Mechanical and Chemical Injuries

G. B. Ramsey

Mechanical and chemical injuries during the grading, processing, packing, and shipping of fresh fruits and vegetables may sometimes be mistaken for diseases. They often open the way for decay-producing organisms that otherwise would not be able to invade sound produce.

All fresh fruits and vegetables are contaminated to some extent by thousands of spores and fragments of mold of various fungi that are present in the soil, water, air, field boxes, and grading bins. Whether the organisms will cause infection and decay often depends on the presence of wounds or other injuries, the types of organisms present, and temperature conditions. Although not all contaminating organisms cause decay, some do, and consequently the safest procedure is to harvest, pack, and ship all produce as carefully as possible to avoid injuries that might open the way for infections.

Among the most common mechanical injuries in the preparation and marketing of fruit are bruises, cuts, and stem punctures made at harvest-time, and nail, splinter, and sand injuries from field boxes and grading bins. Bruises, cuts, and splits also occur during shipment to markets when the containers are loaded improperly, the freight cars receive rough handling in the switching yards, and the containers are being unloaded and hauled to the warehouse or market.

In harvesting it is necessary to make fresh wounds when the fruits and vegetables are cut or pulled from the plants. Nevertheless, it is advisable to harvest, handle, and pack with care to avoid making injuries any more extensive than necessary. Vegetables and fruits are often seriously cut and bruised when containers with high bulge packs are lidded. Tight packs are desirable, but unnecessary pressure should be avoided.

Commodities like potatoes and onions are subject to mechanical injuries during harvesting and packing. They also are sometimes severely bruised and split during transit if protective pads are not used over the floor racks of the car. Severely injured stock in the bottom layer of bags must be sorted out and sold at a discount or discarded even if the wounds have not become infected.

Because of the difficulty of making a tight load of watermelons that will remain in place during transit, watermelons are probably more seriously damaged by splits and bruises than any other kind of produce. Rhizopus rot, yeasts, and other fungi often follow the injuries because the melons are not shipped under refrigeration. Careful loading with an adequate bedding of straw or similar material on the floor and padding on the ends and sides of the cars help reduce the damage.

Chemical injuries of fruits and vegetables during transit and storage are often caused by accidental exposure to some toxic gas; by chemicals used improperly for the control of decay, for washing, and other kinds of processing; or by accidental contact with chemicals in storage or in transit.

The most important chemical injuries found on produce in the market are caused by acid, ammonia, arsenic, nitrogen trichloride, and sulfur dioxide. Less serious injuries sometimes occur when the produce comes in contact with chemicals left in the freight cars. However, chemicals such as salt, fertilizers, coal tar, and oil products that used to cause injuries are seldom hauled now in cars used for shipping.
fruits and vegetables and injuries of this kind are seldom encountered. Potatoes and watermelons are the products that most frequently suffer chemical injuries from car contamination. Often the injuries thought to be caused by chemicals are found to be merely bruises on the commodities in contact with the floor and sides of the car, but occasionally the flattened areas on potatoes and melons are so soft, flabby, and discolored as to indicate the penetration of some chemical.

When it is necessary to wash apples to remove spray residue, the best results are had by using hydrochloric acid in the bath. The treatment sometimes injures the fruit unless the proper strength of acid is used. Acid injury on apples may appear anywhere on the fruit where drops of acid water have evaporated. The affected skin is bleached and somewhat softened; after it becomes dry, it often shows slight cracks. That injury can be seen a few days after the apples are washed. It can be prevented by paying special attention to the concentration of the bath and by thorough rinsing after the acid bath.

Ammonia injury occurs most commonly in apples, pears, peaches, plums, and onions when the gas accidentally escapes from cold-storage refrigerating or precooling systems into the cars or storage rooms. Very little of the gas produces decided color changes in the pigments of the skins of fruits and vegetables, especially the red and yellow ones.

The gas enters apples and pears most readily through lenticels or through breaks in the skin. The alkaline reaction of the chemical with the color pigments causes brown or black discolorations of red tissues and dark-brown discolorations of yellow tissues. The color changes take place almost immediately on exposure to ammonia and are permanent except when—rarely—the natural acids neutralize the alkali and some of the natural color returns. This sometimes happens in apples and pears, but usually the lenticels remain more brownish black than normal.

Ammonia injury to peaches appears as brown blotches of various sizes over the fruit. On plums the brownish to black discolorations are usually localized in spots. Heavy concentrations of the gas make the affected areas uniformly brown and affect the tissue under the skin. Even slight ammonia injury makes peaches unmarketable. The injury to peaches and plums occurs most frequently when the fruit is accidentally exposed to ammonia while being precooled in cars before shipment.

Ammonia injury of onions usually occurs in storage rooms. Even slight leaks in the ammonia system will eventually cause severe discoloration of red, yellow, and brown onions. On exposure to ammonia, the dry outer scales of red onions become greenish black or black; those of yellow and brown onions become dark brown as if they had been scorched. White onions show only a greenish-yellow discoloration of the outer dry scales. The discoloration of onions usually is limited to the outer scales, but the blemished appearance lowers marketability. In severe cases the outer fleshy scales of the bulbs become greenish yellow and water-soaked.

Arsenical injury may come about when apples have a heavy coating of arsenical spray residue and are allowed to remain wet for several hours before washing. It may also be produced if old washing solutions in which dissolved arsenic has accumulated are used and when the fruit has not been properly rinsed after washing. Soluble arsenic generally accumulates in the stem basin or calyx cavity and causes a burning of the skin and death of the tissue immediately underneath. The dark-brown or black and slightly sunken spots spoil the appearance of the fruit and often open the way for decay-producing organisms.

Nitrogen trichloride is used for fumigating citrus, melons, tomatoes, and other produce to reduce decay
Cuts, Bruises, and Spoilage

T. R. Wright, Edwin Smith

Fruits and vegetables, being tender, bruise easily and then spoil quickly—as every housewife knows who sorts apples, pears, peaches, bananas in the grocery as a matter of course to avoid taking spoiled ones home.

Between tree and retail bin—before the housewife inflicts her own bruises on them with thumbnail and fingers as she sorts them—apples might have to go through quite a bombardment of heavy blows when packages are roughly handled during storage, car loading, transit, and delivery to retail stores.

Pears, before softening, are more resistant to bruise injuries than most other deciduous fruits. Their market value is lowered greatly, though, by skin injuries that resemble bruises but actually are caused by friction. That type of blemish, sometimes called "belt burn," occurs during packing and handling. Pears withstand normal handling without showing blemishes when they are packed immediately after picking. As they age in storage, however, the skin becomes less resistant and the degree of disfigurement from a like amount of friction increases progressively during successive weeks of storage.

At a temperature of 31° F., Anjou pears may be stored for a month before packing without showing excessive abrasion blemishes, but longer delays are not advisable. In packing, paraffin-coated chip-board liners will protect