RESISTANCE OF VARIOUS SLEEVE TYPES TO CO_2 DIFFUSION

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The resistance of three sleeve types to diffusion of respiratory CO_2 produced by chrysanthemums was evaluated. Plants in open air or packaged in perforated plastic sleeves maintained gas concentrations within the plant canopy equal to ambient CO_2. Respiratory CO_2 accumulated in plants packaged in paper or fiber sleeves.

Introduction

Greenhouse grown pot chrysanthemum plants are sleeved prior to shipping to reduce handling damage during packing and transport. A wide variety of sleeve types are available for this purpose. Some of the more common materials used to manufacture sleeves are: clear or colored plastic films, paper and spun fibers. Properties considered desirable for a sleeving material include strength, resistance to moisture and ability to breathe. The ability to breathe, or a lack of resistance to gas diffusion, is a somewhat nebulous concept of unproven utility, however, manufactured sleeves are often marketed based on this property. This experiment was undertaken to determine if differences in diffusion of respiratory gases through different sleeve types could be detected and if so, which sleeve types offer the least resistance.

Materials and Methods

Chrysanthemum plants in 6.5 inch plastic pots were obtained from Aldershot of New Mexico from two regular shipments prior to sleeving and boxing. Plants of a variety of cultivars were sleeved in either a brown paper sleeve, a perforated plastic sleeve, a spun fiber sleeve, or were not sleeved. Gas sampling tubes were inserted into the canopy of each plant. Gas samples were withdrawn and analyzed daily for six days. Samples were analyzed for CO_2 using an infrared gas analyzer (ADC Inc.). Statistical analysis were performed using BMDPpc.

Results and Discussion

Respiratory CO_2 accumulated within the canopy of plants sleeved with either paper or spun fiber sleeves. In excess of 100 ppm difference CO_2 concentration between inside and outside the sleeves was observed in some cases. This represents a significant resistance to diffusion caused by the sleeves. This trend was observed in all cultivars, sampling dates, and with both harvests. In contrast respiratory CO_2 was not accumulated in plants sleeved with a perforated plastic sleeve. Clearly the size and number of perforations was more than adequate to provide adequate gas exchange.

The paper sleeves used were a relatively heavy brown paper with no perforations, and it was not surprising that they offered resistance to gas exchange. The fiber sleeves on the other hand, look like they would offer little or no resistance to gas exchange. These fiber sleeves, were however no better than paper sleeves in their ability to breathe.

Although it is clear that the marketing claim of fiber sleeve manufacturers that their product breathes well is incorrect at least with regard to carbon dioxide, it is not clear that this is detrimental to plant longevity. One clear exception would be resistance to diffusion of ethylene. Although not measured there is no reason to believe that resistance to ethylene diffusion would differ substantially from that of respiratory CO_2.

Conclusion

Spun fiber sleeves do not breathe better than paper sleeves and offer more resistance to gas diffusion than perforated plastic sleeves. The decision to purchase spun fiber sleeves should be based on criteria other than ability to breathe.

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