

KEEPING YOUR SOIL CLEAN

Select Fields Carefully

- Review the land history for prior uses and prior applications of chemicals, municipal sludge, or animal manure.
- Plant only in produce fields that are uphill and/or well separated from animal housing and grazing operations. If necessary, consider runoff controls such as ditches, grassed berms, or grassways.

Use Manure and Manure-based Compost with Caution

- Most pathogens found in compostable materials (such as manure, produce discards, and wood chips) are killed within days or weeks of composting by high temperatures created during aerobic composting. A well managed compost pile requires turning and watering until it does not reheat after turning.
- Using composted or treated manure is always preferable to fresh or untreated manure because composted manure carries a lower risk of pathogen contamination.
- Maximizing the time between application of fresh manure or mature, composted manure and harvest minimizes the risk of pathogen contamination.
- Store fresh and composted manure separately and well away from and below any production area. Use containment and runoff controls as needed.
- If applying fresh manure, mix it thoroughly into the soil and wait a minimum of 60 days before planting. Fresh manure should not be used on fresh-market fruit and vegetable crops.
- Even mature, composted manure can carry a risk. Apply it at least 120 days before the expected harvest date.
- ABSOLUTELY DO NOT SIDEDRESS** fresh-market fruit or vegetable crops with fresh or slurry manure, manure "tea" or mulches containing fresh manure.
- If sidedressing with compost or compost tea, ensure the material is well aged and was thoroughly composted.
- Keep records of manure and compost treatments, application rates, sources, and dates.



Do not grow edible crops downhill from fresh manure or compost piles, as the crops can be contaminated by runoff from the pile.



Maximize the time between storing or composting fresh manure and field application. Be careful not to introduce the microbes from untreated (uncomposted) manure, via "contaminated" equipment, into a mature composted manure pile.



Restrict access of domestic pets, wild animals, and pests to production areas (including processing areas and transportation vehicles) using fences, screens, doors, berms, and other physical barriers. These animals can spread pathogens from their excrement and on their feet.



Do not graze livestock near produce fields or water sources. Exclude domestic and wild animals from production fields to reduce the risk of contamination from animal waste products.



Mix fresh manure thoroughly into soil; wait at least 60 days before planting edible crops.

USING CLEAN WATER

Water Quality

- Learn about upstream conditions that might impact water quality so that possible sources of contamination can be identified and removed.
- Prevent surface runoff or airborne drift of possible microbial contaminants from animal operations from entering produce fields.
- Prevent pesticide spray drift from contaminating surface and groundwater. (Follow all label instructions when applying chemicals.)
- When using hillside water catchment systems, filter irrigation water to remove possible contamination.
- Use potable water for crop protection sprays to reduce the possibility of chemical, biological, or physical contamination. If potable water is not available, use clean water.
- Perform water quality tests for microbial contamination (such as for fecal coliform indicators) on a regular basis and keep accurate records.

Irrigation Source and Methods

- Identify the source of origin of irrigation water so that possible sources of contamination can be identified.
 - Municipal drinking water is typically the lowest-risk source.
 - Potable well water is a low-risk source if the well casing is maintained and livestock are excluded from the recharge area.
 - Surface water is a medium- to high-risk source, depending on the irrigation method and exposure of the surface water to contamination.
- Application methods for irrigation water can possibly determine the risk of produce-surface contamination. From the less risky to the more risky: subsurface is less risky than surface drip or furrow, and both are less risky than overhead.

Wash Water

- Use potable water for all produce and processing-surface washes to reduce the possibility of chemical, biological, or physical contamination.
- Maintain clean water in produce washing tanks by changing and sanitizing the water regularly.
- Use only FDA-approved disinfectants. Read and follow all label instructions.
- Avoid tank water temperatures more than 10°F cooler than produce temperature, because cold-tolerant pathogens can be drawn from the water into the produce interior through the stem if wash water is too cold.



Conduct water quality tests for appropriate contaminants as often as required.



Maintain accurate records of water quality testing and the laboratory results.



Do not allow runoff from animal operations to enter produce fields. Keep all animal operations and waste sources below production fields.



Do not allow crop protection chemicals to drift into surface water sources or onto crop surfaces where they are not intended.



Where feasible, use drip irrigation to reduce crop wetting and minimize risk of microbial contamination from water sources.



If using overhead irrigation, apply early in the day so leaves dry quickly.



Seal wellheads to help keep clean water clean. Wellheads should be located up-slope from sewage or drainage runoff. They should also be well elevated off the ground.



Do not leave wellheads unprotected. Cover wellheads to avoid contamination of water sources and to reduce the risk of harm to people and animals.



Chlorinate wash water as appropriate (other approved disinfectants can be used as well). Monitor chlorine levels and maintain them between 50 and 200 ppm, according to crop chlorine tolerance. Typical contact time is 1-2 minutes. Maintain water pH at 6.0-7.0. Provide final rinse if required by disinfectant label instructions.



Do not allow tank water temperature to become 10°F cooler than produce temperature. Cold-tolerant pathogens can be drawn from the water into the produce interior through the stem if wash water is too cold.

To order a free copy of this poster, go to <http://www.ctahr.hawaii.edu/oc/forsale/FST-7flier.pdf>

USING CROP-PROTECTION CHEMICALS SAFELY

Chemical Control Measures

- Follow all instructions when applying a pesticide—be sure it can be legally used for the intended purpose.
- Use pesticides and other agricultural chemicals only when necessary.
- Calculate the amount of spray mixture needed to spray a given size of field ahead of time to avoid leftover diluted chemicals.
- Mix and dilute chemicals outdoors, rather than inside your farm buildings.
- Carry clean water in a nurse tank to the field to measure and mix with chemicals.
- Store chemicals on the farm for only a short time, and in a locked, labeled, weather-tight enclosure.
- Dispose of any excess chemical and its container in accordance with label directions and local regulations.
- Keep accurate records of all chemical applications and original product information.

Equipment Safety Measures

- Maintain all application equipment in good working order and calibrate it regularly.
- Check the accuracy of your sprayer periodically to make sure you are applying the amount recommended on the pesticide label.
- Periodically clean and rinse spray equipment to keep it in good working condition and when switching from one chemical to another.

Worker Safety Measures

- Use appropriate protective equipment and clothing, according to label instructions.
- Do not apply pesticides during very hot weather or in windy conditions.
- Wash skin and clothing if spills occur and after applying chemicals.
- Do not smoke while working with chemicals.
- Note all active chemical applications on a central board where everyone can see them.
- Label all fields with application notices and re-entry times.



Calibrate equipment frequently to avoid overdosage and waste of money.



Calculate chemical dosages before application to avoid overtreatment.



Clean spray tanks to avoid chemical contamination and to keep equipment in proper order.



Pesticide residue carry-over equals illegal residues; use chemicals carefully.



Post a sign when chemicals are used and allow enough time (re-entry time) between chemical application and harvest.



Do not leave chemicals out in the open. Store separately from where people work for extended periods of time. Keep in a locked, labeled, weather-tight storage area.



Store all chemicals off the floor. Powders should be on higher shelves, separated from liquids, and all should be appropriately labeled.



Maintain accurate records of all uses of chemicals.



Post chemical application information in a central location so that employees know when and where it is safe to work with a crop after a chemical application.



Provide regular worker safety classes that review the farm's Standard Operating Procedures.

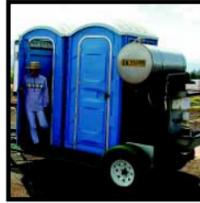
PROMOTING WORKER HYGIENE AND HEALTH

Worker Hygiene and Health

- Teach workers about microbial risks to produce and the importance of hygiene. Encourage employees to wash their hands with soap and water frequently.
- Workers should try to keep their clothes, footwear, and personal tools and equipment clean. Provide clean aprons or smocks daily.
- If possible, provide non-food contact jobs for sick employees. Employees should be trained to report illness.
- Have emergency procedures in place for all possible events.
- Provide drinking water facilities for employees.
- Supply protection to workers with cuts or lesions on parts of the body that may make contact with fresh produce.
- If employees wear gloves, they should be used properly and worn only over washed hands. Wash gloves frequently with soap and water.
- Provide properly located and well supplied toilet facilities to all workers in the field and in the packing house.
- Use caution when servicing portable toilets to prevent leakage into a field.



Supply soap, clean water, and single-use towels for hand washing; post signs to remind employees to wash their hands before breaks and after using the restroom.



Provide and maintain clean employee restrooms that are easily accessible. Provide cool drinking water and one-time-use cups.



Encourage workers to wear protective clothing in the field, such as hats, gloves, shoes, long-sleeved shirts, long pants, sun screen, sun glasses, and so forth.



Provide regular worker safety classes that review the farm's Standard Operating Procedures.



Keep first-aid kit well stocked and where everyone can easily get to it.

MAINTAINING A CLEAN, PEST-FREE, AND SAFE WORK ENVIRONMENT

Clean, Pest-Free, and Safe Work Environment

- Develop daily cleaning schedules for work surfaces, equipment, restrooms, and keep maintenance logs posted for employees to see.
- Clean and sanitize loading, staging, and all food-contact surfaces at the beginning of a work day and any time contamination occurs. Clean the same surfaces at the end of the work day.
- Establish and maintain a methodical pest control program.
- Perform repairs and block access of pests to enclosed facilities and reduce clutter that may provide shelter and coverage for pests.
- Repair any leaks and eliminate standing water wherever possible, as water attracts pests.
- Keep records of pest activity and control measures (chemical and other control techniques).
- Set above-ground fuel storage tanks at least forty (40) feet from any building, and maintain them child-proof and free of weeds and other easily combustible material.
- Ensure chemicals are stored in a lockable, well lit, and well ventilated area. Make sure they are separated from other chemicals that may cause them to react dangerously.
- Properly dispose of all empty chemical containers.



Clean and sanitize loading and staging areas and all food contact surfaces on a regular basis.



Keep rodents and other disease-carrying pests from entering facilities by blocking access and using the recommended number of baited, well maintained traps.



Elevate fuel storage tanks to allow for easy detection of leaks that can harm people or the environment.



Do not keep excess chemicals, fuels, or lubricants on the farm. Dispose of them properly to avoid accidental chemical spills.



Keep potentially harmful chemicals in a locked, weather-tight, clearly labeled cabinet.

HANDLING, TRANSPORTING, AND TRACEBACK

Clean and careful handling, transportation, and traceback

- Clean and sanitize loading, staging, and all food-contact surfaces at the beginning of a work day and any other time when contamination occurs. Clean the same surfaces at the end of the work day.
- Processing buildings and equipment must be clean, not harbor pests, and not be a source of contamination (such as dust and feces from overhead pipes).
- Check that produce bins are clean and in good repair.
- Wash and sanitize bins thoroughly prior to harvest and clean bins daily during harvest. Do not transport non-produce items (such as tools, chemicals, lunches, fertilizer) in produce bins.
- Remove excess soil from produce in field.
- Handle produce gently to minimize bruising. This improves quality and helps prevent possible contamination.
- Use ice made from potable water and chill produce as required as soon as possible. Make sure coolers and refrigerators are washed and sanitized before use. Never store non-produce items in coolers.
- Store produce at appropriate temperatures to maintain good quality.
- Protect produce from direct sun exposure.
- Inspect transportation vehicles for cleanliness, odors, and obvious dirt and debris, and before loading clean and sanitize as necessary.
- Develop procedures to track individual products from the farm, to the packer, distributor, and retailer, in as much detail as possible using a traceback label on the produce box.



Wash out harvest bins regularly to reduce sources of contamination.



Remove excess soil from produce in the field—before it reaches the packing house.



Do not overload produce containers as damaged produce can spoil faster and be contaminated more easily.



Chill produce quickly to minimize growth of potential pathogens.



Keep fresh produce separated from ready-to-ship products as fresh products can contaminate products ready to be shipped.

Contributors and information sources

College of Tropical Agriculture and Human Resources, University of Hawai'i at Mānoa: Jim Hollyer, Luisa Castro, Dale Uno, Lynn Nakamura-Tengan, Aurora Hodgson, Robert Paull, Craig Okazaki, Rogelio Corrales, Joe DeFrank, Charles Nagamine, Barry Brennan, Mason Morizumi and Carl Evensen

Hawai'i Department of Agriculture: Albert Louie and Sam Camp

US Food and Drug Administration: Michelle Louie and Sam Camp

Nalo Farms • Jeff's Farm • Aloun Farms • Volcano Veggies, Inc. • Sodexo • Maui Produce Processing Cooperative

Cornell University: GAPs Team. *Reduce Microbial Contamination with Good Agricultural Practices (2007)*. A brochure for farmers.

* To obtain additional copies of this poster, contact the Publications and Information Office, CTAHR-UHM, 3050 Maile Way (Gilmore Hall 119), Honolulu, HI 96822; 808-956-7036; 808-956-5966 (fax); e-mail: ctahrpub@hawaii.edu.

March 2002, CTAHR Food Safety and Technology publication no. FST-7

* The University of Hawai'i is an Equal Opportunity/Affirmative Action Institution providing programs and services to the people of Hawai'i without regard to race, sex, age, religion, color, national origin, ancestry, disability, marital status, arrest and court record, sexual orientation, or veteran status.

* This poster contains information on a majority of issues surrounding on-farm food safety. More information and remedies can be found in the following manuals: FDA's Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables (at left) and the Current Good Manufacturing Practice in Manufacturing, Packing, or Holding Human Food. Both publications are available from:

Food Safety Initiative Staff, HFS-32
U.S. Food and Drug Administration
Center for Food Safety and Applied Nutrition
200 C Street S.W., Washington, DC 20204
www.fda.gov

Funding for this poster provided by USDA/CSREES Grant No. 96-34172-2078

For more information on food safety visit the Hawaii Agricultural Gateway at www.hawaiiag.org or go to www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs.html



Do not transport produce with chemicals as harmful contamination can occur.



Clean and sanitize transportation vehicles regularly and maintain at the proper transport temperatures.



Reduce contamination of new cardboard packing boxes by storing them properly, preferably in an enclosed building. Do not reuse boxes as used boxes are a major source of microbial contamination and hinder traceback.



Traceback labels provide important product and farm identification information and can be of great help in an emergency recall. Name and weight of produce should also be included on the box.



Do not smoke or eat in the packing area.