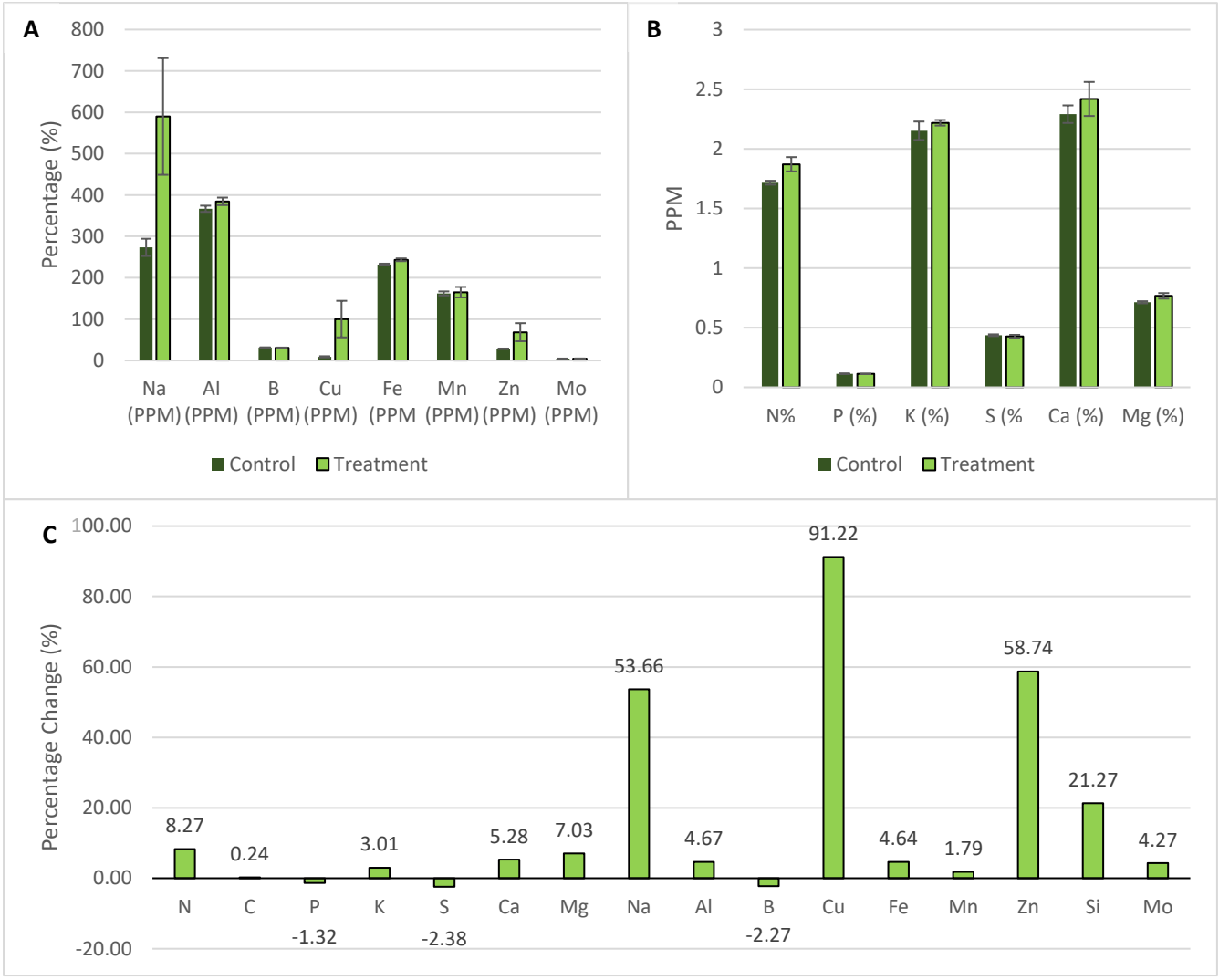

Figure 8. The effect of Re-Leaf® application on the nutrient levels of elements in the leaves of plants compared to the control plants (A and B) and the percentage change (C). A t-test was performed to determine the significant difference between the control vs treated, different superscripts show significant difference ($P<0.15$). The t-test was performed with Prism 7 (Graph Pad Software).

Conclusion

This study demonstrates that Re-Leaf® applied through fertigation can increase the yield of almonds grown in soil with salinity problems. More explicitly:

- Plants treated with Re-Leaf® had increased nutrients in their leaves.
- The outturn was increased by 3.1% by the application of Re-Leaf®.
- The yield of almonds collected in a 50cm transect was increased by 40% in rows treated with Re-Leaf® compared to the control rows.

References

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