even low rates of simazine. We interpret our data and the reports of others (11, 12) as indicating that late July applications of simazine at 3 kg/ha reduced quantity of photosynthate available both immediately and for storage, and hence limited development and extension of new roots.

We conclude that simazine is indeed safe to use in the stoolbed at rates as high as 3 kg/ha, at least for MM 106, but that modest reductions in root development should be expected. Making split applications in early summer and midsummer is the procedure most likely to lead to maximum economic production of salable liners while providing adequate weed control. Clones other than MM 106 should be screened for sensitivity; barring unusual reactions, simazine seems an appropriate general choice of herbicide for the stoolbed.

**Literature Cited**


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**Abstract.** Increased water loss during storage in air at 0-1°C was associated with reductions of senescing and low temperature breakdown of 'McIntosh' apples (Malus domestica Borkh.) in 3 storage seasons. Postharvest CaCl₂ dip-treatments reduced storage breakdown when water loss was minimal.

Increased water loss from apples in storage has been associated with reductions in senescing and/or low temperature breakdown of 'Bramley's Seedling' (6, 11), 'Cox's Orange Pippin' (5, 6, 17), 'Delicious' (12), 'Democrat' (7), 'Granny Smith' (7), 'Sturmer Pippin' (7), and 'Twenty-One' (13), as well as reduction of 'Jonathan' breakdown (5, 7, 12, 14) and 'Spartan' breakdown (10). Postharvest CaCl₂ dip-treatments have also been reported to reduce 'Jonathan' (3) and 'Spartan' (8, 9) breakdown. The purpose of the present study was to determine if 'McIntosh' breakdown (15) is influenced by water loss in storage, and if so, whether postharvest CaCl₂ dip-treatments could be substituted for the accelerated water-loss treatment.

In 1978-79 and in 1979-80, the apples from 2 Lake Ontario farms were held at 0-1°C in separate storage rooms at Ithaca. In 1980-81 all treatments of apples from one of these farms were replicated in 2 storage rooms at Ithaca. The apples were picked within a few days of the predicted optimum harvest date (1) each season. Chevron X-77 surfactant was added (0.1%) to the 1980-81 postharvest 3% CaCl₂ dip treatments. Apples from 6 single tree replicates per farm were stored in separate wooden storage trays (45x60x15 cm deep) lined with polyethylene film. Polyethylene film tray covers were stapled to the trays and perforated with one 15 mm diameter hole. Apples were placed in the trays on 12 mm hardware supports.
soaked paper towels or crystals of Cargill cloth which was supported over water.

Accelerate water loss. Apples were weighed before and immediately after weighing before and immediately after removal from storage. Relative humidity inside the trays was measured periodically in 1978-79 with a General Eastern dewpoint meter. Ethylene of the atmosphere withdrawn from inside the trays was determined with a Varian GC. Flesh firmness was evaluated with a fruit penetrometer (2). Low temperature breakdown (brown core) incidence was estimated by visual inspection. Senescent breakdown (McIntosh breakdown) incidence was scored for apples with visual symptoms and/or flesh firmness values below 3.18 kg (15). Flesh firmness and storage disorder evaluations were made after apples were removed from storage and held for 1 week at 19°C.

The presence of road-salt adjuvant to the storage tray decreased the ambient relative humidity and increased fruit weight loss, but did not affect the ethylene of the atmosphere surrounding the fruit (Table 1). Low temperature breakdown and senescent breakdown were consistently reduced by the presence of road-salt, but flesh softening was significantly reduced only one season (Table 1 and treatments 3 and 4 in Table 2). Storage scald was not affected.

Our test results in 5 previous seasons (data not shown) supported reports from other investigators (4, 16) that postharvest CaCl2 dip treatments also significantly reduced 'McIntosh' breakdown. The postharvest CaCl2 dip and the storage water loss treatments were combined in 1980-81 to determine if the treatment effects on storage breakdown were substitutional or additive (Table 2). The postharvest CaCl2 dip treatment significantly increased water loss in the road-salt trays (treatment 2 vs. 4). CaCl2 dip treatment also increased flesh firmness (treatment 1 vs. 3, and 2 vs. 4). Greater flesh firmness of sound apples was also associated with less water loss (treatment 1 vs. 2, and 3 vs. 4). If the treatment effects on senescent and low temperature breakdown were additive, treatment 2 would have yielded less breakdown than treatments 1 and 4. This did not happen. If the treatment effects on storage breakdown responses were substitutional, the statistical notations for breakdown would appear as they do in Table 2: senescent and low temperature breakdown were not significantly less in treatment 2 than in treatments 1 and 4.

Either postharvest CaCl2 dip treatments or increased water loss in storage may be used to reduce senescent (McIntosh breakdown) and low temperature (brown core, core flush) breakdown of 'McIntosh' apples. There did not appear to be any advantage in combining these treatments.

Although the relationship between water loss and storage breakdown has been reported by several investigators, the present communication is the first such report from the U.S.A.

### Literature Cited