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# COMPARISON OF FREEZING PROTECTANT SPRAYS APPLIED TO AVOCADO TREES

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## ABSTRACT

Six freezing protectant products were sprayed at maximum label rates on one year old Hass avocado trees. Control trees were sprayed with water. Treatments were applied three times at monthly intervals, December 20, January 20, and February 20. Products tested were Copper Count-N®, Champ®, Frost Guard®, Frost Shield®, Anti Stress 550®, and Insulate®. Trees experienced one night of damaging temperatures with a duration of five and one-half hours at or below 1.1°C (30°F) and a minimum temperature of 2.3°C (27.9°F) on January 4. All of the products tested provided some level of freezing protection to mature leaves as compared to water-treated control trees, however there was no statistical difference between products.

## INTRODUCTION

A number of chemical freezing protectant products have been advertised in recent years. Some are claiming to work as bactericide ice-nucleation inhibitors, some as anti-transpirants. This study tested the effectiveness of six products sold for freezing protection.

## MATERIALS AND METHODS

Six freezing protectant products were sprayed at maximum label rates on one year old Hass avocado trees in order to test and compare their effectiveness. Control trees were sprayed with deionized water. Treatments were applied three times at monthly intervals, December 20, January 20, and February 20. The products tested were Copper Count-N®, Champ®, Frostguard®, Frost Shield®, Anti Stress 550®, and Insulate®. Rates were 3.43 qt, 8 qt, 18 qt, 8 qt, 8 qt, and 4 qt, respectively, diluted in 300 gal of water which was the equivalent rate per acre for mature trees. Copper Count-N and Champ are bactericide anti-ice nucleators containing copper compounds. Frost Shield, Anti Stress 550, and Insulate are anti-transpirants. Frost Guard has secret ingredients.

Two separate orchard areas were treated, one with additional freezing protection by a wind machine and the other with no wind machine. The experimental design for each orchard area was a randomized complete block with seven replications.

Mature Hass avocado leaves freeze at 1.1°C (30°F) (McNeil, 2001). Freezing temperatures and subsequent leaf damage occurred on January 4, which was two weeks after the first treatment. The wind machine protected area experienced two hours at or below 1.1°C (30 °F) with a minimum temperature of 1.2°C (29 °F), while the area without a wind machine experienced five and one-half hours at or below 1.1°C (30 °F) with a minimum temperature of 2.3°C (27.9 °F).

One hundred mature leaves per tree were rated as to any freezing damage, slight damage (1-33%), moderate damage (33-66%), or severe damage (66-100%).

## RESULTS AND DISCUSSION

All six freezing protectant products consistently reduced freezing damage of mature leaves below that of the water treated control trees except in one instance for all four categories of leaf freezing damage evaluated in both orchard areas, that with and that without a wind machine (Tables 1 though 4). Damage was reduced by approximately half for some of the treatments as compared to control trees. Data for four products (Anti Stress, Copper Count-N, Insulate, Champ) was statically lower than the control slightly damaged leaves (Table 2) and for all six products (including Frost Guard and Frost Shield) for moderately damaged leaves (Table 3). Data was not statistically different between products.

## CONCLUSION

All of the freezing protectant products tested appeared to be able to provide some level of freezing protection to mature leaves of Hass avocado trees as compared to water treated control trees. Further tests are recommended to compare these products with each other before any one might be recommended over any other since statistical differences between products were not observed in this study.

## REFERENCES

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**Table 1**

Comparison of chemical freeze protectants as to any damage to avocado leaves

| Mean % of Leaves with Damage* | | | |
|---|---|---|---|
| **Avocado Block #1 (with wind machines)** | | **Avocado Block #2 (without wind machines)** | |
| Treatment | Percent | Treatment | Percent |
| Water | 18.7 | Water | 40.8 |
| Anti-Stress | 15.9 | Frost-Guard | 30.5 |
| Insulate | 13.7 | Frost-Shield | 29.4 |
| Frost-Guard | 11.9 | Anti-Stress | 29.3 |
| Copper Count-N | 11.8 | Insulate | 28.5 |
| Frost-Shield | 11.2 | Copper Count-N | 24.4 |
| Champ | 8.3 | Champ | 21.3 |

*no significant differences by analysis of variance

**Table 2**

Comparison of chemical freeze protectants as to slight (1-33%) damage to avocado leaves

| Means % of Leaves with Damage* | | | |
|---|---|---|---|
| **Avocado Block #1 (with wind machines)** | | **Avocado Block #2 (without wind machines)** | |
| Treatment | Percent | Treatment | Percent |
| Water | 4.1 a | Water | 14.4 a |
| Insulate | 3.7 a | Frost-Guard | 11.3 ab |
| Frost-Guard | 3.7 a | Frost-Shield | 10.8 ab |
| Copper Count-N | 3.1 a | Anti-Stress | 10.0 b |
| Anti-Stress | 3.0 a | Insulate | 9.9 b |
| Champ | 2.9 a | Copper Count-N | 9.6 b |
| Frost Shield | 2.7 a | Champ | 7.5 b |

* means not followed by the same letter are significantly different at the 5% level, Duncan's Multiple Range test