Check Sheets for High Quality Fruits and Vegetables

PRODUCTION

Check	Goal	Notes
❑	When choosing cultivars, consider yields but also think about postharvest characteristics and susceptibility to postharvest pests and diseases.	
❑	Plan planting/harvest dates, select cultivars that mature when market prices are high and demand for the product is high (avoid periods of glut).	
❑	For perennial crops such as tree fruits, plant several different cultivars to extend the harvest and marketing period.	
❑	Select cultivars with unusual characteristics (heirloom varieties, different colors or shape variations, produce for ethnic cuisines) to take advantage of market niches.	
❑	Use clean, healthy, high quality planting materials.	
❑	Avoid over-fertilization with nitrogen (reduces quality, increases possibility of decay, insect damage and storage problems).	
❑	Take care with animal manures and incompletely composted materials used as fertilizers (prevent contact with produce and/or heat-sterilize these materials before use). Make sure a minimum safe interval of time has passed between application and harvest.	
❑	Test soils for possible contaminants if you think that animals have had access to the field, the field has ever been used as a feedlot, land fill or waste site.	
❑	Avoid wetting the leaves and fruits of plants when watering to minimize the spread of disease.	
❑	Avoid over-watering during the weeks before harvest (decreases produce firmness, increases storage problems).	
❑	Practice orchard and field sanitation to prevent fungal infections and insect damage. (Remove last year's fruit from fruit trees, remove diseased produce left in the field or on the orchard floor, DO NOT leave culls in the field, and clean picking containers).	

- ❑ Use good pest management practices (spray for insect or fungal control, bag produce susceptible to insect or bird damage, rodent or insect traps, etc.).
- ❑ Use fine-mesh nets (about 10 threads/cm or 20-30 threads per inch nylon mesh) to protect against bird damage.
- ❑ Enhance quality by using good cultural practices—calcium sprays to prevent bitter pit in some fruits; pruning and/or thinning to increase fruit size for stone fruits; blanching (exclusion of light to prevent greening) for asparagus, celery, cauliflower, leeks and endives)

HARVEST

Check	Goal	Notes
❑	Always consider the needs and requirements of the market for your produce (customer preferences for size and/or stage of maturity).	
❑	Regardless of commodity or development stage of produce, all horticultural products require extreme care at harvest.	
❑	Containers used for harvesting should be: clean; smooth of rough edges; vented; and not top large. Steel or plastic buckets make good harvesting containers. Sanitize regularly.	
❑	Use stackable plastic crates as field containers during harvest—while initially expensive, these are durable, reusable and easily cleaned.	
❑	Train harvest personnel in the proper way to harvest the crop to minimize damage and waste during harvest.	
❑	DO NOT pick up produce that has fallen onto the ground during harvesting.	
❑	Train harvesters to recognize the proper maturity stage for the produce they are picking (such as size, shape, color, sweetness or firmness).	
❑	Round the tips of knives to minimize gouges and damage to plants. Sharpen knives and clippers.	
❑	Wear cotton gloves, trim fingernails, and remove jewelry such as rings and bracelets that might damage produce during harvest. Wash gloves every day.	

- ❑ Wash hands with soap and water after going to bathroom.
- ❑ Train pickers to empty their picking bags and/or baskets with care. Never dump or throw produce into field containers.
- ❑ Keep produce clean to reduce food safety hazards.
- ❑ Avoid laying harvested produce on bare soil.
- ❑ Always provide shade for harvested produce to prevent heat and sun damage.
- ❑ Pick produce in early morning. Let dew dry off first if harvesting crops susceptible to fungal diseases.
- ❑ Cool produce (remove field heat) as soon as possible after harvest.
- ❑ Grade roads between the field and the packinghouse and keep them free from large ruts, bumps and holes.
- ❑ Secure containers during transport and, if stacked, DO NOT overfill.
- ❑ Disinfect all tools and equipment that come in contact with produce.
- ❑ Prohibit the use of field containers for any other purpose (tools, foods, fuel, etc.) than carrying produce.
- ❑ Consider field packing to reduce the number of times produce is handled between harvest and marketing.
- ❑ Cure root and tuber crops intended for storage by exposing them to moist, warm conditions that heal wounds and thicken peels.
- ❑ Cure bulb crops such as onions and garlic (by drying neck tissue and outer skins) before packing, storage or marketing.

PACKING

Check	Goal	Notes
❑	Provide shade for harvested produce waiting to be sorted and packed.	
❑	Grade the roads and entryways between the field and the packing facility.	
❑	Avoid locating the pack house directly next to an unpaved, dusty road.	

- ❑ Minimize mechanical damage—avoid drops, throwing and rough handling.
- ❑ Use hand-carts to assist workers in the careful movement of produce.
- ❑ Pre-sort to remove damaged, diseased, immature or overmature produce.
- ❑ Provide good lighting to help sorters see defects.
- ❑ Provide sanitary facilities (bathrooms and hand washing stations) for workers.
- ❑ Provide clean and sanitary conditions for all supplies, including box storage.
- ❑ DO NOT wash green beans, cabbage, okra, peas, peppers or summer squash before packing.
- ❑ Provide cushioning on all sharp edges and rough surfaces of packing tables or the washing/sorting/grading/packing line. Clean and sanitize the tables regularly.
- ❑ When trimming produce, DO NOT remove more than necessary for high quality. Dispose of waste materials properly.
- ❑ Remove older outer leaves: cauliflower, head lettuce, swiss chard and other leafy crops.
- ❑ Remove tops: radishes, carrots, beets, turnips and other root vegetables.
- ❑ Trim excess tissue (mostly for appearance or ease of packaging): long leaves from green onions (although oriental food markets prefer the entire plant), tough stems from asparagus spears.
- ❑ DO NOT use any chemical treatments that are not specifically recommended or approved for your commodity.
- ❑ Pack securely to immobilize produce, but DO NOT overfill or underfill packages.
- ❑ Cool the produce as soon as possible after harvesting.
- ❑ Quality standards for many horticultural commodities can be found on the USDA web site: http://www.ams.usda.gov/standards/stanfrfv.htm

PACKAGING

Check	Goal	Notes
❑	Use sturdy packages, capable of standing up to handling, cooling and storage.	
❑	Line rough packages such as baskets and wooden crates with cardboard inserts.	
❑	Reinforce packages used for heavy produce with corner supports or folded dividers.	
❑	DO NOT use very large packages—the larger the container, the more likely the produce will suffer damage during handling.	
❑	Use shallow packages for delicate produce such as berries, grapes, summer squash and ripe stone fruits (single layer or double layers).	
❑	DO NOT overload packages or allow produce to bulge up over the sides.	
❑	Packages should be vented, about 5% of the surface area per side.	
❑	DO NOT pack produce either too tightly or too loosely.	
❑	Consider using packaging materials such as trays, cups, wraps, liners and pads to help protect produce, but don't overdo it.	
❑	Small, rigid plastic containers such as clamshell baskets (consumer sized containers placed into larger boxes) are useful for protecting berries from damage and water loss.	
❑	Liners made of plastic films with holes will decrease the rate of water loss from produce such as cherries.	
❑	Use mesh bags for garlic and onions.	
❑	DO NOT block the holes of packages with fillers or liners.	
❑	Pack "consumer packages" such as gift packs or display trays into larger, more protective outer containers before stacking, transport and marketing.	
❑	Consider the use of packages with "hand-holds"—these cut-offs can reduce damage since they provide an easy way to pick up and carry produce.	
❑	Use virgin/food grade materials whenever possible. Avoid wood, nails, staples due to possible food safety problems.	

MANAGING TEMPERATURE AND RELATIVE HUMIDITY (RH)

Check	Goal	Notes
❑	Cool produce as soon as possible after harvest.	
❑	Cool using appropriate methods for each commodity.	
❑	Shade should be provided over harvested produce, packing areas, for buildings used for cooling and storage and for transport vehicles.	
❑	Trees are a fine source of shade and can reduce temperatures around packing houses and storage areas.	
❑	Light colors on buildings will reflect light (and heat) and reduce heat load. Design buildings with overhangs on the sunny side to provide shade.	
❑	Wet the floor of storage rooms to increase the humidity inside the room. (DO NOT do this when storing onions or garlic).	
❑	Monitor storage rooms by measuring temperature in several locations (in packages, at edges of stacks, near vents, doors and cooling ducts). Re-arrange produce or adjust air flow to avoid too warm and/or too cold spots. Calibrate thermometers monthly.	
❑	Use proper containers, suited to the method used for cooling (waxed cartons or wooden boxes for hydro-cooling or icing, boxes with aligned side vents for forced air cooling.)	
❑	Consider using forced-air coolers inside a cold room to speed cooling and decrease water loss and decay rate.	
❑	Use clean hydro-cooler water. Clean and sanitize the cooler each day before use.	
❑	DO NOT hydro-cool crops that are easily damaged (apricots or fresh herbs).	
❑	Cool before loading produce into refrigerated trucks (these trailers are designed only to *maintain* cool temperatures).	
❑	Use high quality insulation in coolers, storage rooms and transport vehicles to reduce incoming environmental heat load.	

- ❑ Use plastic strip curtains on doorways to prevent warm air from entering coolers.
- ❑ Mist water-tolerant vegetables during handling, storage and marketing to decrease the rate of water loss.

TRANSPORTATION

Check	Goal	Notes
❑	DO NOT overload vehicles.	
❑	Depending on time of year, pre-cool or pre-heat truck before loading.	
❑	Avoid over-filling of containers (rounded sides or bulge-packing) and stacking heavier produce at the bottom of the load.	
❑	Use strong packages.	
❑	Avoid rough handling during loading and unloading.	
❑	When stacking containers, be sure to align them properly (most of the strength of a corrugated box is in the corners). A one-inch overhang will decrease stacking strength by 15 to 34%.	
❑	Prevent vibration damage by using air suspension systems—these will provide a more gentle ride during transportation.	
❑	Using suitable trays, place packing, use of plastic bags, container liners, or placing a soft pad at the top of a full box can reduce vibration damage.	
❑	Make sure the vehicle has adequate ventilation to prevent heat gain during transport.	
❑	Check to ensure the vehicle is free from food safety hazards such as spilled fertilizer, animal manure, blood or odors.	
❑	Clean and sanitize vehicle bed once per week.	

STORAGE

Check	Goal	Notes
❑	Store only high quality produce, free of damage, decay and of proper maturity (not over-ripe or under-mature).	
❑	Know the requirements for the commodities you want to put into storage, and follow recommendations for proper temperature, relative humidity and ventilation.	
❑	Harvest most crops before a hard freeze, and don't handle crops for storage when they are wet.	
❑	Cure root, tuber and bulb crops before storage.	
❑	Avoid lower than recommended temperatures in storage—many commodities are susceptible to damage from freezing or chilling.	
❑	DO NOT overload storage rooms or stack containers too close together. Leave about 2 to 4 inches between the stacks and the walls, and place produce upon pallets.	
❑	Provide adequate ventilation in the storage room.	
❑	Provide shade for storage structures or paint buildings white or silver to reflect heat.	
❑	Overhanging roof extensions on storage structures are very helpful in shading the walls and ventilation openings from the sun's rays, and in providing protection from rain. An overhang of at least 3 feet is recommended.	
❑	Keep storage rooms clean.	
❑	Storage facilities should be protected from rodents by keeping the immediate outdoor area clean, and free from trash and weeds.	
❑	Containers must be well ventilated and strong enough to withstand stacking. DO NOT stack containers beyond their stacking strength.	
❑	Use stacking patterns that allow for good air movement to remove heat of respiration.	
❑	Monitor temperature in the storage room by placing thermometers at a variety of locations. Calibrate thermometers monthly.	

- ❑ DO NOT store onions or garlic in high humidity environments.
- ❑ Store crops in a dark room. This is especially important for potatoes, since light will stimulate solanine production (a toxic compound not destroyed by cooking).
- ❑ Avoid storing ethylene sensitive commodities with those that produce ethylene.
- ❑ Avoid storing produce known for emitting strong odors (apples, garlic, onions, turnips, cabbages, potatoes) with odor-absorbing commodities.
- ❑ Inspect stored produce regularly for signs of injury, water loss, damage and disease. Remove damaged or diseased produce to prevent the spread of problems.

FARM MARKET DISPLAY

Check	Goal	Notes
❑	Make displays no more than 2 feet deep from front to back, 30 inches high, with a 20 degree slope to allow the customer to easily see and reach the product.	
❑	Decorative umbrellas, colorful awnings or roof extensions shade the display from the sun, protect from rain and draw attention to the market.	
❑	Allow for air circulation, but protect from wind utilizing roll down protective cloth on display sides.	
❑	If you have a large shade tree in a location that can be seen from the road, locate your display under it. This will add shade and protection from the elements.	
❑	Keep in mind product sensitivities and display in a way that product will not be damaged.	
❑	Make smaller displays and restock frequently.	
❑	Never display produce on the floor or ground. Exception—Jack-o-Lantern pumpkins.	
❑	Rotate produce as needed and remove damaged or decayed produce promptly.	
❑	Arrange top quality produce creatively using color contrast for an appetizing display.	

- ❑ Consider moveable display equipment to make restocking and relocation of display easier.
- ❑ Display equipment should be stable and strong.
- ❑ Eliminate sharp edges, pointed corners or rough surfaces which may damage produce or hurt the customer.
- ❑ Wash and sanitize display surfaces frequently with a chlorine bleach solution (3/4 cup chlorine bleach to 1 gallon fresh water). Clean the floor thoroughly and allow surfaces to dry before moving the display back and restocking.
- ❑ Mist leafy green vegetables and baby vegetables with clean cool water to help protect against water loss. Empty and sanitize the spray bottle each night.
- ❑ Consider iced displays for leafy vegetables and other produce that needs to be refrigerated. DO NOT ice beans, cucumbers, cantaloupe, eggplant, peppers, squash, tomatoes or watermelon. Wash and sanitize iced displays a MINIMUM of once a week.
- ❑ Provide hand washing equipment at toilet area for sales staff. Encourage staff to wash their hands with soap and water before returning to work.

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Adapted with permission from: Kitinoja, Lisa and James Gorny, *Postharvest Technology for Small Scale Produce Marketers: Economic Opportunities, Quality and Food Safety*, Department of Pomology, University of California, Davis.

Additional Source: Baertsch, James and Roger Kleve, *Produce Handling for Direct Marketing*, Northeast Regional Agricultural Engineering Service.

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