

STORAGE SCALD PREVENTION

performance of ReTain compared to non-silicone-based products. Dow Sylgard 309 is also reported to be effective. **When high temperatures (over 90 F) are anticipated, use surfactant at 0.05%.**

- ReTain is labeled to be applied at 333 grams (0.73 lb.) per acre. With optimal conditions, 200 grams ReTain/acre (0.44 lb.) can provide good control of preharvest drop for two weeks, however the full labeled rate is needed to provide the retention of fruit firmness in storage. It is recommended that growers apply most of their allocation of ReTain at the full labeled rate after gaining some experience with lower rates. Please note that Retain at full rate retards ripening of Gala 3–4 weeks, so use of half the normal rate may be appropriate.

- **Do not apply foliar CaCl₂ within 4 days (before or after) a Retain application including Silwet or Sylgard.**

Fruits treated with ReTain produce very little ethylene, but are still responsive to ethylene from external sources, such as non-treated mature fruit. ReTain-treated fruit that is harvested at the proper stage of maturity and stored separately from non-treated fruit will lose firmness at a much slower rate. In order to get the maximum retention of firmness in storage, ReTain-treated fruit should be tested for firmness and maturity during picking season. Fruit destined for CA storage should test at least 14.5 lbs. firmness and have a starch index reading of 6 or lower.

NAA (naphthaleneacetic acid) is also labeled for use to reduce preharvest drop. This material should be applied at 10 to 20 ppm, just prior to the onset of preharvest fruit drop. It will take effect about 3 days after it is applied. Drop will be reduced for 7–10 days after application. Longer drop control can be obtained by using a repeat application after 7 days. Unlike ReTain, NAA accelerates fruit ripening and fruit softening, and the effect on ripening increases as the concentration, number of applications, or temperature increases. **The REI for K- Salt Fruit Fix is 24 hours and the REI for Fruitone-N is 48 hours. The PHI for K-Salt Fruit Fix and for Fruitone-N is 2 days.**

PREHARVEST CHILLING HOURS

Ongoing research indicates that scald susceptibility of Cortland and Delicious are reduced by preharvest exposure to over 165 hours of temperatures below 50°F. Limited data indicate that the same may be true for McIntosh. The following guidelines are based on studies of fruit kept in cold storage, and may not apply to fruit kept in controlled atmosphere storage.

If DPA is used for scald control, a reduced rate is likely to be sufficient for fruit of these cultivars exposed to 165 or more “chilling hours” in the weeks before harvest. For Cortland, 500 ppm is probably as effective as 2000 ppm. For Delicious, 1000 ppm is probably as effective as 2000 ppm.

If 200 or more “chilling hours” have occurred before harvest, then probably no more than 500 ppm DPA is required for scald control on these cultivars.

POSTHARVEST TREATMENTS FOR SCALD PREVENTION

Diphenylamine (DPA). Two formulations of DPA are available in the U.S. They are “No Scald DPA EC–283” (31% active ingredient) from Cerexagri, Inc., and “Shield DPA 15” (15% active ingredient) from Pace International. Each of these materials is a distinctive product, formulated with certain solvents, emulsifiers, and other ingredients. Thus, their properties as well as their DPA concentrations vary. Labels should be examined carefully and use should be in strict accordance.

Table 29 - Recommended Concentration for DPA Solution

Cultivar	DPA (ppm)
Baldwin	1,000
Cortland	2,000
Delicious	2,000
Golden Delicious	Not recommended
Idared	2,000
McIntosh	1,000 – 1,500
Rome Beauty	1,000

When to apply. Apples should be treated immediately after harvest (before storage). The induction period for scald is during the first 30–40 days of storage for at least some cultivars. After that time, treatment may have no benefit.

Replenishment. The concentration of chemical in the treatment solution will diminish with time. Approximate concentration of scald-inhibiting chemical in the solution can be measured with test kits that are commercially available: Shield Brite DPA Field Test Kit 121, Decco DPA Calorimetric Test Kit, and Decco DPA Titration Kit all measure DPA concentration. Daily measurement with one of these test kits is strongly recommended.

After careful measurement of the current concentration in part per million (ppm), use the following formula to determine how much No Scald DPA EC-283, or Shield Liquid DPA Super Refined, to add to the tank in order to increase the concentration to the level you desire:

$$\begin{aligned} \text{Pints of DPA product to add per 100 gallons} &= \\ (\text{Desired ppm} - \text{Current ppm}) \times 8 & \\ \% \text{ DPA in product} \times 100 & \end{aligned}$$

EXAMPLE: You measure the DPA solution and find that it is down to 900 ppm. You want to restore it to 1500 ppm. You need to know how much Shield Brite Liquid DPA to add per 100 gallons of dip tank solution. You see on the label that this product contains 15% DPA.

$$\begin{aligned} \text{Pints of DPA product} \\ \text{to add per 100 gallons} &= \frac{(1500 - 900) \times 8}{15 \times 100} \\ &= \frac{600 \times 8}{1500} = \frac{4800}{1500} = 3.2 \text{ pints} \end{aligned}$$

After adding the DPA, add water to bring the level up to a mark on the tank that is exactly the volume desired. Agitate the mix thoroughly before using. It may be desirable to again measure the concentration with a test kit to be sure that replenishment has occurred correctly.

When the suspension becomes dirty, replace it with fresh solution. It is usually necessary to replace the solution after dipping 30 bins in 100 gallons of solution.

Disposal. Do not discharge scald inhibitors into lakes, streams, or rivers. DPA is toxic to fish. Dispose of the material in a manner prescribed by the manufacturer.

Methods commonly suggested are:

(1) spraying the dilute solution on the orchard floor, not to exceed 1,200 gallons/acre; (2) constructing a plastic-lined evaporation pond; and (3) disposal by a commercial waste treatment firm.

Considerations. If exporting is a possibility, then before treating the fruit, determine whether importing countries will permit sale of treated fruit. In the U.S., all postharvest treatments must be indicated on the cartons. The statement, “Treated with diphenylamine for preventing of spoilage” is required. Do not use treated fruit for livestock feed.

Postharvest rots are discussed in Part I of this guide.

SCALD COMMENTS ON CULTIVARS

McIntosh. McIntosh placed in CA storage will not usually scald much before April. This statement is based on the assumption that the fruit is picked at a flesh firmness of 15 to 17 pounds (pressure tester with a 7/16 inch head), moved from the orchard to storage within 24 hours, and cooled at 32°F promptly. CA storage may not always control scald on this cultivar indefinitely, but will delay the time of its appearance.

Consequently, scald may develop in April, May or June on some lots of CA McIntosh which were entirely free from it earlier. It is suggested that DPA be applied to those lots of CA McIntosh held until April or later, and where experience has proven that scald is a problem. However, as a precaution against scald, most growers use DPA on all McIntosh scheduled for CA storage.

Scald on regular cold storage McIntosh is generally not a problem until after January, at which time the bulk of this fruit should have been marketed. DPA has not been outstanding in controlling scald on McIntosh held beyond January in regular cold storage.

Cortland. In contrast to McIntosh, CA storage often increases the severity of scald in Cortland in comparison to regular cold storage. Chemical treatment with DPA is necessary if Cortland are to be stored in CA or beyond January 1 in regular cold storage. In years when mean temperatures are well above average for six weeks or so before harvest, adequate control of this disorder may not be possible.

Empire. Follow recommendations for McIntosh.

Delicious. Fruit placed in CA, or stored beyond January 1 in regular cold storage, should be

treated with scald inhibitor to control scald.

Rome Beauty. CA storage alone has often provided commercial scald control on mature Romes. Early harvested Romes are most susceptible to scald. DPA may cause fruit injury to Rome Beauty.

USE OF 1 - MCP TO SLOW RIPENING IN STORAGE

SmartFresh™ [1-methylcyclopropene (1-MCP)] is a new chemical which is being marketed as a postharvest treatment for a number of products including apples. It is used to slow the ripening process. Ethylene, a gas similar in structure to 1-MCP, is an important initiator of the ripening of apple, and the onset of apple ripening occurs when the fruit begin to produce ethylene. The 1-MCP competes with ethylene for binding sites within the fruit cells, thus interfering with ethylene-activated ripening processes.

The 1-MCP treatments which have been applied on a research scale have consistently and significantly reduced the amount of ethylene produced by apples (and pears). This effect has lasted far into the storage season. How long and how strongly ethylene has been suppressed, have varied by cultivar and stage of fruit maturity at the time of harvest. Fruit already producing significant ethylene should not be as affected by 1-MCP as those not yet producing ethylene. Among cultivars, Gala did not produce appreciable ethylene even after 5 months of refrigerated storage followed by a week at room temperature, but McIntosh and Delicious did produce ethylene after 3 months of air storage when allowed a week at room temperature following the cold storage.

When Retain™-treated McIntosh were also treated with 1-MCP, the fruits' ability to produce ethylene was further delayed. Positive effects of 1-MCP treatment included improved maintenance of fruit firmness, reduction of superficial scald, and reduction of weight loss of stored fruit. These effects varied with cultivar and from season to season in trials. Other effects included delayed change in background color (green to yellow) and delayed development of volatiles which provide fruit with aroma and flavor. Gala still had not developed characteristic odor after 5 months in refrigerated air storage. Taste testing was not done, but when ripening is as completely shut down as it appeared to be in the Gala, flavor development likely will shut down as well. The 2002 1-MCP-treated fruit should give an indication of the effects the product may have on flavor.

The 1-MCP is applied as a gas in a refrigerated sealed room (CA room) in which good air movement is provided. Gas is introduced by mixing the SmartFresh™ powder with water, stirring, then leaving and closing the room. After 24 hours, the fruit are removed, or if the fruit are to remain in the treatment room, the room is flushed with air. SmartFresh™ was available in some states for the 2002 harvest season, and the manufacturer, AgroFresh, has indicated that it will be available in New England for the 2003 season. For 2002, AgroFresh required users to attend a seminar to learn application procedures for the product, and in 2003, rooms to be used as treatment chambers will have to be certified for tightness before the material may be purchased. Also note that the product has been sold in prepackaged units for rooms of defined sizes; the smallest being 18,000 cubic feet (e.g. 30ft x 30ft x 20ft). Please note that no reentry of the room is allowed until 30 minutes after it has been fully vented.

Skilled farmers provide the foundation for a healthy society.

