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COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
AGRICULTURAL EXPERIMENT STATION
COOPERATIVE EXTENSION

DEPARTMENT OF ENVIRONMENTAL HORTICULTURE
DAVIS, CALIFORNIA 95616-8587 USA
Tel: (916) 752-0130
Fax: (916) 752-1819

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March 28, 1995

Lynne Dory
California Cut Flower Commission
2339 Gold Meadow Way, Suite 101
Gold River, CA 95670-4467

Dear Ms. Dory,

Enclosed please find the final reports for the grants *Controlled Atmosphere Disinfestation of Export Floral Products* and *Molecular Investigation of Senescence in Non-Climacteric Flowers.* I apologize for not having them in time for the CCFC Research Committee meeting in Sacramento on March 22. If you need any more information, please contact Dr. Michael Reid or myself.

Sincerely,

Linda Dodge

Linda Dodge, Staff Research Associate
Dept. of Environmental Horticulture
University of California
Davis, CA 95616
916-752-8633
916-752-1819 (FAX)

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FINAL
REPORT TO:
CALIFORNIA CUT FLOWER COMMISSION

SUBJECT:
CUT FLOWER DISINFESTATION FOR MARKET ACCESS

Research carried out at UC Davis by Dr Alan Carpenter, Professor Michael S. Reid, Ms Linda L. Dodge, & Ms Amanda Lewis (with assistance from- Department of Agronomy and Range Science, Department of Entomology -Professor Michael Parella, Mr C. Le Gault, and Mrs M Cross Rivers, and Department of Vegetable Crops - Dr Marita Cantwell and Ms Xunli Nie.
19.4.94-23.9.94

1. Project outline; there were six components to the research
   (i) Effectiveness of elevated carbon dioxide controlled atmospheres for the postharvest control of second instar and adult Western flower thrips. Fifteen atmospheres were tested: air, nitrogen, carbon dioxide; 40, 60 & 80% carbon dioxide with either- no oxygen, 0.25% oxygen, 2% oxygen (all balance nitrogen) and air (this equals about 12, 8 or 4% oxygen, with 40, 60 or 80% carbon dioxide). Exposure times were 0.5, 1, 2, 4, 8, or 24 hours, in 0, 12, 24, 30, 36, or 48 degrees Celsius. The thrips were reared on alfalfa.
   (ii) Effectiveness of elevated carbon dioxide against Melon Aphid. The atmospheres used were; air, nitrogen and carbon dioxide, and 60% carbon dioxide with 0, 0.25, 2 or 4% oxygen, all balance nitrogen. Exposure times were 0.5, 1, 2, 4, 8, & 24 hours, at 0, 12, 24, 30, 36, & 48 degrees Celsius. The aphids were reared on chrysanthenum.
   (iii) Effectiveness of the carbon dioxide propelled aerosol of permethrin and natural pyrethrins against Western flower thrips. This formulation, known as Floragas in New Zealand, was imported especially for the trial.
   (iv) Precommercial evaluation of a controlled atmosphere for control of aphids and thrips, and the effect of the treatment on flower quality after simulated transport to the East Coast of the USA. The atmospheres tested were air and 60% carbon dioxide+40% nitrogen at 40 degrees Celsius for 2, 4 or 8 hours. Simulated transport time was 7 days and quality was assessed after 7 days vase life.
   (v) Evaluation of carbon dioxide atmospheres for serpentine leafminer control on chrysanthemums. The atmospheres tested were air, 20, 40, 60, 80 and 100% carbon dioxide for 3, 6, 12, 24 & 48 hours at 23 degrees Celsius. The leafminers were treated at the first instar stage.
   (vi) Evaluation of carbon dioxide for bulb mite control on freesia bulbs.

2. Results
   (i) Second instar Western flower thrips were much more difficult to kill than were the adults. At 36 & 48 degrees the temperature effect was more important than the atmosphere effect. The atmospheres worked more quickly if they did not contain

oxygen. The data have been sent to a statistician at Riverside for analysis. As there were 2 replicates of 1080 total treatments, analysis will take some time and interpretation will be complex.

(ii) Aphids were readily killed by temperatures above 30 degrees. At lower temperatures atmospheres with no oxygen were more effective than those with oxygen present. The aphids were affected by low temperatures (zero deg. Celsius).

(iii) Floragas was completely ineffective against Western flower thrips, even at twice the application rate used to control New Zealand flower thrips.

(iv) The precommercial trial evaluated roses, carnations, Godetia, Freesia, stocks, larkspur, chrysanthemum, aster and Alstroemeria. The effects of the treatments on Western flower thrips and Melon aphid were also tested. Plant response was variable and appeared to depend partly on water status and general condition. Mortality of the insects increased with time of exposure. An effective postharvest treatment appeared to be 4 hours treatment.

(v) Treatment of Serpentine leafminer with 60% or more carbon dioxide caused 100% mortality in 12-24 hours. With 100% carbon dioxide and longer exposure times for 60 and 80%, there was some damage to the plants.

(vi) 80 and 100% carbon dioxide gave excellent control of bulb mites in 24 hours

3. Conclusions:

Elevated carbon dioxide controlled atmospheres offer an effective approach to postharvest insect control and to ensuring that planting material is insect free. There are a number of factors that need investigating prior to implementation of the technology.

(a) The importance of oxygen in a controlled atmosphere for minimising any phytotoxic responses is completely unknown. One approach to this that has not been investigated fully is to use scanning calorimetry to develop profiles of metabolic response to potential treatments. As there are many floricultural crops that may be subject to a quarantine treatment, this sort of experimental approach offers major economies. There is now no doubt that thrips and aphids die faster in atmospheres with no oxygen and that plants have at least some tolerance of these treatments.

(b) There is little useful data on the use of controlled atmospheres for scale and mite control on any crop, and for Lepidoptera control on ornamental crops.

(c) The most resistant lifestage of Western flower thrips to treatment with elevated carbon dioxide controlled atmospheres are the pupae. There are no effective methods for generating these in enough numbers to test in a statistically valid way.

(d) Research into new ways of disinfesting floricultural crops in California has focused on Western flower thrips. There are many native thrips species in California and some of these may occur on floricultural crops and be more resistant to controlled atmosphere treatment. It is absolutely essential that an up-to-date pest list be developed so that disinfestation research can be effectively targeted.

SUMMARY: Controlled atmospheres based on elevated levels of carbon dioxide offer cost effective solutions to insect contamination of floricultural crops, both for planting material and for floristry. The speed of action of such atmospheres is fast enough for them to be used as a preshipment treatment, relevant for both surface and air transport. It may be that the final solution

will be a preshipment treatment to get, say, 95% control and an in-shipment treatment, probably based on low oxygen and moderate levels of carbon dioxide, to complete the process. Research relevant to this project is underway in New Zealand, Australia and Holland, as well as the USA, s it is likely that over the next 2 years there will be rapid progress, providing industry support continues to be available.

Alan Carpenter B.Sc., M.Sc.(with distinction), Ph.D., Dip.Bus.Studies (Marketing)
New Zealand Institute for Crop and Food Research Ltd.,
Levin Research Centre,
Private Bag 4005,
Levin,
New Zealand 5500.