

Controlled Atmospheres as a Quarantine Treatment for Table Grapes

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Over the past three years, our laboratory has been involved in a research program designed to develop a quarantine treatment which would allow California table grapes access to Australian markets. Three pests, identified by the Australian authorities as of concern for incoming California table grapes, were targeted in the research project: omnivorous leafroller, western flower thrips and Pacific spider mite. Controlled atmosphere treatments were investigated for their effectiveness against the three target pests and for the tolerance of grapes. Initially, treatments with different levels of carbon dioxide and oxygen at temperatures from 20°C (68°F) to 0°C (32°F) were tested. As expected, grape tolerance was best at lower temperatures. High carbon dioxide atmospheres were more effective than lower oxygen atmospheres.

After considerable research, we settled on two treatments to test extensively: 45% carbon dioxide and either air (11.5% oxygen) or 0.5% oxygen. These treatments were tested at 0°C (32°F) and 5°C (41°F) on all lifestages of the three pests. Omnivorous leafrollers were the easiest pest to kill, while the Pacific spider mites were most tolerant of the controlled atmosphere treatments. While mortality of many lifestages occurred faster at 0°C (32°F), the difference in time to mortality for the two temperatures was small. A comparison of the two atmospheres tested showed that the 45% carbon dioxide + air atmosphere provided more rapid mortality than 45% carbon dioxide + 0.5% oxygen. Statistical analyses showed that between 9 and 11 days of treatment was required to achieve quarantine security.

In 1995, with the assistance of TransFresh Corporation and SunWorld Inc., a commercial scale test of the treatment was conducted. Two 20 foot containers were each filled with 4 varieties of table grapes: "Thompson Seedless", "Red Globe", "Crimson" and "Ruby Seedless". Mesh covered plastic cups containing omnivorous leafrollers, western flower thrips or Pacific spider mites were placed into grapes boxes at scattered locations throughout each container. For 12 days, one container was maintained at 45% carbon dioxide + air at 0°C (32°F) while the second container

was maintained with air at 0°C (32°F). After the treatment, grape quality and pest mortality were assessed.

The evaluation of grape quality involved a visual assessment of berry color and rachis condition, measurement of soluble solids and titratable acidity and an informal sensory analysis. No detrimental effects to grape quality were detected. Mortality of the three pests in the CA container was 100% while in the air container mortality was 44, 2 and 26% for omnivorous leafroller, western flower thrips and Pacific spider mite, respectively.

This controlled atmosphere treatment protocol has been submitted to the Australian authorities and a dialogue has been initiated. We are hopeful that a favorable decision can be reached soon that will allow California table grapes to be shipped to Australia for the first time.

