



Pest control

A pest control program should be in place to reduce, as much as possible, the risk of contamination by rodents or other animals.

Postharvest Handling

Precooling and storage

Carrots have a high rate of respiration, which means field heat must be removed before dense packaging and storage. Precooling is accomplished by using cold water in the revolving drum washer or by running field bins through a hydrocooler. Temperatures should be kept at 40°F.

Topped fresh-market carrots are very perishable and rapidly transpire moisture. Wilting symptoms become evident with as little as 3 percent weight loss. Therefore, high humidity (95-100 percent) is imperative in storage. Moisture, if allowed to condense on carrots, will promote decay. Good air movement is necessary to prevent decay during storage. Topped carrots should be held at 32°F.

Facility sanitation

Packinghouse facilities have the potential for developing microbial growth on walls, tunnels, ceilings, floors, doors, and drains.

Scheduled washdown and/or sanitizing of the facility will reduce the potential for microbial growth. The cooling system should be monitored and cleaned as necessary.

Temperature control

Maintaining proper holdingroom temperature will promote product quality and reduce microbial growth. Temperature should be monitored in order to ensure it stays within established product temperature parameters.

Shipping

Vehicles

Trucks must be inspected for sanitary condition and optimum transit temperature before being loaded with produce. Check for visible cleanliness, odors, dirt, and/or other debris prior to loading. Any truck showing these conditions should be rejected. Check for pest infestation, physical condition and the presence of a properly aligned air chute before loading. Make sure a Ryan temperature recorder is present to monitor cold temperature during transit. Never load produce into a warm truck.



Good Agricultural Practices for the Production and Handling of Sweet Potato, Carrots, and Root Crops

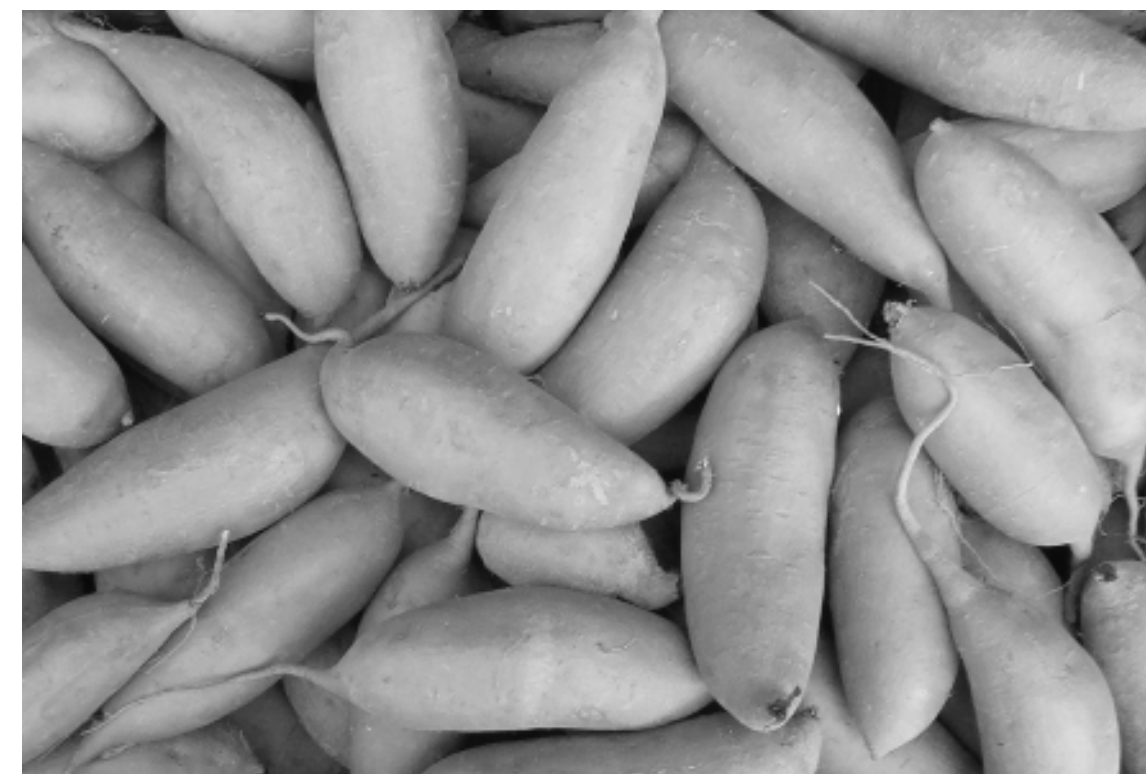
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Introduction

When newspaper headlines and radio or television newscasts announce that a foodborne illness associated with fresh produce has occurred, the entire industry from grower to retailer should take notice. Today's produce increasingly is being regarded as a potential safety hazard. Carrot growers and shippers must take a proactive role in minimizing their crop's food-safety risks.

Preharvest

Safety

Carrot quality and safety are often perceived by consumers to mean the same thing. Good quality carrots may be visually appealing and delicious, yet may contain human pathogens or toxins that can cause illness in the consumer. A safe product, by contrast, may be discolored, overmature, and unappealing, yet present no hazard to the consumer. Unfortunately, the safety of fresh carrots cannot be determined by their outward appearance or condition.

Raw product safety

The principal safety concern in fresh produce today is microbial contamination by pathogens that may harm humans. Ensuring raw product safety begins with preventing hazards in the carrot field. The best guarantee of a safe product is a proactive food safety program that has been designed and implemented to identify and prevent hazards during fresh carrot production and postharvest handling.

Land-use history

Grazing animals on or near crop land can introduce bacteria harmful to humans into

the soil. Growers should ensure that land has not been used for animal husbandry and that it is not close to animal feedlots or water runoff from grazing lands. Also, past improper use of pesticides can result in hazardous residues on raw products.

Fertilizer use

Incompletely composted organic fertilizers may contain pathogenic (to humans) bacteria derived from animal or human feces. If organic fertilizers are used, they must be completely composted so pathogens are not present. Inorganic fertilizers originate from nontoxic, synthetic chemicals having no pathogens. Composted sewage sludge should not be used, as it may contain pathogens as well as heavy metals.

Irrigation

Natural surface water (e.g., canal, lake, pond) provides enough organic matter to support the growth of bacterial pathogens. It may be used with caution for irrigation but should be tested for the presence of the bacterium *Escherichia coli* (*E. coli*), which is an indicator of fecal contamination. Groundwater is less likely to harbor pathogens that will harm humans but should be analyzed for heavy metal, bacterial, and pesticide contamination.

Overhead irrigation is more likely to spread contamination to above-ground plant parts than is root-zone irrigation. Growers should document how water is stored, if animals are confined nearby, and if water is of drinking quality (potable).

Pesticide usage

Growers must comply with all federal and state labels and must be able to answer the following questions: Do you oversee your pesticide-spraying program? Do you have record-keeping procedures to track all spraying of this crop? Do you or the state/federal government regularly test your crops for residue levels?

Harvesting and Handling

Carrots are machine-harvested before reaching full maturity (when they are 7-9 inches in length and about 1.5 inches in

diameter). Tops are mechanically cut and allowed to fall back onto the field while the trimmed roots are placed in trucks for bulk transport to a packing shed.

Harvesting

Mechanical harvesting can wound produce, encouraging contamination from the soil. Hand harvesting also may lead to pathogen contamination if field workers practice poor hygiene. Field crews must be trained and monitored for personal hygiene, and portable bathroom and hand-washing facilities must be provided in the field.

Field containers

Containers for harvesting fresh produce should be nontoxic, easy to clean, and free of extraneous materials (e.g., nails, wood splinters, etc.) that can carry over into processing. They must be approved by the U.S. Department of Agriculture (USDA) or the Food and Drug Administration (FDA) for field use. After detergent cleaning, field bins, buckets, etc., can be sanitized by using a very strong sodium hypochlorite solution dispensed from a high-pressure sprayer.

Receiving

Harvest crews should remove as much soil from the product as is possible before the product leaves the field. Pallets should be cleaned before being placed in cooling. Part of the receiving yard should be set aside for this activity.

Packing house

At the packing house, carrots are off-loaded into a dry dump tank, conveyed through a revolving cylindrical cleaner to remove dirt and sand, and then put into a revolving drum washer with spray nozzles. The washed carrots proceed along a series of sizing belts, where they are sorted by length and diameter. Sized carrots drop onto conveyor belts for hand grading to remove culls and are then hand-packed into 1-, 2-, 3-, and 5-pound polyethylene bags, which are finally packed on pallets.

Mechanical damage to the crop can be minimized by the proper operation of all harvesting, sizing, and grading equipment. Excessive speed or overloading of equipment will result in an increase of mechanical damage to the carrots. Such bruising or cutting will open up avenues for greater water loss and the invasion of decay microorganisms and pathogens harmful to humans.

Water

Water used in cleaning and cooling should be chlorinated at a concentration of 75 to 100 ppm of free chlorine. Chlorination can be accomplished using a gas injection system, adding bleach, or using calcium hypochlorite tablets. Chlorination levels in the water should be monitored frequently during operation through the use of a chlorine test kit. Water pH should be maintained between 6.5 to 7.5 to avoid having to use excess chlorine and in order to maintain recommended free chlorine levels. Excessive use of chlorine causes gassing off (which leads to objectionable chlorine odor, irritation of workers' skin, corrosion to equipment, and increased sanitation cost).

Employee hygiene

Good employee hygiene is very important. Employee training, health screening, and constant monitoring of packinghouse sanitation practices (hand washing, personal hygiene) are important in reducing contamination by employees.

Packinghouse equipment

Packinghouse equipment should always be maintained in clean condition. Scrubbing to remove particles should be part of the cleaning procedure.

Sanitizing by spot spraying with a chlorine solution should be carried out, especially on belt conveyors and equipment. Knives, saws, blades, boots, gloves, smocks, and aprons should be cleaned or replaced as needed.

