

Evaluation of Citrus Frost Protectant Materials

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ABSTRACT

With the high cost of maintaining and operating wind machines, growers are increasingly interested in alternative methods of freeze protection. Several possible frost protectant materials were applied to Valencia oranges at the Yuma Mesa Agricultural Center. Although temperatures reached the mid-to-upper 20s at the test site during the winters of 1984-1985 and 1985-1986, no frost damage occurred. As a result, it was impossible to evaluate the effectiveness of the materials.

INTRODUCTION

With the increased cost of maintaining and operating wind machines, citrus growers are looking for less expensive methods of frost protection. The Arizona Citrus Advisory Council has listed this as a high priority item.

One method being investigated by researchers is the use of frost protectant materials which can be sprayed on the trees. It has been found that certain bacteria occurring naturally on plants act as nucleating agents for ice formation. By either killing these bacteria or preventing them from acting as a nucleus, the plants can withstand temperatures several degrees colder than normal without receiving frost damage.

One possible approach to control these bacteria is using a bactericide such as Streptomycin. This appears to be effective when applied before a large population is present on the plants. However, the bacteria potentially could develop resistance to the spray, making it ineffective.

Since only a small percentage of the bacteria found on plant surfaces are active as ice nuclei, another possible approach is using antagonistic bacteria to keep the number of ice nucleating bacteria under control. To be successful, it appears that the plant environment must be altered to favor the antagonistic bacteria.

The most promising method is a material which will inhibit the ability of the bacteria to act as a nucleus for ice formation. These materials include weak acid solutions or heavy metal ions such as copper and zinc. These materials must not be applied in concentrations that would damage the trees.

It has been estimated that approximately one-third of the citrus acreage in the Yuma area received some type of frost protectant spray during 1984-1985, and nearly half the acreage in 1985-1986.

METHODS AND MATERIALS

Six materials were tested on Valencia oranges at the Yuma Mesa Agricultural Center during 1984-1985. Two copper based fungicides, a trace mineral spray, a polymer product used to coat the plant, a weak acid solution, and a product containing several of the above materials were used. In 1985-1986 two additional materials, including bactericides, were added to the study.

The materials were applied at the manufacturers' recommended rates using a John Bean sprayer with a handgun operating at 300 psi. The trial included four trees for each treatment using a completely randomized design. Guard trees were used to prevent contamination due to drift.

RESULTS

Although there were several periods when temperatures fell into the mid- to upper-20s, no frost damage has occurred at the test site since the study began. As a result, evaluating the effectiveness of the frost protectant sprays has not been possible. None of the materials used appear to cause any phytotoxicity problems.

Even if freeze damage does occur, it would be difficult under the current situation to evaluate the effectiveness of frost protectant materials due to the many variables involved. For each material tested, the variables include: the optimum rate of application; the length of time after application before protection is provided; the length of effectiveness before reapplication is necessary; and the amount of protection provided in OF.

Adequately determining the answers to these questions requires laboratory evaluation methods. An effective method of evaluation has been developed by Steve Lindow of the University of California which can be used under our local conditions. Funding for the necessary equipment is currently being sought; the fall of 1987 is the target date for the equipment and procedures to be in place.