

control of

Storage Scald

of apples

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Cooperative Extension Service

Michigan State University

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APPLE STORAGE SCALD (common scald) is a troublesome physiological disorder affecting apples during and following storage under refrigeration and controlled atmospheres. It is associated with advanced aging of the fruit and consequently it becomes more prevalent and severe as the storage and marketing season is prolonged.

Although its actual cause is not proven, it can be controlled by chemical means and regulated somewhat by the application of good handling and storage practices.

Storage scald initially appears as a superficial browning of the skin of the green-colored portion of the fruit. With further development, it affects the red-colored skin and eventually the browning may extend as deep as one-quarter inch into the flesh.

Sometimes it is evident when the apples are taken from storage; at other times it becomes apparent only after the fruit is taken from storage and exposed to room temperatures. In such cases it is not detected until after the apples have entered distribution and market channels. Also, slight scald apparent at the time of packing the fruit is likely to become severe by the time the apples reach the consumer.

Susceptible Varieties

Many apple varieties are susceptible to storage scald, but it is most commonly observed on Rome Beauty, Stayman, Turley and Cortland. The popular market varieties of McIntosh and Red Delicious scald badly in some years.

Other susceptible varieties include Rhode Island Greening and Wagener. Jonathan is rarely affected by storage scald in Michigan, but it is very susceptible

to soft scald (ribbon scald) which is an entirely different disorder that requires separate control measures.

There is always the danger of economic loss due to the development of scald on susceptible varieties which are stored more than two or three months after harvest. Its development can be somewhat delayed by prompt storage of the fruit after picking, by rapid cooling of the apples to the storage temperature and by employing the lowest possible storage temperatures in keeping with the varietal requirements. Adequate control can be obtained only by the use of chemical scald inhibitors.

Chemical Inhibitors

There are two materials suitable for use on apples: Diphenylamine (DPA) and ethoxyquin. Diphenylamine available as "No Scald DPA" may cause fruit injury, particularly to the Rome Beauty variety and its several strains. Ethoxyquin, available as "Stop Scald", is not likely to injure the fruit, but it is not always effective against scald on Red Delicious.

There are residue tolerances established by law for both materials and label directions for the use of these chemicals must be followed explicitly.

Application and Concentrations

Dipping apples in bulk boxes or bushel containers offers the most practical means of positive and adequate application of DPA or ethoxyquin.

Because of the danger of fruit injury and the accumulation of excessive residue in the lower portion of bulk boxes, DPA should be used at a concentration of no greater than 1,000 ppm for apples dipped in bulk. If applied by dipping bushel crates of fruit, the standard concentration of 2,000 ppm is used. One pound of DPA (83% wettable powder) in 100 gallons

of water gives 1,000 ppm; 2 pounds in 100 gallons of water, 2,000 ppm.

Ethoxyquin is used at 2,700 ppm (3 pints "Stop Scald" per 100 gallons of water) for dipping apples in bulk or bushel boxes.

The dipping procedure is similar for both materials:

— Submerge the filled container with a weighted or clamped-on lid for 15 to 30 seconds or until bubbles cease to appear at the surface.

— Then remove the container and allow another 15 seconds (more or less) for drainage of the excess solution back into the dipping tank.

A small quantity of spreader or wetting agent added to the DPA solution may enhance complete coverage and reduce injury to the fruit surface (but use only as necessary as determined by trial and observation).

Tilting or inverting the container during the drainage period would be helpful in reducing the danger of fruit injury or residue accumulations by removing excess solution from the stem and calyx cavities of the fruit and from the bottom of the container, but the danger of fruit bruising must be considered.

Equipment for dipping bulk or bushel containers of apples can be elaborate or rather simple. A relatively inexpensive dipping system for bulk boxes utilizes a suitable tank, a lift truck with modified forks and a weighted box lid as illustrated in Fig. 1. One limitation is that it ties up a lift truck and operator continuously. Commercially manufactured dipping systems are available.

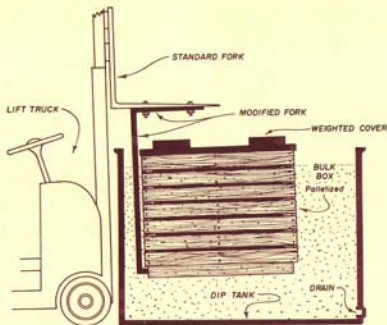


Fig. 1. Equipment of this type has been successfully used for the bulk dipping of apples in scald-inhibitor solution. An adjustable lid cover attached to the lift would simplify the operation somewhat. Also, a motor-driven agitator should be employed to prevent settling of the active ingredient to the bottom of the tank.

Drenching or flooding of bulk boxes or bushel crates can be accomplished several ways provided 3 to 4 gallons of solution are supplied for each bushel of apples and adequate drainage space is allowed to salvage the excess solution. It is important that the surface of all apples receive the material. Use 1,000 ppm of DPA; 2,700 ppm of ethoxyquin.

Tree sprays for scald control, although practical, are rather expensive and not as effective as other methods. Use 2,000 ppm of DPA or 2,700 ppm of ethoxyquin and cover the tree to the drip stage. Applications should be made within 48 hours of harvest.

Rome Beauty and Baldwin seem more susceptible to injury from DPA than other varieties. Therefore, if treated by tree spray, use 1,000 ppm of DPA rather than 2,000 ppm on these varieties. Ethoxyquin is unsuitable as a tree spray for Delicious.

Box sprays, either for filled bushel or bulk lots, can be used but considerable difficulty is encountered in completely covering the fruit with solution. Use 2,000 ppm of DPA or 2,700 ppm of ethoxyquin.

Timing and Temperature are Important

Post-harvest applications of scald inhibitors are best made immediately before placement of the apples into cold storage. In all cases, the fruit must be treated within one month from harvest and the fruit temperature must be 50° F or higher. DPA applied with

fruit or solution temperature above 80° may cause fruit injury. Temperatures of 70° to 80° are ideal for all methods of application.

Precautions

Cautious use of these chemicals is essential.

Do not inhale DPA dusts and use rubber gloves if the fruit is handled when wet with either of the scald inhibitors.

Do not make more than a single application of material on a given lot of fruit. If a second application is needed, as may be required if rain follows a tree application, use the other material.

Solutions must be constantly agitated to maintain a suitable suspension of the chemicals in water. Discard solutions when they become dirty or after 2 days of use. Thoroughly wash the tanks before making a new solution. One hundred gallons of DPA or ethoxyquin solution should treat at least 1,000 bushels of fruit by the drench or dip methods.

Label Fruit

Market containers of treated fruit must be labeled whenever the fruit is treated post-harvest (i.e., by drench or dip) with DPA or ethoxyquin but not when the materials are applied as tree sprays. For ethoxyquin the label should read: "Treated with ethoxyquin to retard spoilage"; for DPA: "Treated with diphenylamine to retard spoilage." The letters must be as large as other lettering on the container. Labeling of the master container is adequate for bagged apples.

Check for Scald

In years of severe scald development, the inhibitors may not give complete control, or other factors may reduce their effectiveness. Therefore, whether or not you have treated the fruit, it should be checked periodically, such as every 2 to 3 weeks, after several months of storage have elapsed. Samples of fruit should be held at room temperature for scald development. Lots showing a scald potential can often be marketed immediately without difficulty.

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