

initiation in long days. This would overcome the problem of premature budding in 'year-round' chrysanthemum crops.

Tip scorch of chrysanthemum cuttings (R. Nichols)

The symptoms of tip scorch are browning and withering of the apical and axillary shoots. The disorder has often been attributed to effects of cool storage, which is used to facilitate marketing and to control *Spodoptera littoralis* on imported cuttings. To find out if the symptoms were associated with storage a small number (192) of symptomless cuttings of 'Yellow Hurricane' were planted in August to provide stock plants for production of cuttings. Within eight weeks many of the shoots from the stock plants were showing symptoms of tip scorch. Between October and January, 23% of the cuttings showed some symptoms. It is evident that the stock plant can show the disorder. Healthy cuttings taken from these plants were rooted and planted in December; none of these has shown symptoms. It appears, therefore, that there is some effect of season or environment on the disorder, and this aspect, in relation to the storage of cuttings, is being investigated further.

Carnation Dianthus caryophyllus L.

Water relations of cut carnation flowers (B. Acock and R. Nichols)

In the Annual Report for 1974, p. 50, we noted that at the end of their life in water carnation flowers wilted because their cell membranes became leaky. It was evident, however, that this was not caused exclusively by lack of metabolic substrate even though feeding with a sugar solution prevented or delayed wilting. To find out more about this phenomenon, cut carnation flower stems were stood in water or sucrose solution (4%) to which silver nitrate (0.003%) was added. Changes in water content, water and osmotic potential, turgor pressure and solutes (sucrose, reducing sugars, nitrogen, phosphorus, potassium) were measured throughout the life of the petals.

Turgor pressure decreased rapidly after the seventh and fifteenth day in water or sucrose respectively because the content of tissue solutes decreased, but at incipient wilting the petals had a higher specific water content than when the flowers were first cut (day 0). Nearly all of the osmotic energy of the petals at day 0 could be accounted for by sugars, potassium and its associated anions; only about half by sugars alone. It follows that as flowers with their stems in water age, and sugars are respired, potassium ions contribute a larger proportion of the osmotic energy of the petals. In flowers with their stems in sucrose solution, endogenous reducing sugars contributed an increasing proportion of the osmotic energy, but it seems feasible that part of this osmotic energy could be substituted by inorganic ions as indicated by the observations

of Mayak, K
of preservative

Silver ion treatment

Silver salts have been used for a long time, although the actual mechanism of the interpretation is not clear.

By immersing cut flowers in a solution (equivalent to 100 ppm) for flower life, it has been found that the life is doubled (Veen). This has suppressed the normally associated respiration of the flowers for as long as 10 days. The amount of the osmotic energy of the solution with R. G. is that the silver ions are produced. This is of cut carnation thiosulphate treatment with exogenous ethylene.

Other cut flowers have not so far been treated with copper, mercury or a combination with thiosulphate.

Rose Rosa spp.

Starch metabolism

Work has been done on starch breakdown. Starch is present in the petals and increases after harvest.

Gradient centrifugation of the enzyme was possible. The enzyme was possibly released from the petals, possibly by a detergent, the solution at 100,000 g, insoluble enzyme, β -limit dextrinase.

of Mayak, Kofranek & Tirosh (1978), thereby lowering the cost of preservative or bud-opening solutions.

Silver ion treatment of cut flowers (R. Nichols)

Silver salts have been used for many years in cut-flower preservatives although the affinity of silver ions for proteins and olefins has hindered the interpretation of their role in flower senescence.

By immersing carnation flower stems in silver thiosulphate solution (equivalent to 2 mmol Ag) for 24 h, and then in water until the end of flower life, it has been confirmed that the flower life can be approximately doubled (Veen & van de Geijn, 1978). The silver thiosulphate treatment suppressed the ethylene surge (about $0.25 \mu\text{l flower}^{-1} \text{h}^{-1}$) which is normally associated with natural wilting; it did not affect the rate of respiration of the corolla nor the amount of sugar consumed, at least for as long as comparisons with untreated flowers could be made. Since the amount of silver thiosulphate is insufficient to affect substantially the osmotic energy of the corolla (verified experimentally in collaboration with R. Grange) and no other substances were added, the inference is that the silver ion acts directly on the mechanism leading to ethylene production. This is consistent with the observations of the water relations of cut carnation flowers described earlier (p. 62). In addition, the silver thiosulphate treatment prevented the irreversible wilting caused by exogenous ethylene (1 v p m for 24 h).

Other cut flowers (chrysanthemums, roses, narcissus, and tulip) have not so far been found to respond to silver thiosulphate; neither have ions (copper, mercury, cobalt) other than silver been found effective in combination with thiosulphate for delaying carnation flower senescence.

Rose Rosa spp.

Starch metabolism in rose corollas (J. B. W. Hammond)

Work has proceeded on characterizing the enzymes responsible for starch breakdown in rose petals. Although amylolytic activity appears to be present in the cytoplasm, this study has concentrated on that bound to the crude starch fraction of the cells since this activity appears to increase after harvest (see Annual Report for 1977, p. 61).

Gradient centrifugation of the crude starch fraction indicated that the enzyme was present both in the amyloplast and in other, smaller particles, possibly fragments of the amyloplast matrix or membrane. After its release from the crude starch fraction by treatment with a non-ionic detergent, the solubilized enzyme was not sedimented by centrifugation at 100,000 g, indicating that in this form it is a true soluble enzyme. The soluble enzyme was active against the specific α -amylase substrates β -limit dextrin and amylopectin azure, and was inactivated by trypsin in