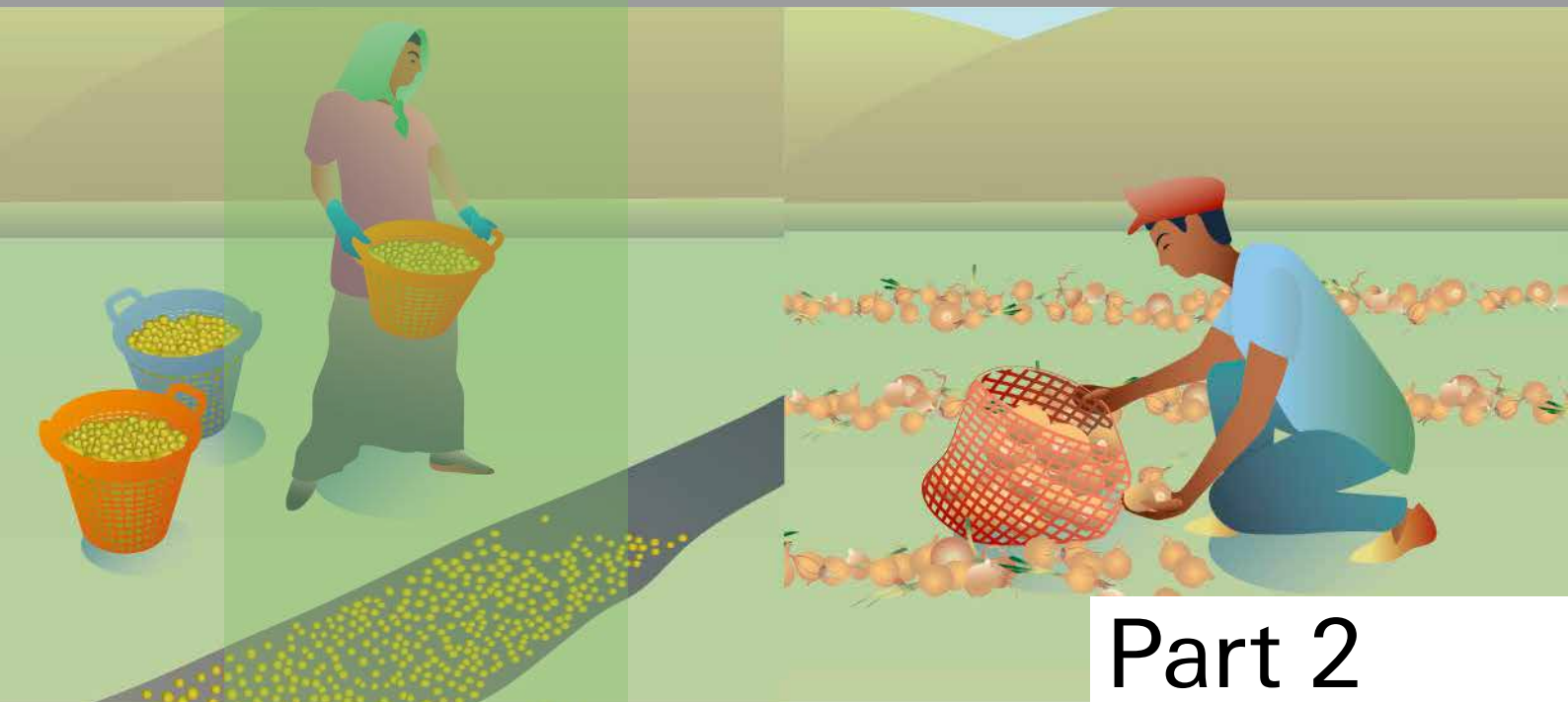


# Minimizing microbial contamination in primary production of fruits, vegetables, herbs and spices



## Part 2



© 2018, Nestec Ltd., Vevey (Switzerland)

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# 5. Hygiene and human health



Recommendations from this chapter are mainly designed for workers during manual harvesting of the crop. However, these hygiene and human health requirements are also applicable for all workers during any activity where there is a direct or indirect contact with the crop (e.g. at pre-harvest, at post-harvest, during mechanical harvesting).

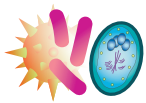


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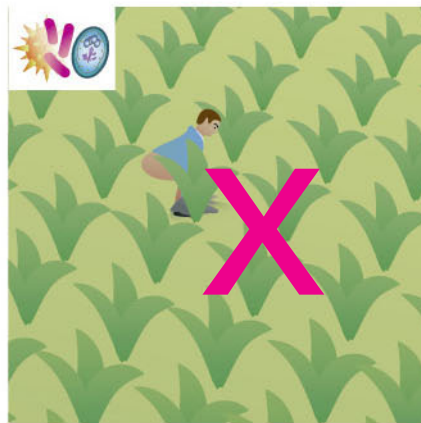
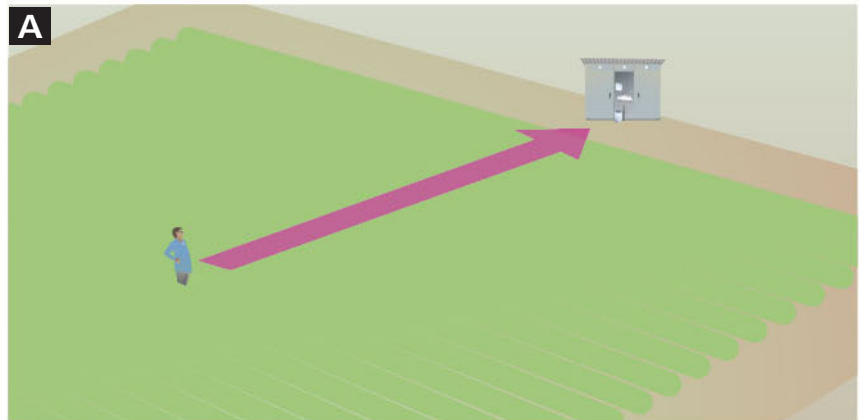
# Toilet facilities (fixed and mobile)

**A** Toilets should be accessible in close proximity to the field, i.e. in a manner to encourage their use, and not only when workers are on break.



Stools can be contaminated with

high concentrations of human pathogens such as bacteria, viruses or parasites, even in the absence of symptoms. Do not relieve yourself in the growing field or in the crop production area, always use toilets!



**B** Toilets should be in sufficient numbers to accommodate personnel from both genders, e.g. a minimum of one per 20 workers or according to local regulation, if defined.



**C** Toilets should be maintained in good repair, clean, with toilet paper and a covered waste basket. Door should close well.



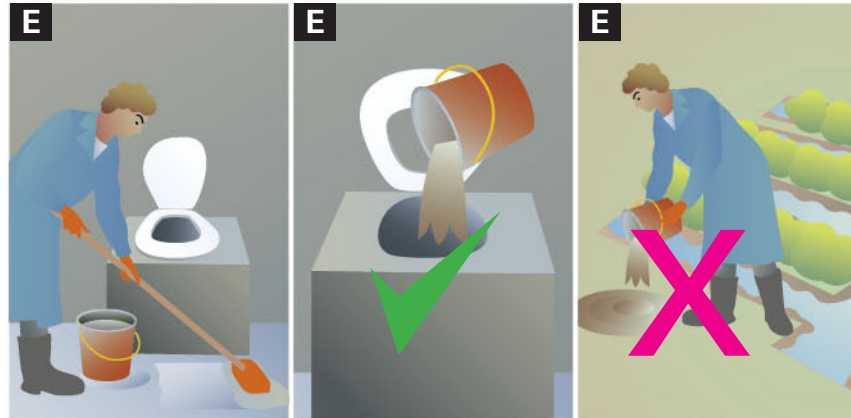
**D** Remind workers to use the toilets (consider the use of signs) and that soiled paper should go into the bowl, not in waste baskets or on the floor!



# Toilet facilities

(fixed and mobile)

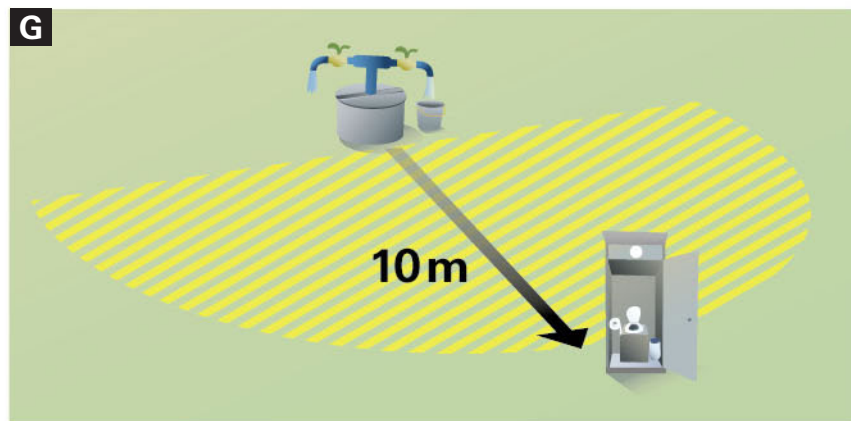
**E** Toilets should be cleaned daily and preferably constructed of materials that are easy to clean. Cleaning waste water should be discharged directly in the bowl or outside the crop production area in a place where it can be quickly infiltrated in the soil.



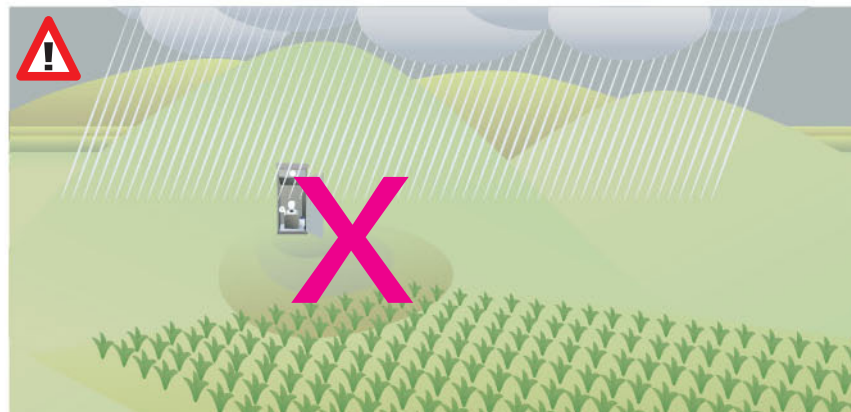
**F** Use caution with mobile toilets! Waste water from mobile toilet facilities that may drain into growing field can contaminate the crop. Verify regularly the good condition of the mobile toilets (i.e. no risk of leakage).



**G** Toilet facilities should be located away from agricultural water sources (at least 10 meters away or according to local regulation).



 Care should be taken to avoid locating toilet facilities where run-off into the growing field could happen.

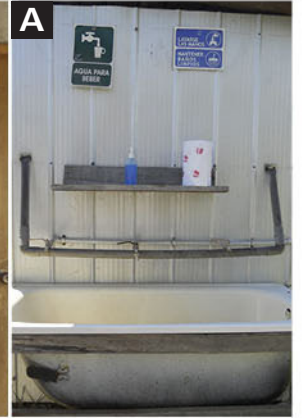




# Hand wash stations

(fixed and mobile)

**A** Hand wash stations should be located inside or adjacent to toilet facilities and nearby break areas.



**B** Hand wash stations should provide potable water (i.e. water that meet the microbial standard for drinking water). They should have hand soap, disposable paper towels or other hand drying device and towel disposal container (covered waste basket).



**Hand sanitizers alone (hand disinfectants) are not an acceptable alternative to water, soap and disposable paper towels.**



# Hand wash stations

(fixed and mobile)

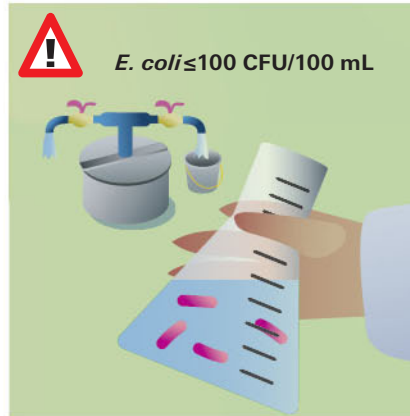
**C** If it is not possible to use potable water for hand washing, sanitizers should be used after washing hands with soap and agricultural water.



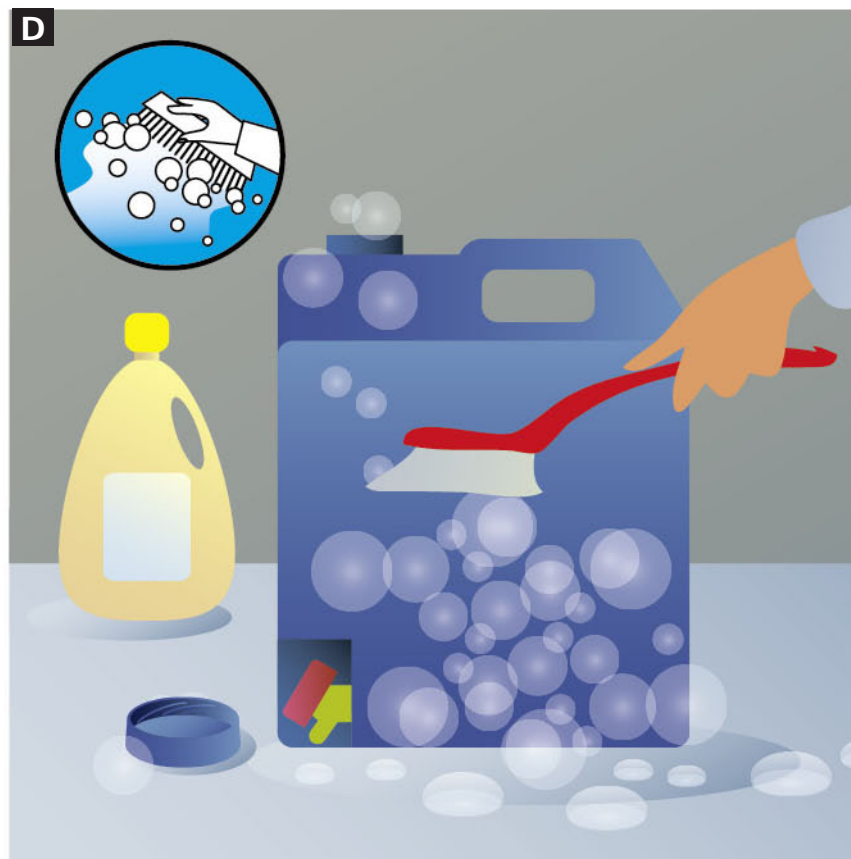
The agricultural water used for this purpose should have *E.coli* levels not exceeding 100 CFU/100 mL.



*E. coli* ≤ 100 CFU/100 mL



**D** Containers used to transport and store water for hand washing should be regularly cleaned with water and detergent (at least once a week).



# Hand washing

(when and how)

- A** Wash hands with soap and water:
- Before starting work;
  - After using the toilet;
  - After blowing your nose;
  - After contact with contaminated material or body fluids, including saliva and runny noses;
  - After touching animals or any waste of animal origin;
  - After eating, drinking and after breaks;
  - After smoking.



- B** Remind workers about the importance of hand washing, and how to perform a proper hand wash: use hand washing signs in local languages and/or pictures adjacent to hand wash stations, instructing people to wash their hands after each toilet visit.



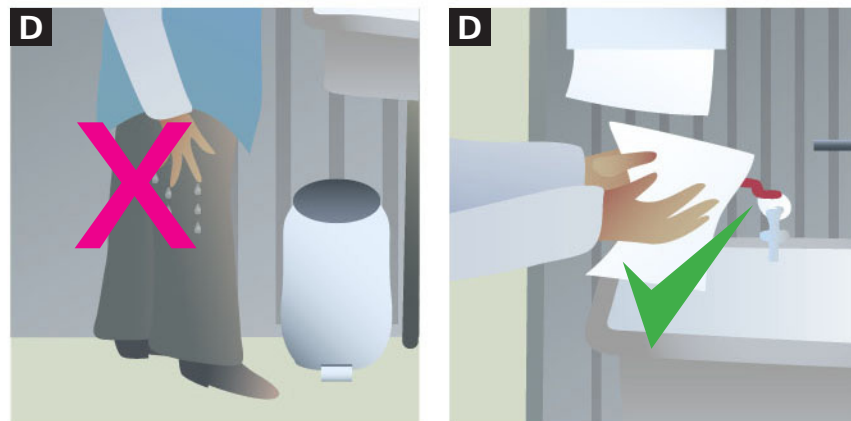
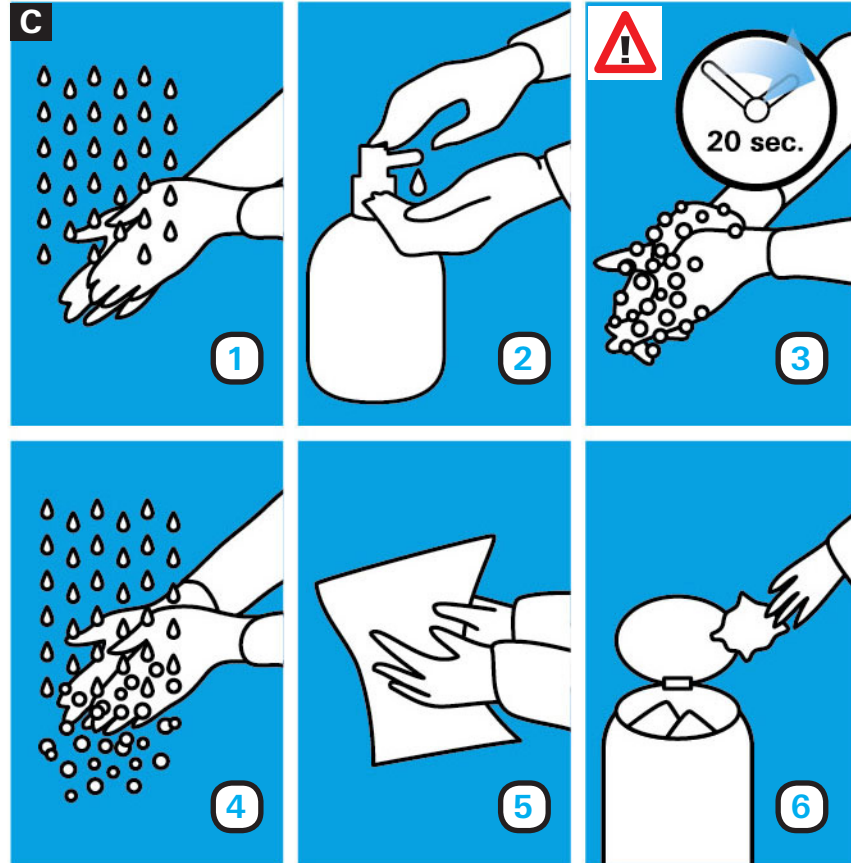
# Hand washing

(when and how)

**C** Consider using signs showing the six simple steps to follow for proper hand wash:

1. Wet hands with potable water
2. Apply soap
3. Scrub hands, between fingers and under fingernails, and top of your hands for at least 20 seconds – **FRICTION** and **DURATION** of friction are KEY to good hand washing
4. Rinse soap off thoroughly
5. Dry hands with disposable paper towels
6. Discard disposable paper towels in waste basket

**D** As environmental contamination on outer clothing can be transferred to wet hands, do not dry hands on pants or shirt sleeves but use disposable paper towels!



# Sewage disposal

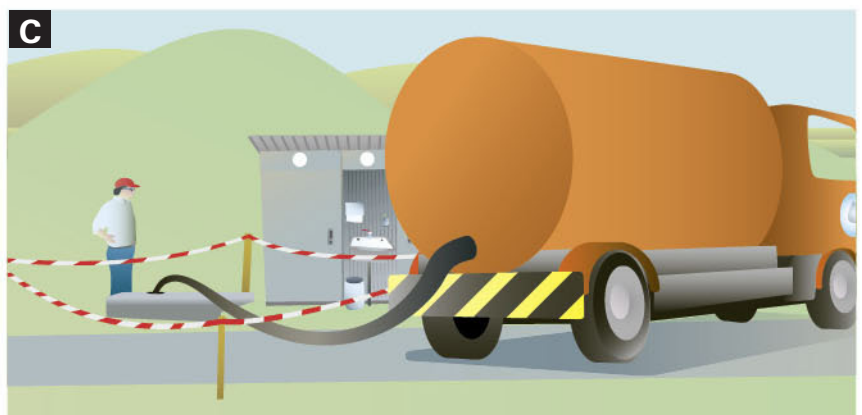
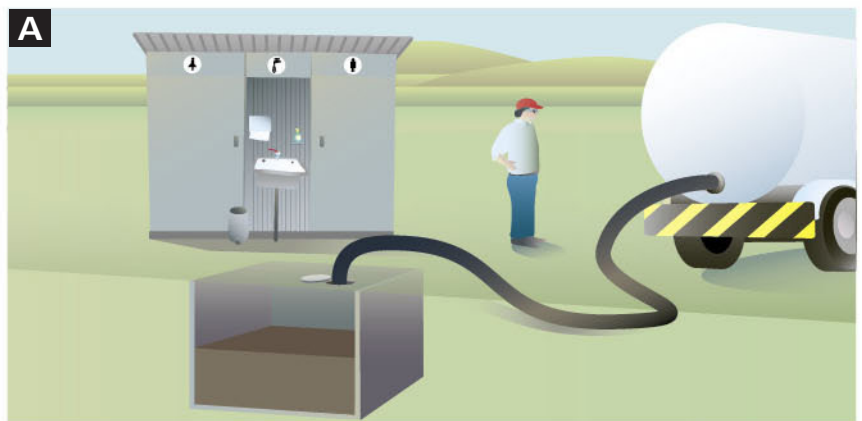
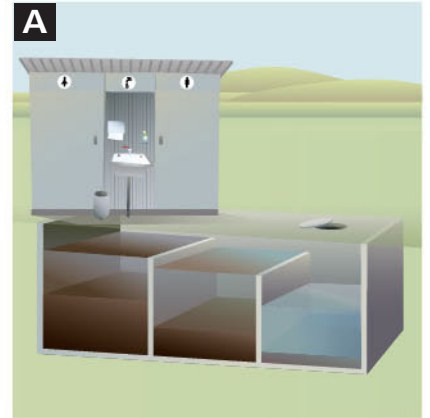
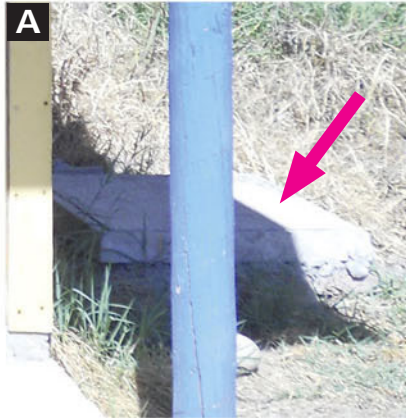
**A** Toilets should be connected to a sewage disposal system (either municipal sewage system or septic tank system) or a storage tank emptied through a sewage transport truck.

**B** Hand wash stations should be connected to a disposal system for used hand wash water (e.g. municipal sewage system or a tank that captures the water). Water captured in tanks must be discharged outside the crop production area.



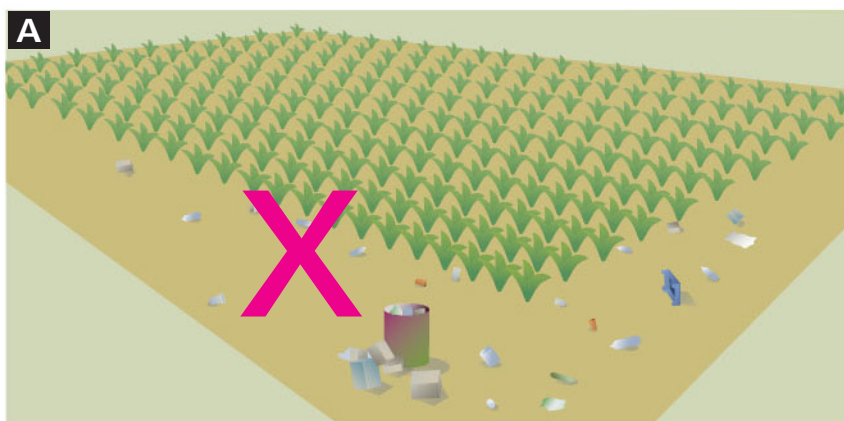
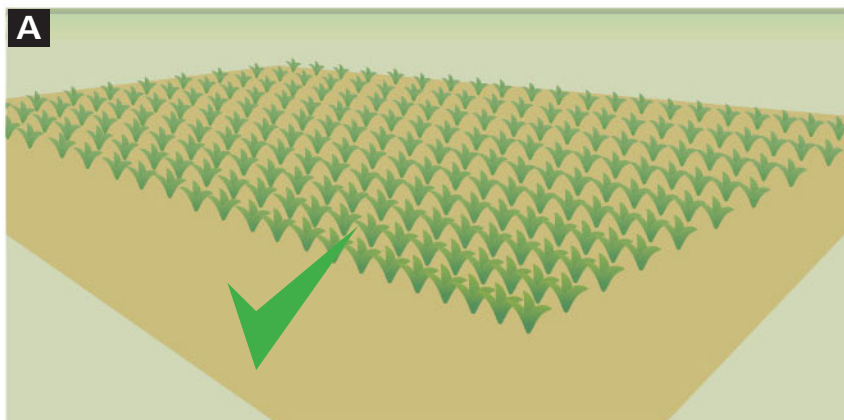
If there is no disposal system for used hand wash water, water should at least infiltrate quickly into the soil, without any risk of run-off (e.g. hole in the soil).

**C** Sewage transport trucks need direct access to toilet facilities to ensure proper collection and disposal of waste. Use appropriate barriers to prevent contamination in the event of an accidental leak or spill.



# Waste management

**A** Keep the growing field and the whole crop production area free of trash, papers, plastics and empty containers which do not belong to farm activities.



**B** Install covered rubbish bins in the crop production area to dispose waste and empty the rubbish bins once the working day is over. These rubbish bins should be easily accessible to workers during harvesting activities and in the crop production area.



Harvested crops unfit for human consumption should be separated before storage and transport and disposed hygienically.

# Restrictions in growing fields and in storage areas

**A** Smoking, eating and drinking (other than water), chewing gum or tobacco are prohibited and are confined to designated break areas. Spitting is prohibited and workers should avoid blowing their nose, sneezing or coughing over unprotected crop.



**B** Jewelry and visible body piercings are prohibited.



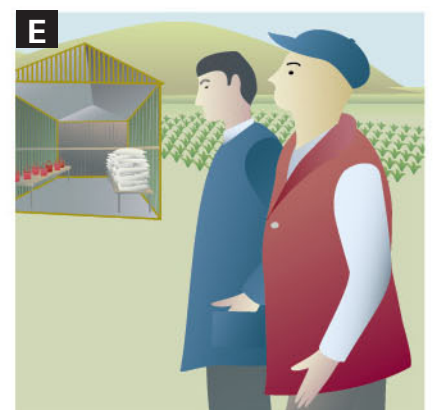
**C** Children should not be present in growing fields and storage areas where the harvested crop and/or equipment are stored.



**D** Use signs showing restrictions.



**E** Authorized visitors should follow good hygiene practices and be under supervision all time.

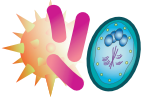


# Glove policy

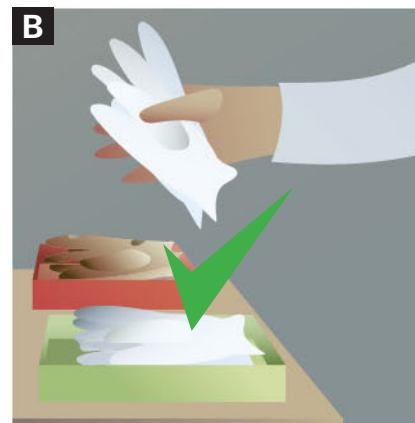
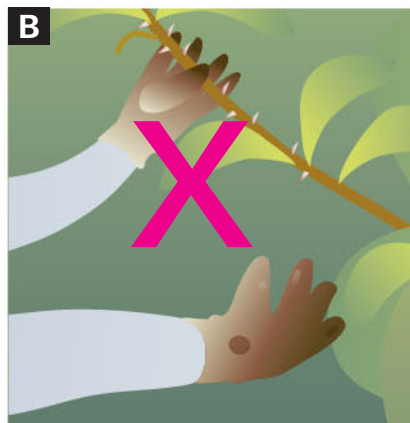
**A** The use of gloves is possible during harvest and post harvest operations.

**B** Where gloves are considered a useful practice:

- clean gloves, in good repair should be provided by the farm;
- gloves should be replaced as soon as they become torn, soiled or otherwise contaminated;
- non disposable gloves should be made of material that are easily cleaned and disinfected, they should be cleaned regularly and stored in a dry clean area.

 **The wearing of gloves or the use of hand sanitisers does not exempt the worker from having thoroughly washed hands before putting on gloves.**

**C** Personal gloves are prohibited. Only use gloves advised in section B.





# Break area

**A** A clean place to store food and to eat should be provided to the workers (break area/canteen).

**A**

**A**

**B** Break areas should be designated and separated from the growing field(s) and equipment in contact with the crop.

**B**

# On-farm living quarters

**A** On-farm living quarters may be provided for workers. They should be habitable, with a sound roof, windows and doors.



**B** They are kept clean and have basic services of running potable water, toilets and shower.



# Personal hygiene and clothes

**A** Workers should have a shower daily and ensure clothes are clean at the start of the working day.



**B** Workers should have clean hands with short nails, tied hair, and no open shoes.



**C** Work clothes should be washed separately from all other laundry to avoid cross-contamination.



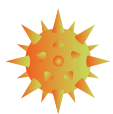
 **Conventional household washing detergents have a good virucidal efficiency at or above 40°C.**

**D** Worker's feet (with or without shoes) should not come in contact with the crop, e.g. post-harvest activities such as pepper threshing. Favor the use of cleanable or single use sticks to separate berries from spikes and/or mechanical threshing with a machine.

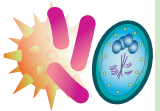


# Worker illnesses and open lesions

**A** Farmers and workers should be familiar with typical signs and symptoms of infectious illnesses (e.g. fever, abdominal cramps, vomiting, diarrhea, jaundice and skin infections):



**Fever, headache, fatigue combined with dark urine and pale in color stool, or jaundice, are indicative of Hepatitis A.**



**Diarrhoea and vomiting are indicative of gastroenteritis caused by infectious agents such as Norovirus or Salmonella or Cyclospora.**



**B** Any worker showing symptoms of an infectious illness should not have direct or indirect contact with crops and therefore should be excluded from the crop production area.



# Worker illnesses and open lesions

**C** Workers with symptoms of gastroenteritis or with symptoms of acute Hepatitis A should only be allowed to return to work 48h after disappearance of symptoms of vomiting and diarrhea and after disappearance of jaundice for hepatitis.

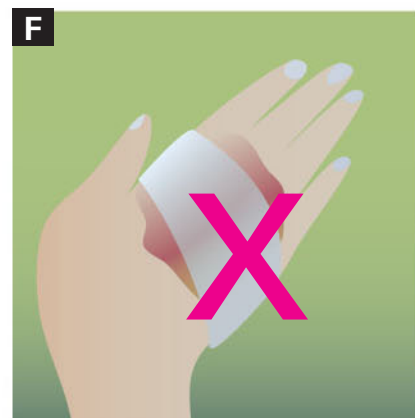
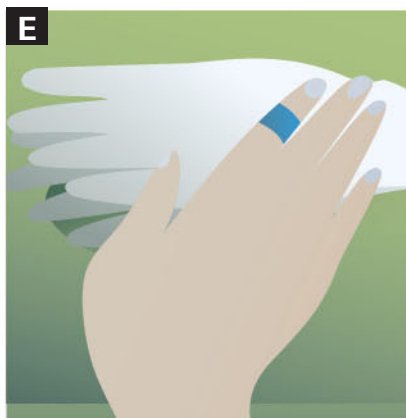
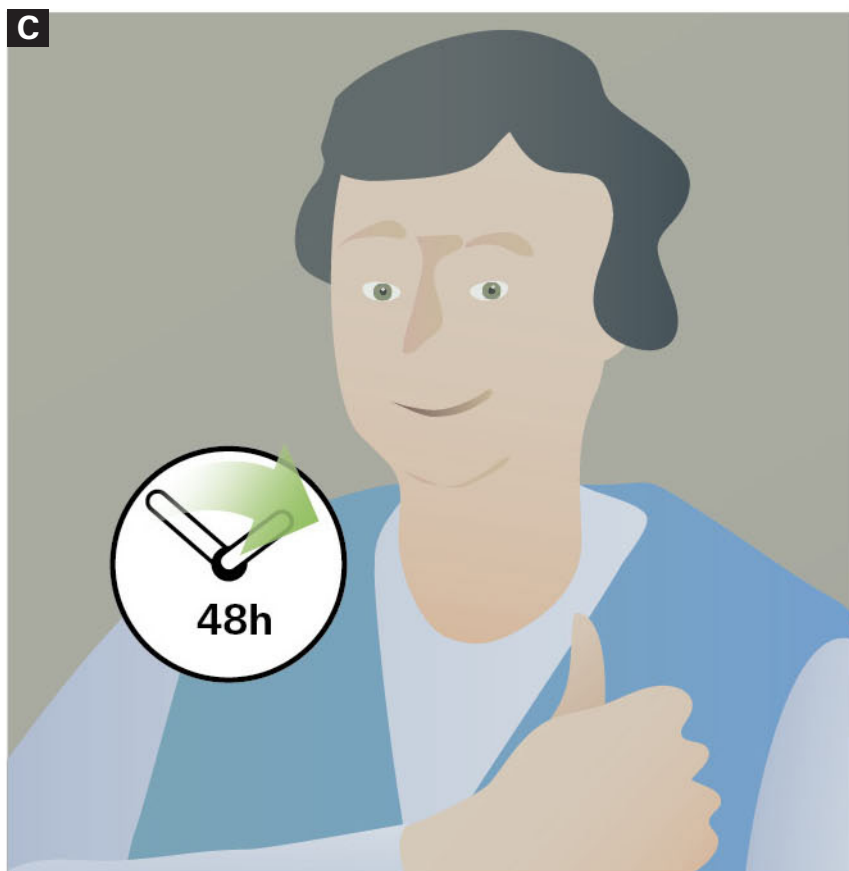


**Workers can be infectious before appearance and after disappearance of symptoms, emphasizing adherence to hand hygiene at all time!**

**D** Workers should be instructed to report any active case of illness to their supervisor before beginning work.

**E** Workers can continue to work despite having minor cuts, provided the injury is covered with a water-proof dressing. In addition there should be a secondary barrier, such as gloves (in compliance with glove policy) or clean protective clothing.

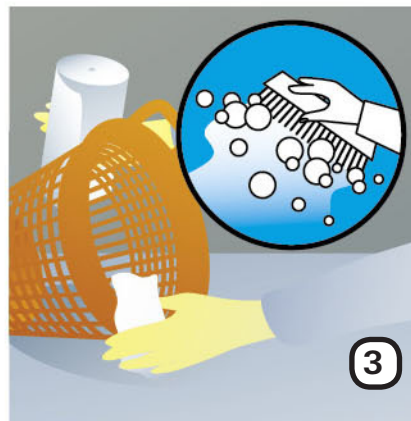
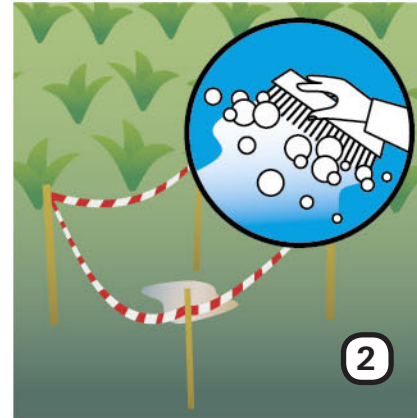
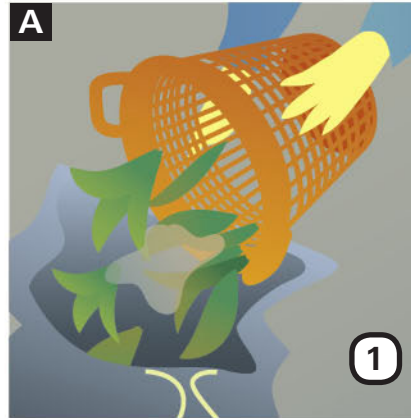
**F** If it is not possible to effectively cover the lesion and if the lesion is located on part of the body that might have contact with the crop or harvesting equipment, the worker should not have direct contact with the crop or equipment.



# Body fluid policy

**A** If a body fluid such as vomit or blood comes in contact the crop or crop production area, the incident should be reported by the worker, recorded by the farmer, and the following protocols should be applied:

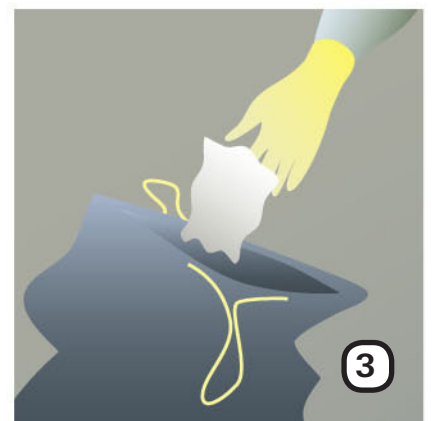
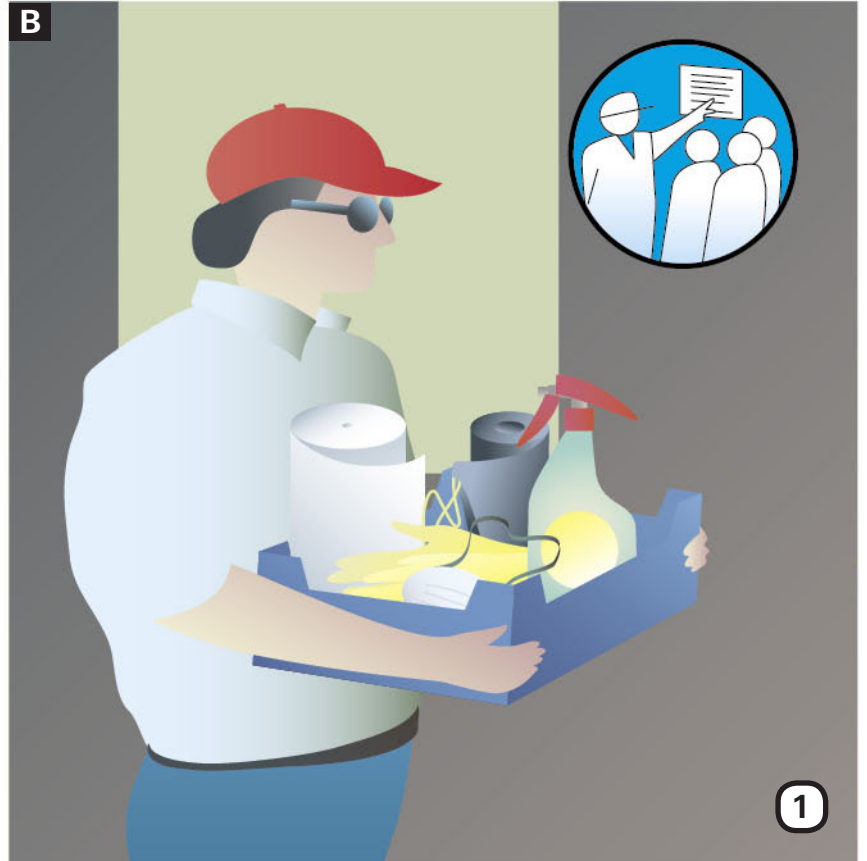
1. The contaminated crop should be segregated and disposed of;
2. The contaminated area should be confined, cleaned and disinfected immediately;
3. Contaminated equipment should be cleaned and disinfected immediately;
4. Stock of material to clean up and disinfect after spillage should be maintained (disposable paper towels, disinfectant, sealable waste bags, disposable gloves, disposable facemask, disposable apron).



# Body fluid policy

**B** Cleaning and disinfection protocol, especially in case of a vomiting incident:

1. Cleaning and disinfection should be performed by a person trained in cleaning up infectious material;
2. Disposable gloves, a disposable facemask and a disposable apron should be worn during cleaning;
3. Wet and dry paper towels should be used to wipe up the infectious material (e.g. vomit) and transferred into a sealable waste bag;
4. The most effective disinfectant against viruses and pathogenic bacteria (if present in vomit) is a freshly prepared sodium hypochlorite solution ( $\geq 1000$  ppm/0.01% free chlorine for at least 5 minutes).

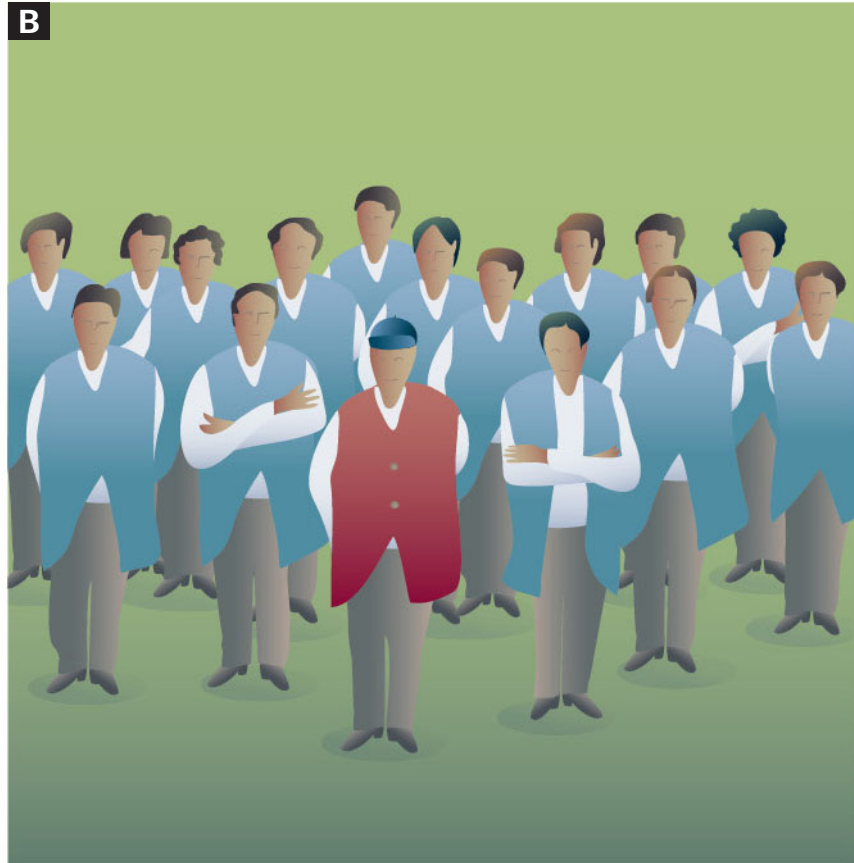


# First aid kits

**A** First aid kits should always be available in the vicinity of the growing field. Inspect frequently and replenish the kit as needed.



**B** As a minimum one worker per 20 should be trained in first aid.





# Drinking water

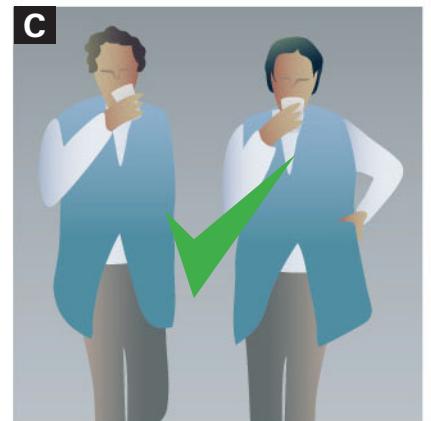
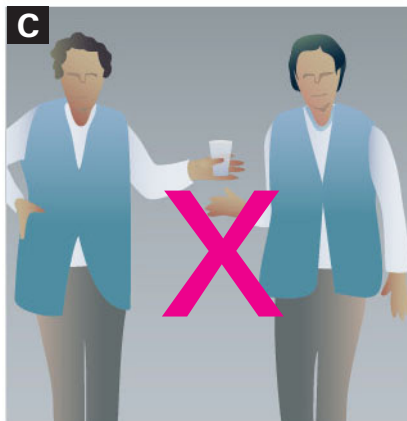
**A** Potable water (i.e. water that meets the microbial standard for drinking water) should be easily accessible to workers.



**B** If in containers, drinking water stored outside in the crop production area should be changed daily. Containers should be kept covered, rinsed before refill and regularly cleaned with water and detergent (at least once a week).

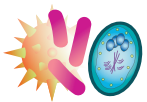
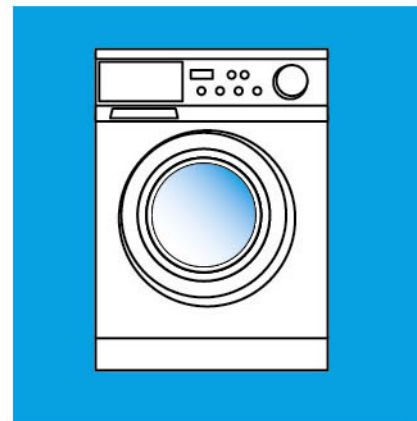
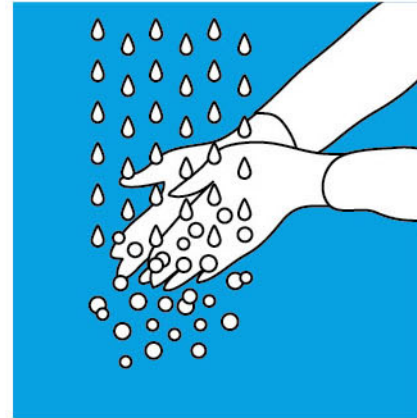
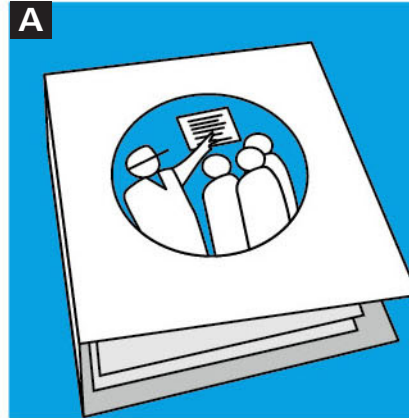


**C** Drinking cups (single-use) or water bottles should not be shared (and should be disposed off in appropriate bins).



# Training

**A** Establish/use a training program on hygiene to explain basic hygiene principles, including importance of hand washing and personal hygiene to avoid crop contamination.



The virus, bacteria and parasite risks

should be included, with an understanding on the main routes of contamination (Animals, personal hygiene, manure, water..).

**فيروس التهاب الكبدى أ (بوصفير)**  
**Virus d'hépatite A**

**التعريف**  
هو التهاب فيروسي يصيب الكبد. ينتقل عبر الفم عن طريق أظعمة ملوثة ببراز شخص مصاب بالفيروس

**الأعراض**  
إصفرار العين قىء وإسهال صداع

**طرق انتقال الفيروس**  
أواني ملوثة  
الأطعمة الملوثة  
اتصال مباشر

**الوقاية**  
تققيم المياه  
نظافة المراحيض  
غسل اليدين بالماء والصابون وتعقيمهما:  
بعد الخب  
قبل

و جميع المعدات الملوثة بالفيروس

# Training

**B** All workers should be trained on these basic hygiene principles: training should be documented (who, when, training material, trainer) and a periodic refresher should be made available.

**C** Competent supervisory personnel should be designated to ensure that workers follow the training requirements, such as toilet use, hand washing, restrictions in growing area etc. Competence of the designated personnel should be verified (e.g. simple test/quiz).

**D** If a formalized program is not practical (e.g. seasonal field personnel), the farmer should verbally instruct (especially about microbial contamination routes such as fecal material and body fluids) and demonstrate proper practices such as hand washing techniques.



# Hygiene and human health: REMEMBER!

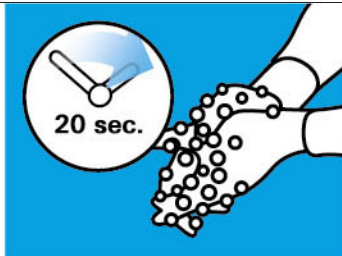
1. Provide clean toilets with toilet paper, which are connected to a sewage disposal system.



2. Provide hand wash station with soap, with either potable water or type A water with *E.coli* ≤100 CFU/100 mL, disposable towels and waste basket.



3. Wash your hands!



4. Manage waste in the crop production area.



5. Use signs to show and remind restrictions rules in the crop production area such as no eating, smoking etc...



6. Follow good personal hygiene practices and do not work in the crop production area if you have symptoms of illnesses!



7. Implement a cleaning and disinfection procedure in the event of a body fluid incident such as vomiting.



8. Train workers! (on hygiene, risk from illnesses, cleaning procedures...).



# 6. Worker harvesting practices



Hand harvesting practices

85

Workers instructions and supervision

87



# Hand harvesting practices

**A** Do not harvest crops that have signs of contamination (e.g. bird droppings or molds) or that have fallen on the ground.



Remove fallen fruits and leaves or other plant waste materials from the growing/harvesting area as they provide ideal growing conditions for molds.

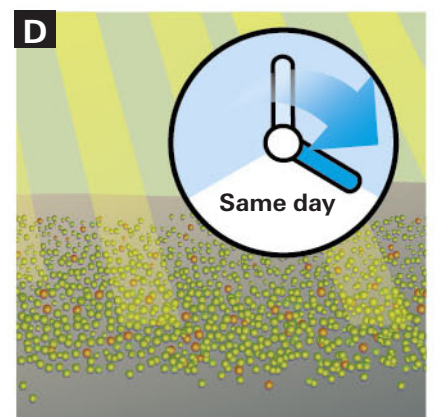
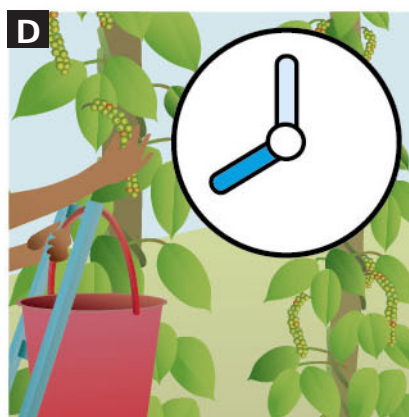
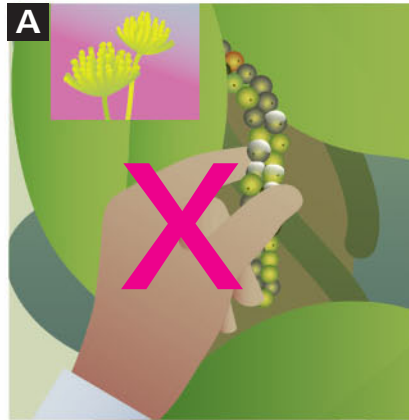
**B** Always handle crops carefully to avoid internal and external damage e.g. do not drop the crop onto hard surfaces such as the bottom of crates.



Remove excess of soil from the harvested crop before it is transferred into the harvesting container.

**C** Keep harvesting containers off the ground e.g. put an extra empty crate at the bottom of the pile, or use a clean piece of tarpaulin or plastic below the pile.

**D** For crops that are dried on-farm, start processing on the day of harvesting.



# Hand harvesting practices



When the amount harvested exceeds processing capabilities, store the excess under appropriate condition (refer to Chapter 7, page 102).

**E** Do not use harvesting containers for other purposes than harvesting (unless clearly marked or labeled for that purpose). Instruct workers not to use harvesting containers to carry their food, tools or clothing or any other non-produce item.

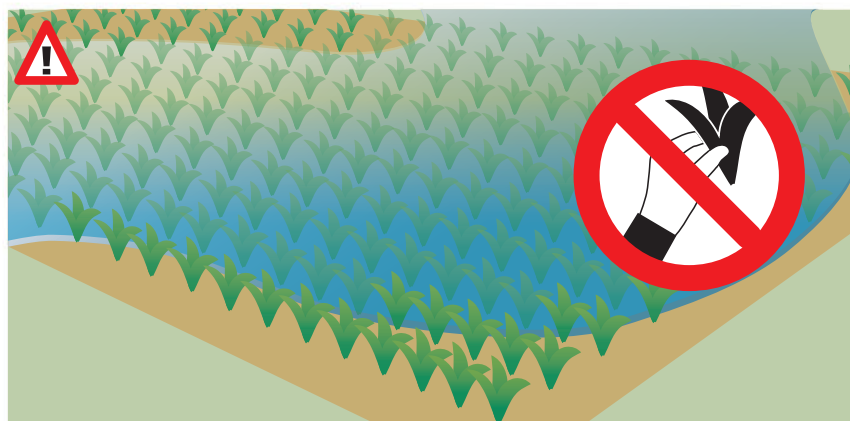
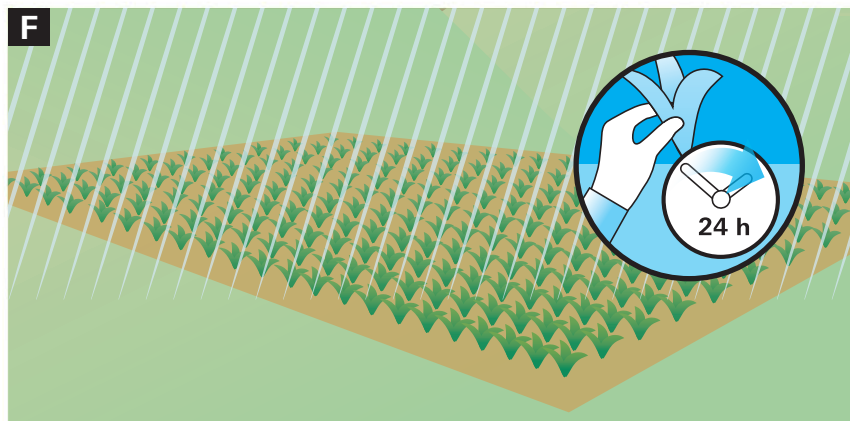


Harvesting containers should be made of material which can be easily cleaned such as plastic. Do not use wood containers.

**F** It is advisable to wait 24 hours after a rain fall to harvest non-covered crops.



If the crop has come into contact with floodwater, record the incident. Further use should be discussed with your raw material buyer, according to the extent and the timing of the flooding. In the event of a severe flooding with crops submerged, these crops should not be harvested.





# Workers instructions and supervision

**A** Hand pickers should be trained on hand harvesting practices (see previous section, A to F page 85–86).

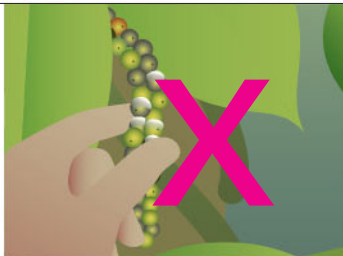


**B** A competent person should supervise hand pickers at all time.



# Worker harvesting practices: REMEMBER!

1. Train workers on hand harvesting practices e.g. do not harvest crops that have signs of contamination such as molds or bird droppings.



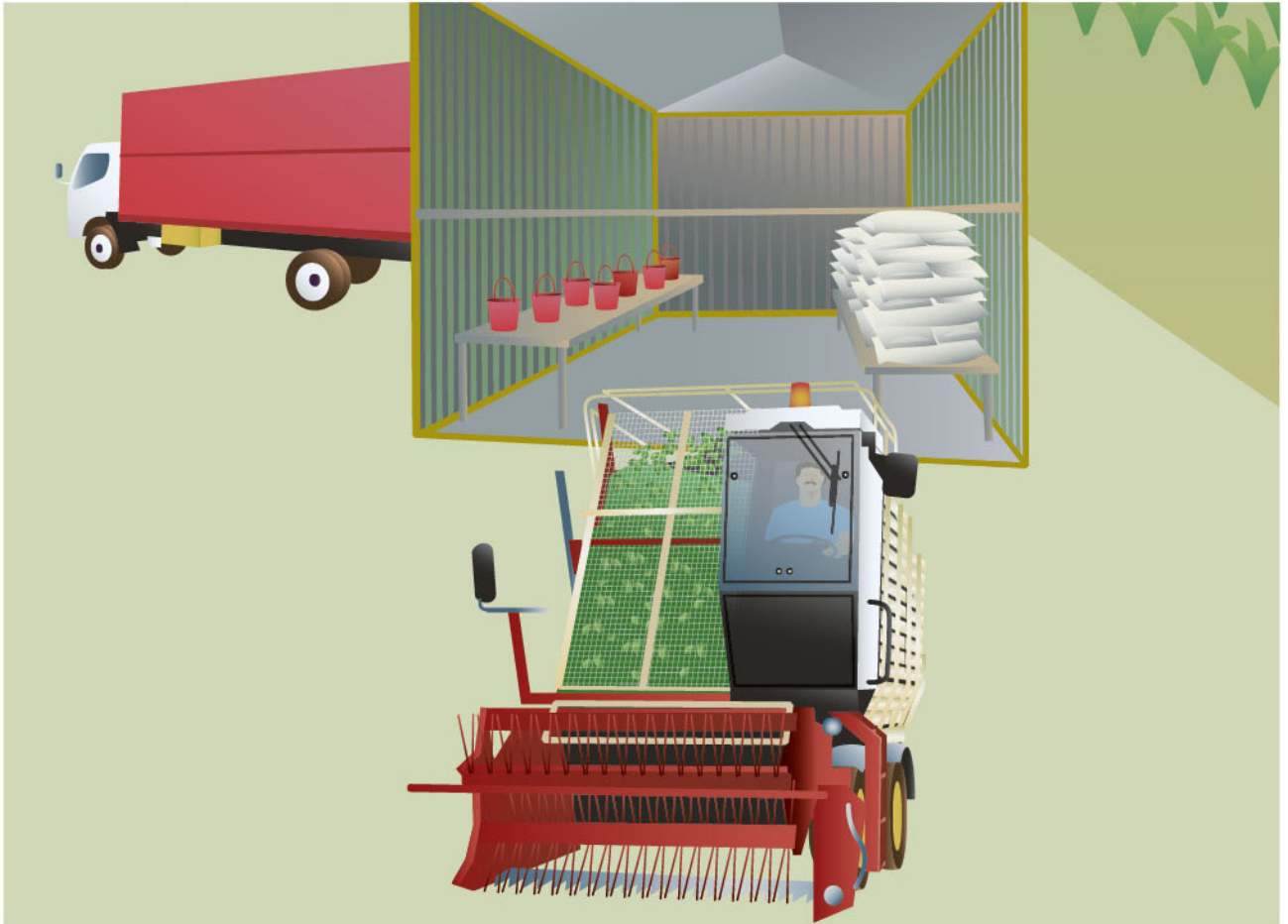
2. Keep harvesting containers off the ground and do not use them for other purposes.



3. In the event of a severe flooding with crops submerged, these crops should not be harvested.



# 7. Equipment, premises and transportation



Generic best practices for cleaning	91
Harvesting containers	93
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Optional on-farm processes before drying	97
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Storage areas	103
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# Generic best practices for cleaning (e.g. harvesting containers, tools, drying sheets, machines, storage areas and transportation vehicles)

## **A** Best practices for cleaning include 3 steps:

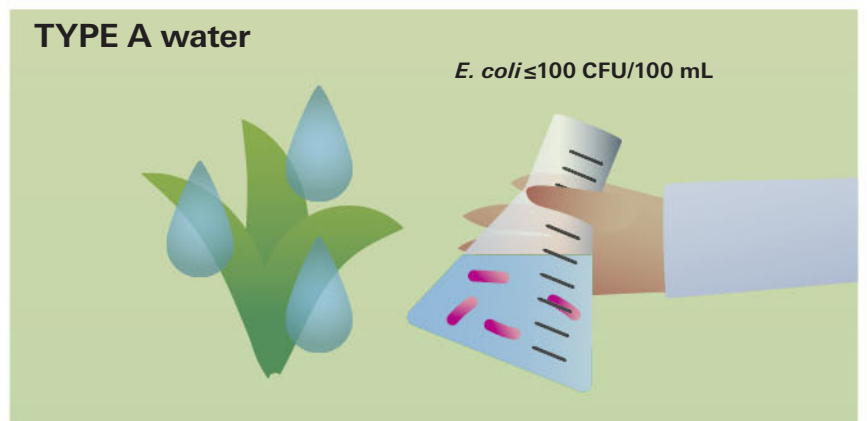
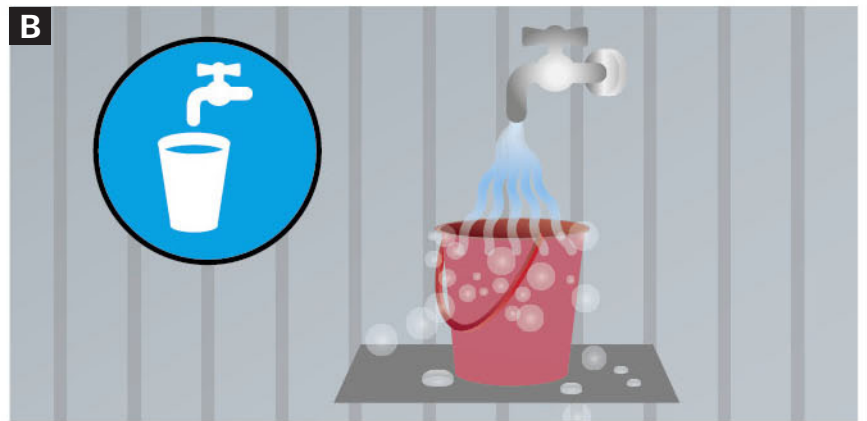
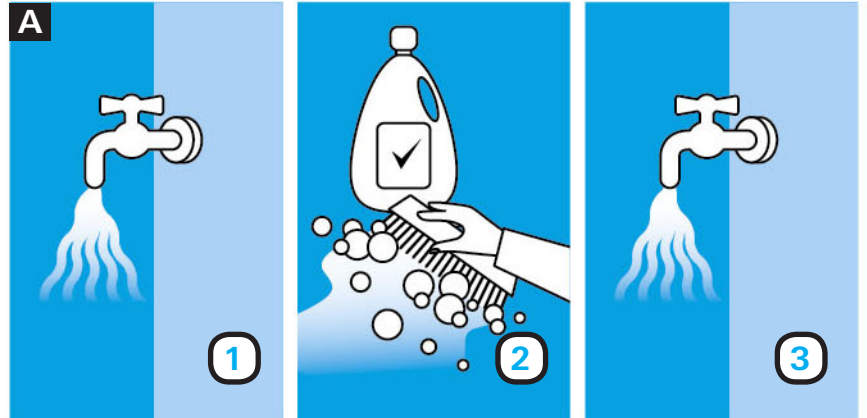
1. Rinse the surface so that any obvious dirt and debris are removed.
2. Apply an appropriate detergent and scrub the surface.
3. Rinse the surface and let it air dry.



If necessary, remove excess soil in advance of step 1.

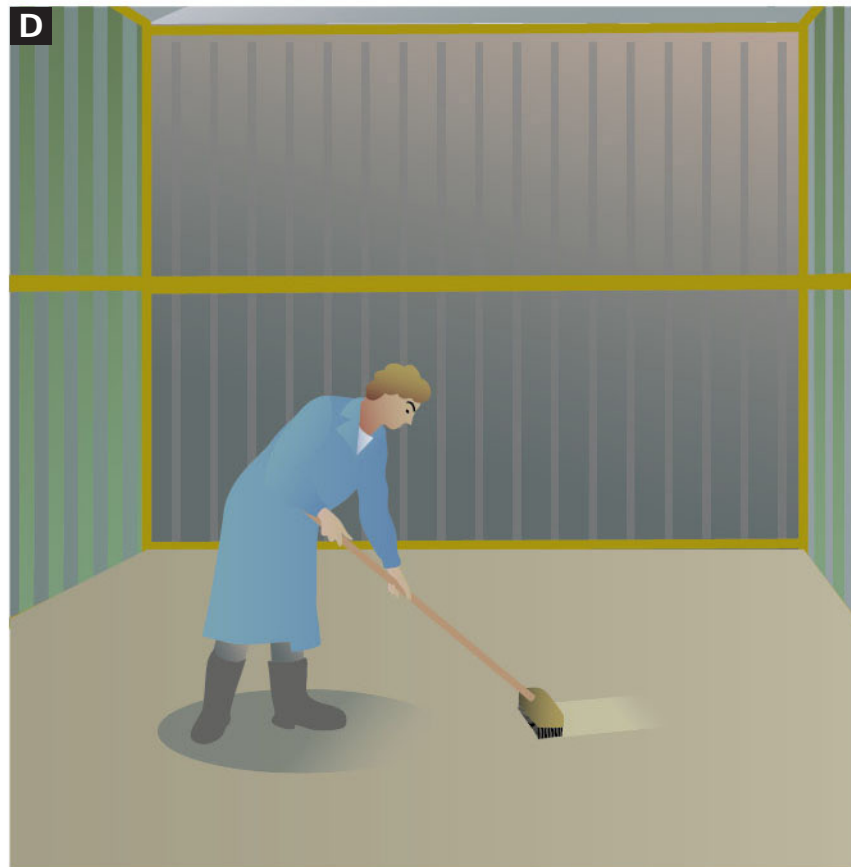
**B** Water quality should be potable water (absence of *E. coli* in 100 mL). If not possible to use potable water, type A agricultural water with *E. coli*  $\leq 100$  CFU/100 mL and with an adequate microbiological testing regime can be used (see chapter on Agricultural water, Table 2 page 56–57).

**C** After cleaning, when sanitization is practicable and recommended, apply an appropriate sanitizer (approved biocide for the food industry). If the sanitizer requires a final rinse, this will require an extra step. Let the surface air dry.

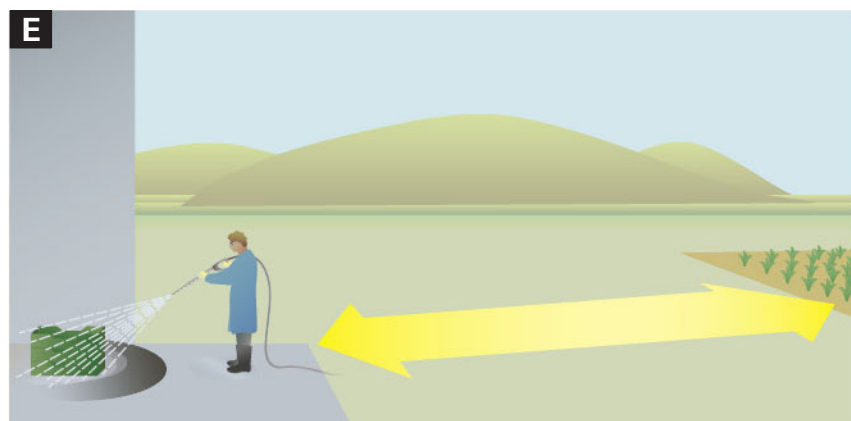


# Generic best practices for cleaning (e.g. harvesting containers, tools, drying sheets, machines, storage areas and transportation vehicles)

**D** For materials/surfaces that cannot be cleaned with water, thoroughly dry-clean with e.g. a brush or a broom. If possible, you can also use a minimum amount of water and detergent (e.g. with a wipe) and dry.



**E** All cleaning (and sanitizing) activities are conducted away from the crop to reduce the potential for contamination.

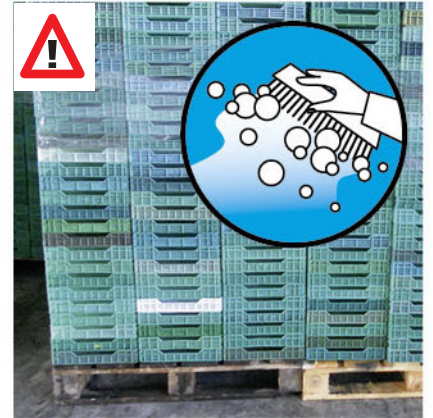


# Harvesting containers (e.g. crates, baskets, buckets...)

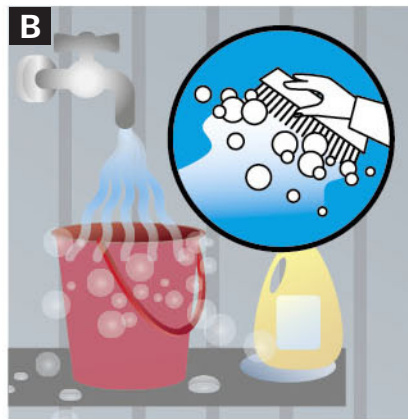
**A** Before use, keep harvesting containers in a clean and sufficiently contained area.




If they are stored outside, they have to be cleaned and sanitized before being used.

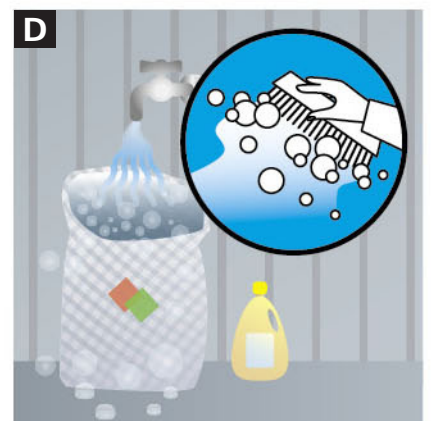


**B** Clean all harvesting containers that come in contact with the crop during the harvesting season (between 2 harvests). Harvesting container belonging to the buyers (e.g. primary processors) should be cleaned between two deliveries to the processing plant.

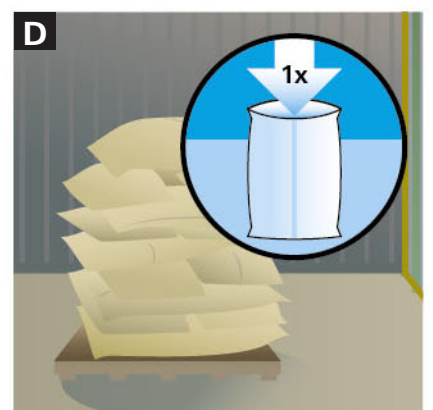


 After cleaning, sanitizer can be applied if practicable (see section C page 91).

**C** When cotton bags are used for harvesting crops (e.g. for spices), they should be washed between two harvests.



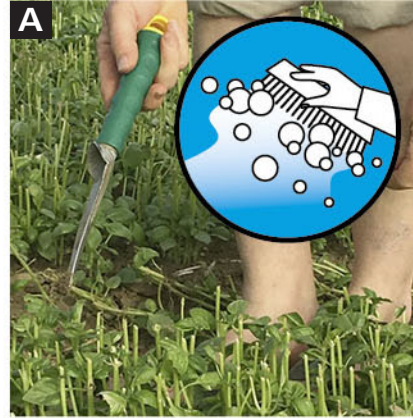
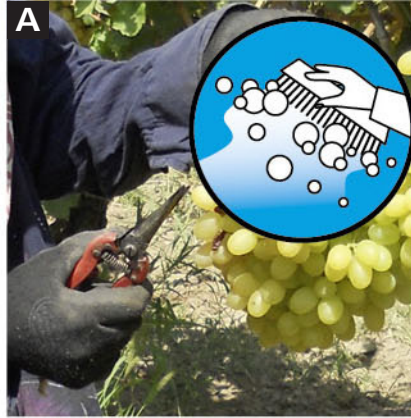
**D** Harvesting bags in synthetic materials should be cleanable (e.g. cleaned and sanitized). If they are not cleanable, they should be used only once.



# Tools

(e.g. scissors, pruners, machetes, knives, forks, rakes, winnowing baskets, sticks, brooms, dustpans...)

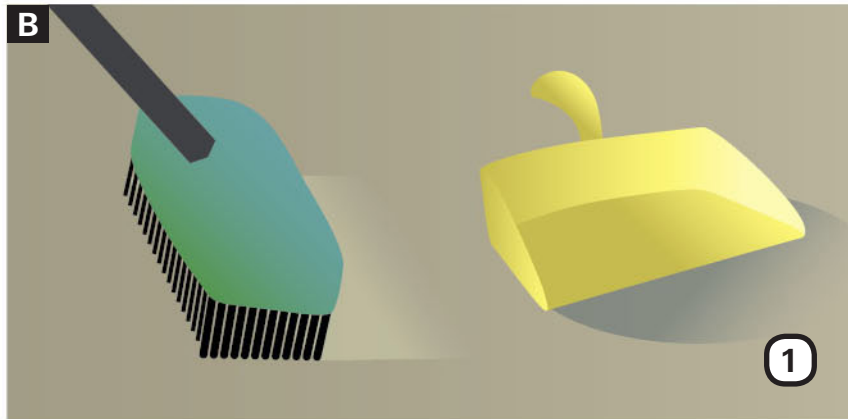
**A** Clean daily all tools that come in contact with the crop (ideally before each use) e.g. scissors, forks, rakes. These tools should be made of cleanable materials e.g. plastic or steel to follow recommendations on wet cleaning given page on 91.



Non-cleanable tools such as tools made of plant materials that come in contact with the crop should be used only once.

**B** Brooms and dustpans should:

- 1 be of a hygienic design to avoid accumulation of residues in interspaces or hollow bodies.
- 2 when used on crop contact surfaces, be wet cleanable (ideally cleaned before each use) and designed to be thoroughly dried.



Be careful to have dedicated tools for floors and for crop contact surfaces (e.g. concrete slabs, harvesting containers) to avoid cross-contamination (e.g. color-coded tools).





# Tools

(e.g. scissors, pruners, machetes, knives, forks, rakes, winnowing baskets, sticks, brooms, dustpans...)

**C** Inspect tools regularly i.e. after cleaning and before usage for sign of wear/deterioration. Damaged ones should be replaced.



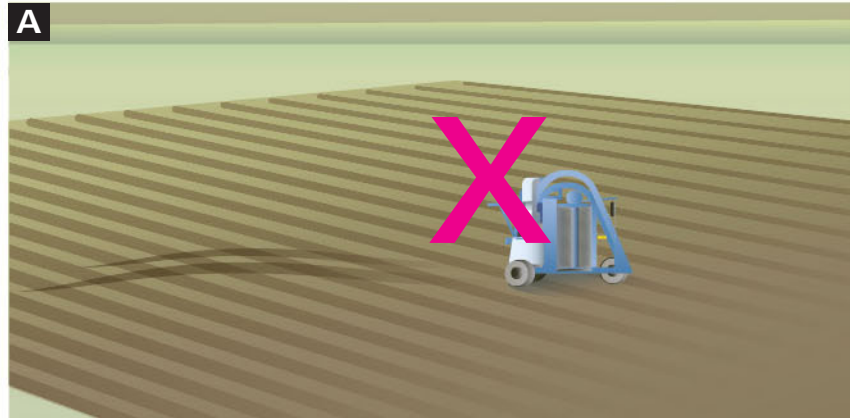
Tools should not have loose parts generating foreign bodies.



# Machines

(e.g. harvesting machines, container trucks, threshers, vehicles...).

**A** Avoid moving machines across fields where raw manure or compost was applied.



**B** Clean machines thoroughly seasonally or as needed (e.g. if the machine runs over an area with heavy animal intrusion or faecal deposits). The seasonal cleaning should be performed at the end of the season i.e. before the machine is put into storage, and before the start of the new season.



**C** Clean all machine surfaces that have been in contact with the crop, between consecutive use (e.g. harvest, threshing).



If detergent cannot be used on the machine, use pressurized water. Sanitization can be done after cleaning if practicable.



# Optional on-farm processes before drying

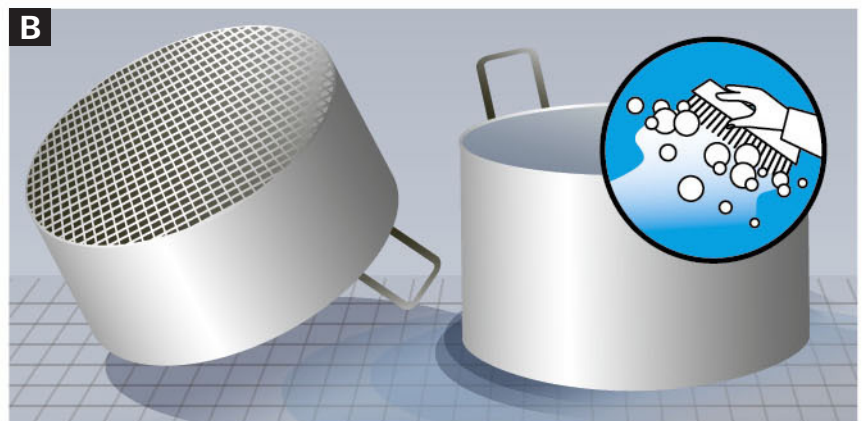
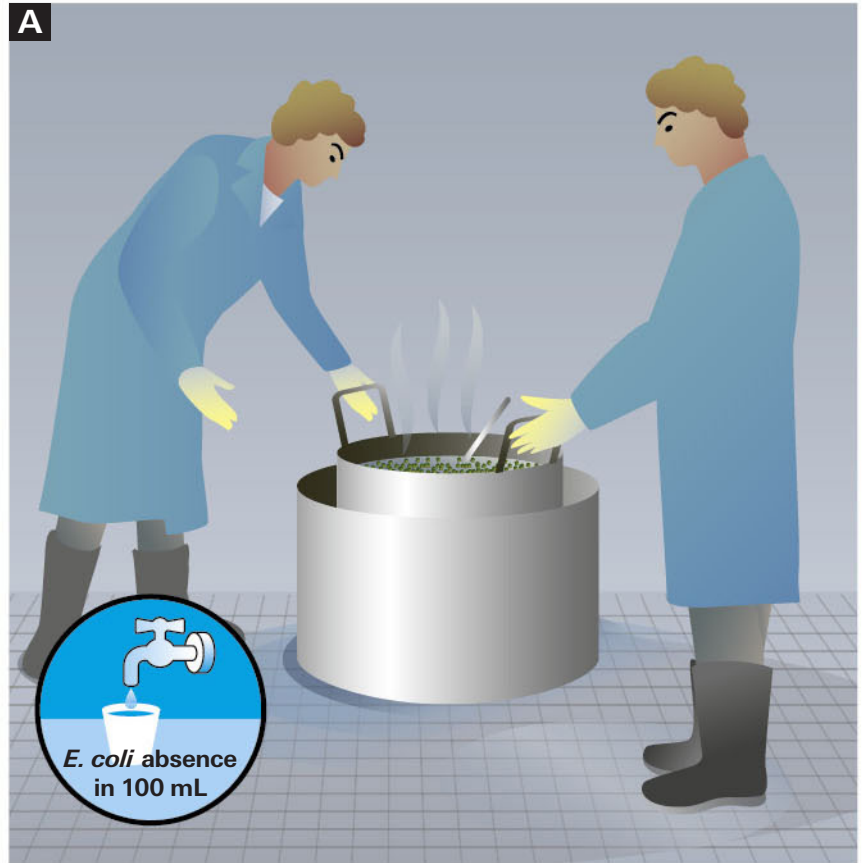


**A** Some crops (e.g. spices) may be cold washed before drying (to remove dust, foreign matter and other debris) or blanched with hot water. For both cold washing and blanching and for any wet processing, use only potable water (absence of *E. coli* in 100 mL).

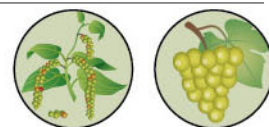


Once the product has been removed from the water, it is best practice to remove any excess water as quickly as possible so that the combination of excess water and heat does not encourage microbial growth.

**B** Basins and perforate vessels used for washing or blanching and draining excess of water should be cleaned and sanitized between consecutive uses.



# Equipment for sun-drying, sun-drying areas and practices



**A** When crops are dipped into a solution before on-farm drying (i.e. to accelerate evaporation), this solution should be prepared with potable water.

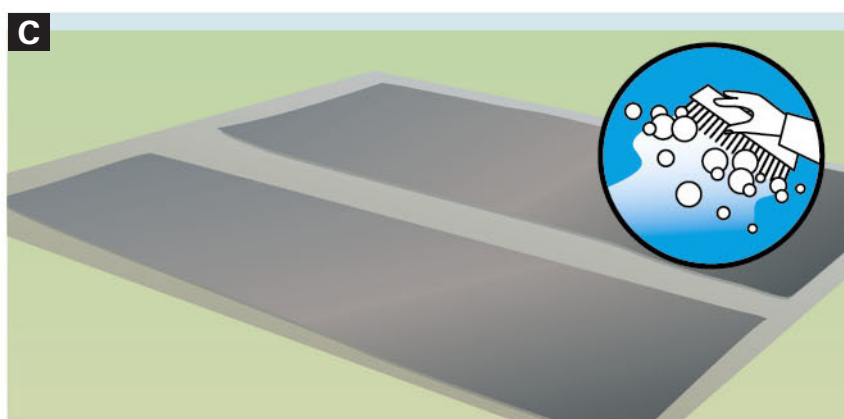


**B** Dipping baskets should be cleaned before being used (refer to page 91 for cleaning practices). Dipping tanks should be cleaned before being filled and covered when not in use.

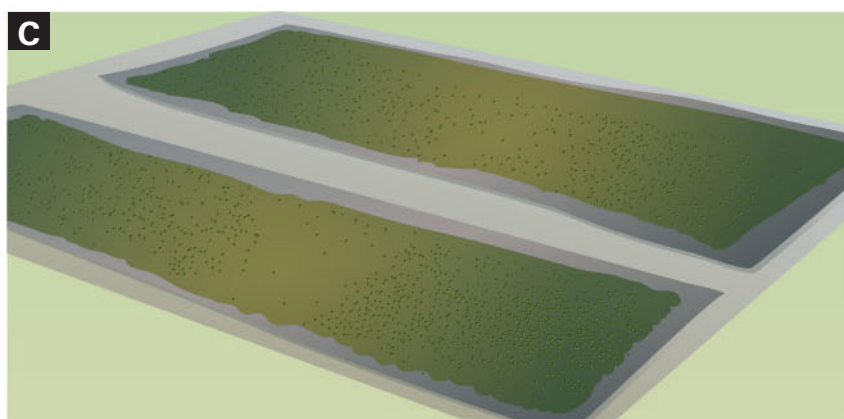


The dipping solution should be renewed according to recommendations from a competent professional. If you do not know whom to contact, discuss first with your raw material buyer.

**C** Clean sun-drying surfaces such as concrete slabs and drying sheets (e.g. Polyethylene-PE-sheets) regularly, ideally before each drying. After cleaning, sanitizer can be applied if practicable (approved biocide for the food industry). Let the surface dry completely before spreading the new batch. Non cleanable drying sheets should be used only once.



Do not dry crops on the bare ground or in direct contact with the soil.



# Equipment for sun-drying, sun-drying areas and practices



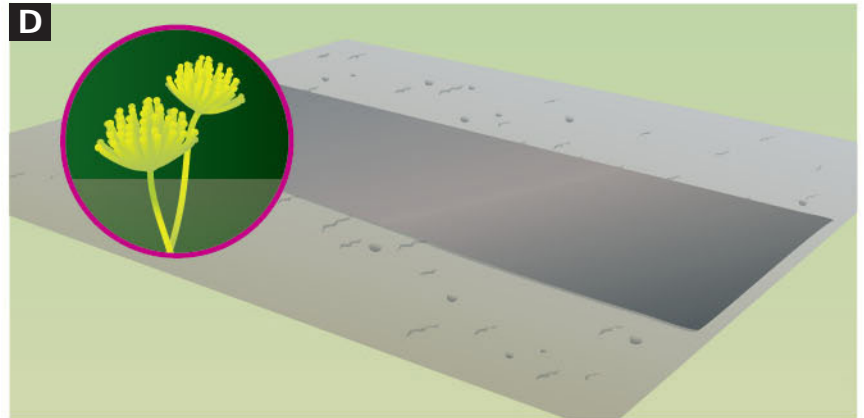
When deemed necessary (e.g. new concrete slabs, presence of cracks, crevasses or stones on the concrete, or for crops such as raisins that have to be dried on highly permeable surfaces) use a suitable drying sheet over the entire slab. The sheet should be completely flat to prevent the formation of water paddles.



New concrete slabs should be used for drying only when it is certain that the new concrete is well cured and free of excess water. They should also have a slightly sloping surface to allow water to run off.

Create footpaths in the drying areas to prevent anyone from walking on the crop.

When mold growth is an issue (e.g. spices), the crop should be dried in thin layers and raked/turned frequently to limit mold growth.



# Equipment for sun-drying, sun-drying areas and practices



**G** Drying platforms should be placed under a roof/tarp/tunnel, to avoid rewetting by rainfall or night dew, and contamination from birds.

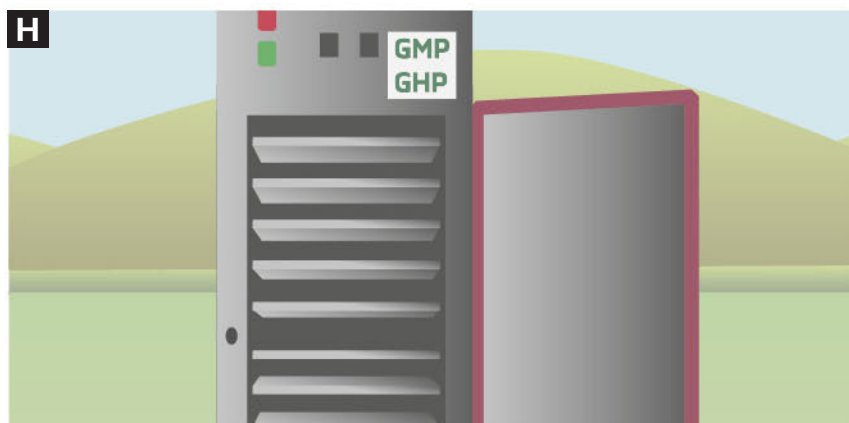
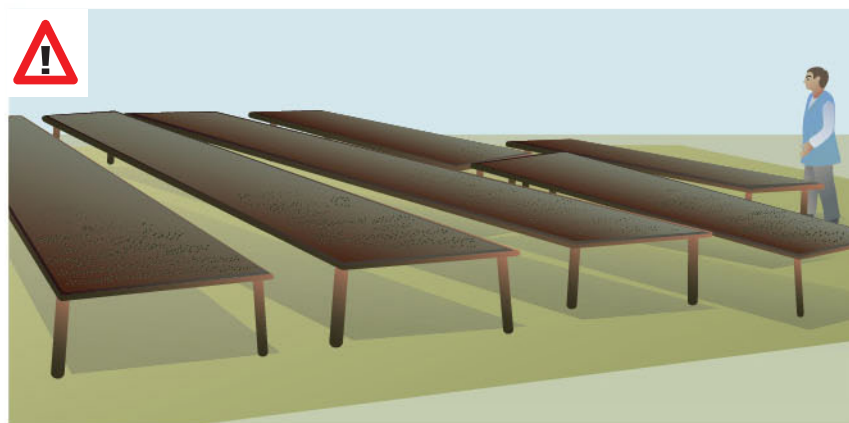
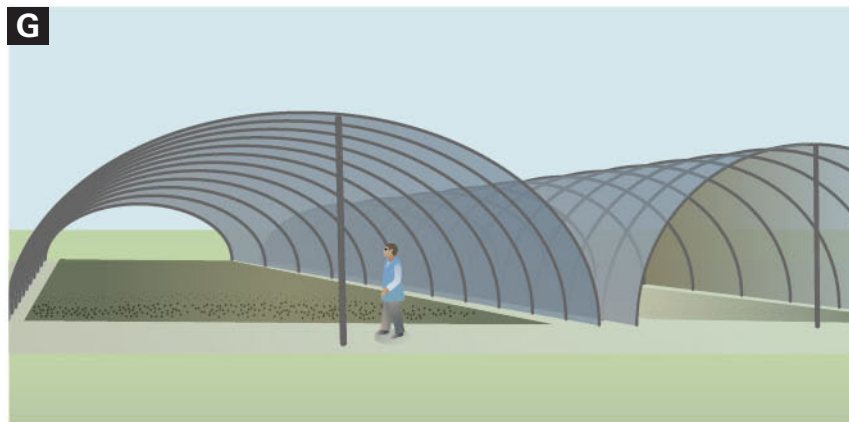


Protect drying crops from contamination and damage by domestic, farm and wild animals (including rodents, birds, reptiles etc) as described in chapter "Animals". When necessary, drying platforms should be raised from the ground to prevent pest ingress.

**H** Sun drying can be replaced by mechanical/controlled drying. Mechanical drying should follow Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP) and hygienic design principles to avoid cross contamination from equipment, environment and workers. Water, if used, should be potable (processing water).



Before initiating on-farm mechanical drying, a competent professional should be consulted to ensure the process selected is fit for purpose and properly implemented.



# On-farm storage areas

(non refrigerated short term storage in the crop production area)

Storage areas should be sufficiently contained (roof, door, walls) to protect crops and harvesting equipment from external contamination (e.g. from pest animals).

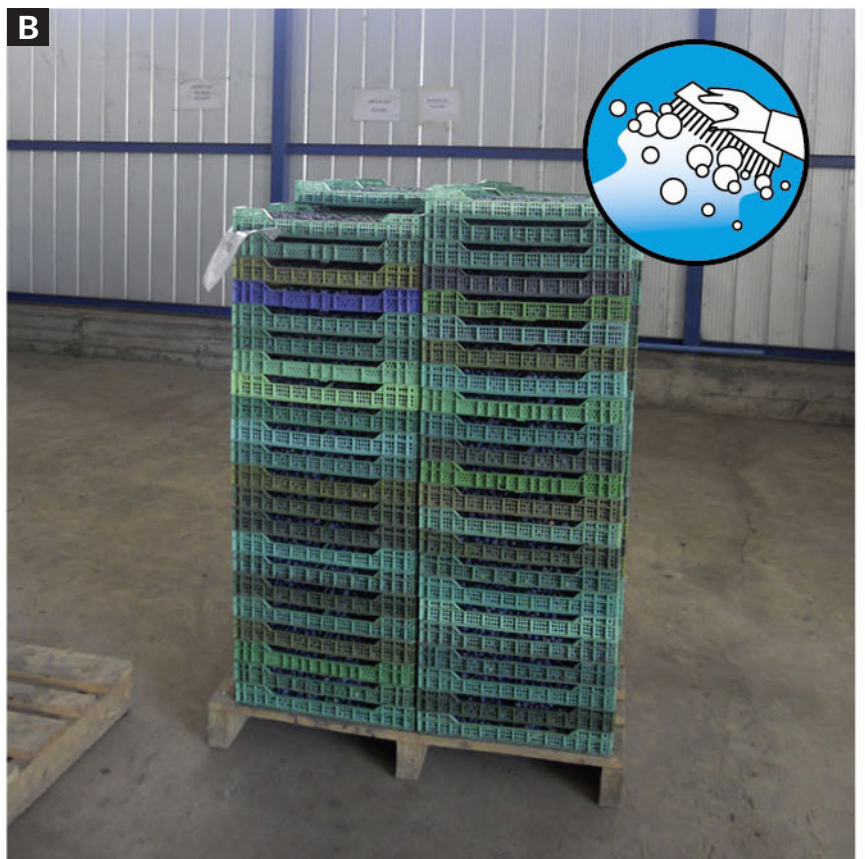


To prevent contamination from pest animals, refer to chapter on animals, section "Wild animals" on page 24.

Storage areas should be cleaned at the beginning of the harvesting season and maintained clean and in orderly manner during season (free of litter, debris, standing water and mold growth, in and around the storage area). Cleaning should not be performed in the presence of harvested crops.



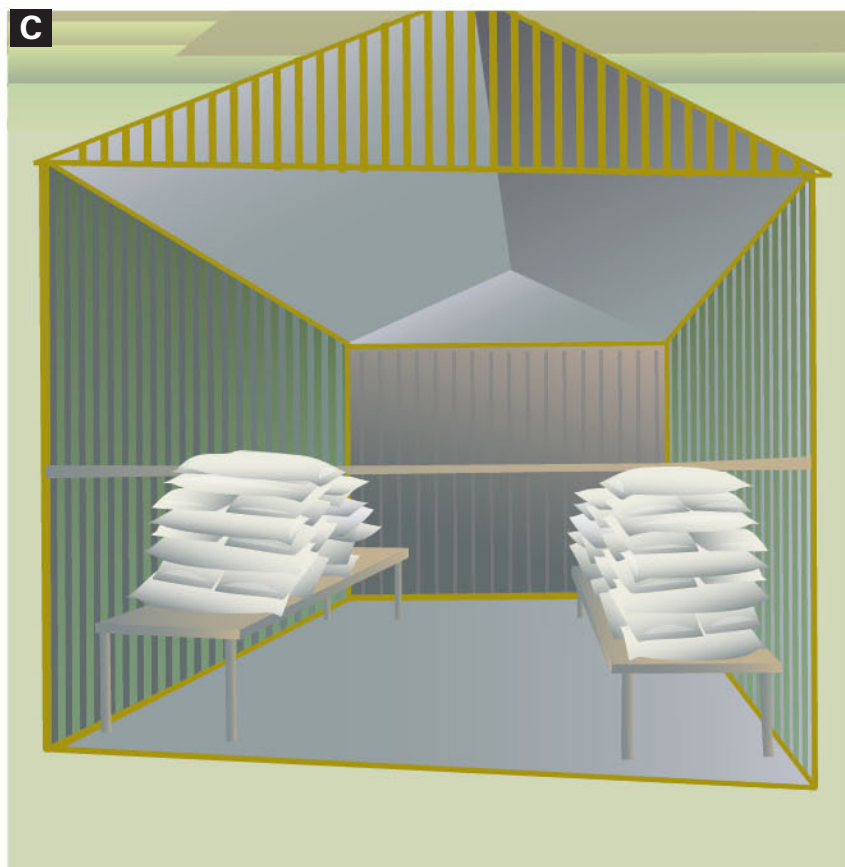
Storage areas should be designed to prevent water ingress whether through leaks in the roof or walls or under doors, through open windows etc.



# On-farm storage areas

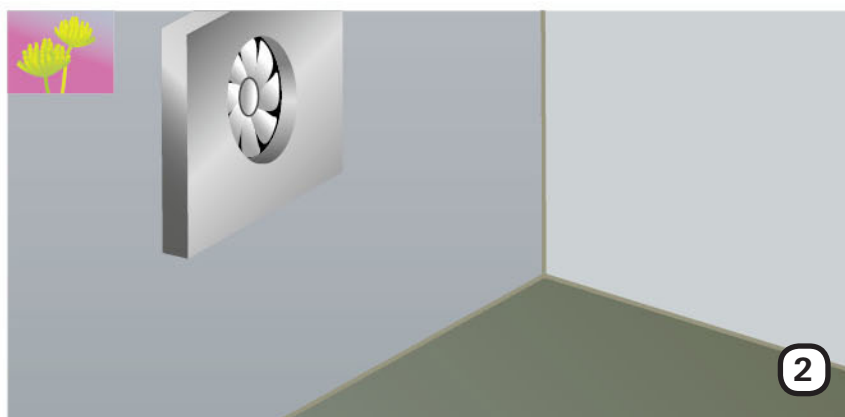
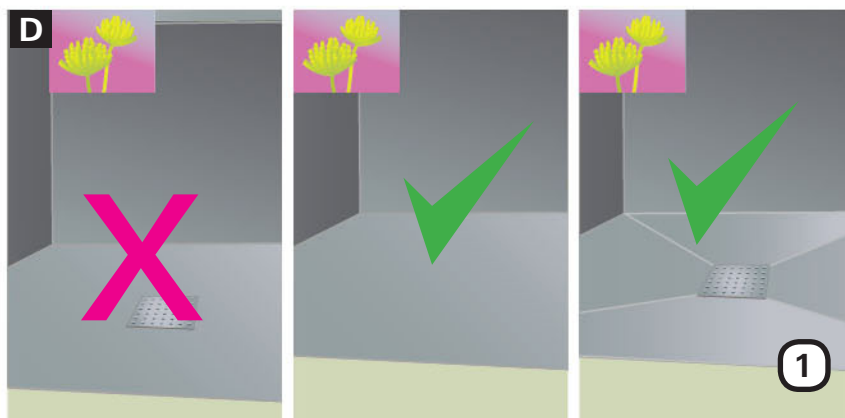
(non refrigerated short term storage in the crop production area)

**C** Harvested crops should be stored off the floor inside the crop production area.



**D** For on-farm dried crops (before or after drying), storage areas should:

1. Have no drain. If drains are present, the surrounding floor should be properly sloped for effective drainage and kept dry under normal conditions.
2. Be well ventilated to prevent mold growth.





# Storage areas

(longer term storage areas refrigerated or not)

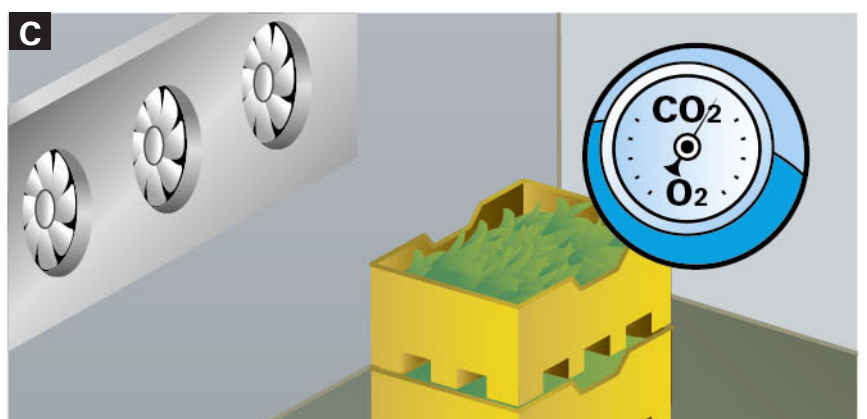
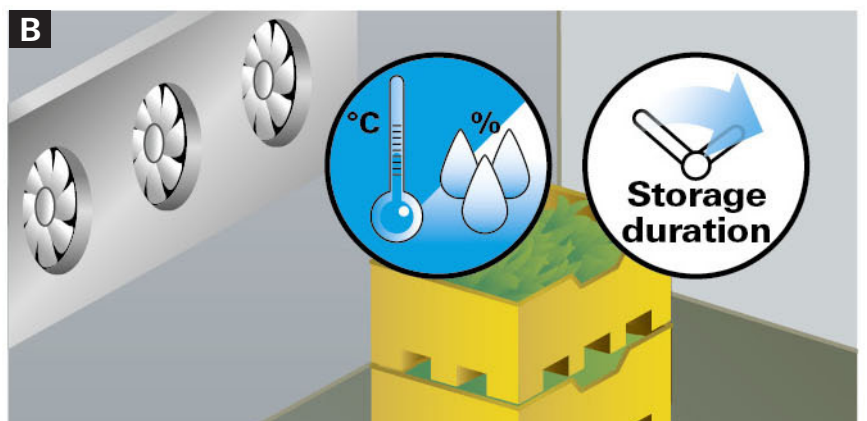
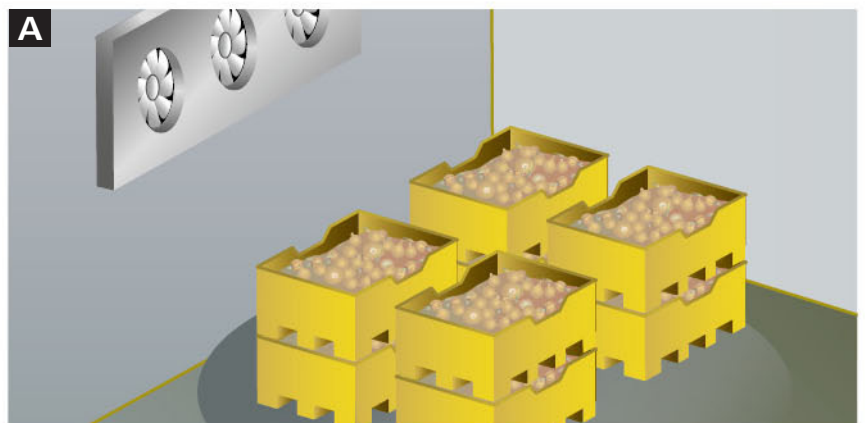
**A** Storage rooms should be dry and well ventilated with air circulating properly.

**B** The recommended storage temperatures (from ambient to refrigerated) and recommended relative humidity vary according to the crop. For a given humidity, temperature will influence the maximum storage duration.



When cold storage is required before transportation, temperature monitoring should be performed and thermometers should be calibrated on a regular basis. Produce should not be stored under dripping area.

**C** In addition to proper temperature and humidity, controlled atmosphere systems (CA) might be used to better control bacterial or mold growth. It usually involves atmospheres with reduced  $O_2$  and/or elevated  $CO_2$  levels. Specific CA combination depends on the type of crops, temperature and duration of storage.



# Storage areas

(longer term storage areas refrigerated or not)



**Never forget that low oxygen environment is extremely dangerous for humans. Do not enter a CA room that will not support a flame without breathing apparatus and without another person.**



**For bulbs, warm crops immediately after removal from CA storage to prevent moisture condensation on the bulbs (e.g. this can be performed by blowing air over bulbs as they warm under ambient conditions).**

**D** A competent professional should be consulted to advice on storage conditions and storage systems.

**E** Storage rooms should be cleaned at the beginning of the harvesting season and then as often as needed to be kept clean.



# Equipment for cooling, cooling premises and cooling practices



**A** Cooling premises and “on-farm post-harvest premises” in general should be cleaned and sanitized after each production day.



Where normal operations release or discharge water (e.g. cooling) or other liquid waste, adequate drainage should be provided.



**B** The cooling system should be cleaned and sanitized as necessary, depending on the type of system.



Water used in contact with the crop in post-harvest processes such as cooling should be potable water (absence of *E. coli* in 100 mL). Water sampling should be performed at least once before the beginning of the harvesting season, at the entry point of the cooling machine.



# Bagging and transportation from crop production area to processing plant

**A** Bags used for storage and transportation should be clean and dry.

**B** Transportation vehicles used to move product from crop production area to processing plant should be cleaned (and sanitized if practicable) at the beginning of the harvesting season and then as often as needed to be kept clean.

**C** They should be in good repair, dry, pest-free, and not be used to transport non-food products (e.g. fertilizers, pesticides...).



Do not load and unload truck if dry crops are exposed to rain. Shelter can be provided so that dry crops do not get wet during this operation.



# Bagging and transportation from crop production area to processing plant

**D** If the transportation vehicle is not fully closed, use covering such as tarpolin sheet to protect the crops during transport.



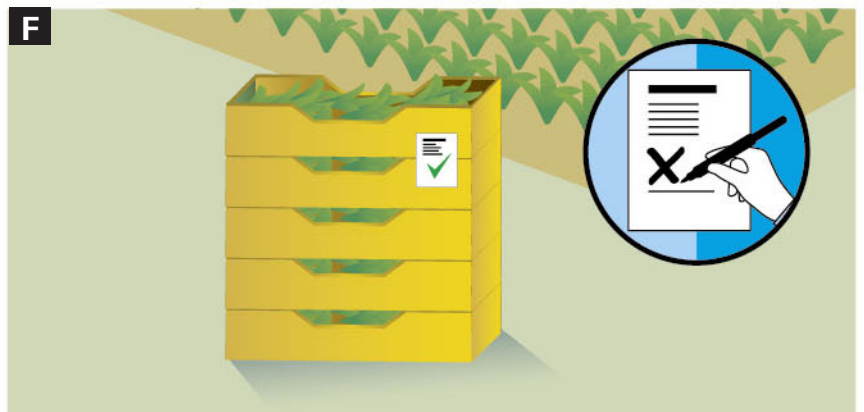
Verify that water from the road cannot get into the truck (e.g. through holes).



**E** For refrigerated transport, the temperature should be controlled and monitored.



**F** Label product moving out of the field to enable traceability.

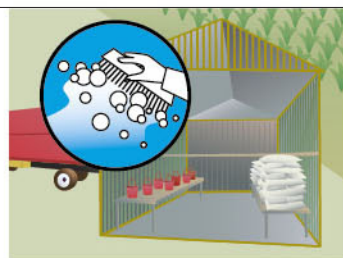


# Equipment, premises and transportation: REMEMBER!

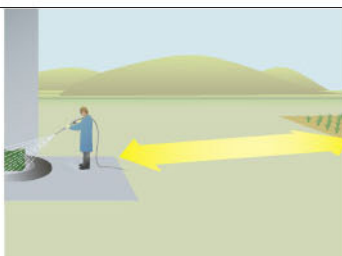
1. Perform cleaning (and sanitizing) of harvesting/ post-harvesting equipment, tools and machines in contact with the crop.



2. Perform cleaning (and sanitizing) of storage areas, post-harvest premises and transportation vehicles.



3. Conduct these cleaning (and sanitizing) activities away from the crop to reduce the potential for contamination.



4. Before use, keep harvesting containers off the floor or ground in a sufficiently contained area.



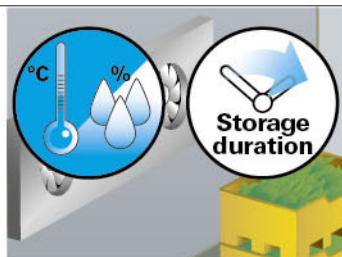
5. On-farm storage areas should be sufficiently contained to protect the crop from external contamination (e.g. from pest ingress).



6. Sun-drying areas should have footpaths to prevent anyone from walking on the crop. Sun-drying should not be performed in direct contact with the soil.



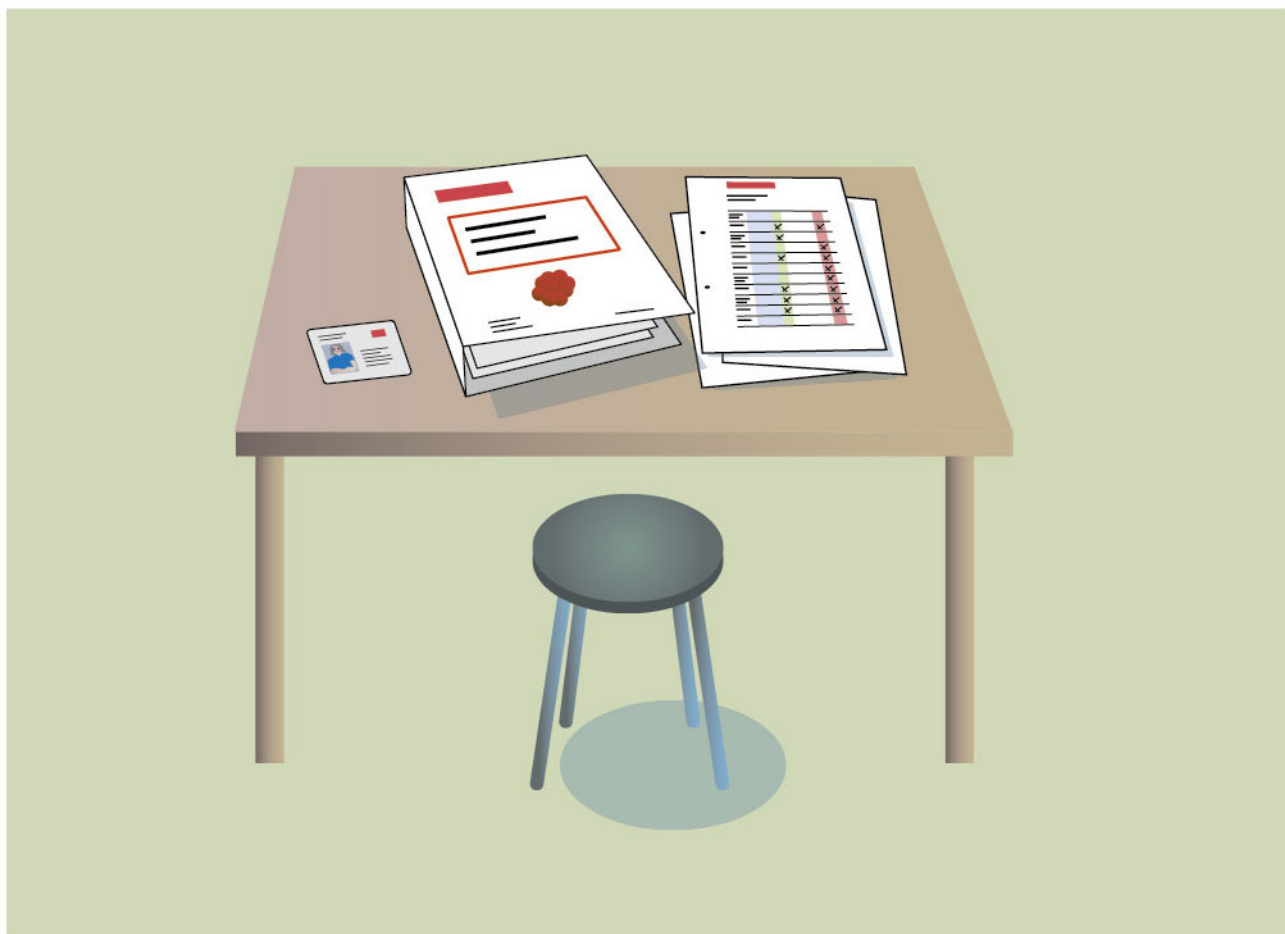
7. Storage rooms should be dry and well ventilated. Recommended temperature and relative humidity vary according to the crop and will influence storage duration.



8. Use transportation vehicles which are closed or at least with a covering such as tarpaulin. For refrigerated trucks, temperature should be controlled and monitored.



# Records and Documents



Records

111

Documents

113





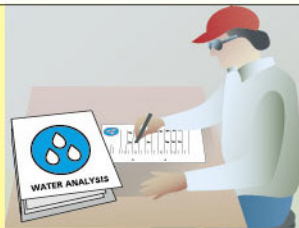
# Records

These are recommendations of important records and documents to be kept. Those of highest importance are highlighted in yellow boxes.

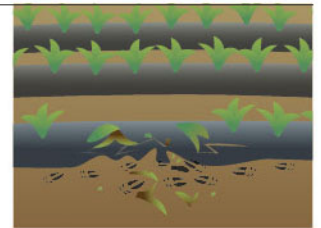


Records are important to show an action is taken (e.g. regular cleaning of toilets). Therefore, the following actions/data should be recorded and a person should be responsible to maintain the records in a timely manner. Records should include the date, person responsible and procedure/document used when applicable, e.g. for a training: record who followed the training, when, who performed the training and which document/training material was used (reference, title...).

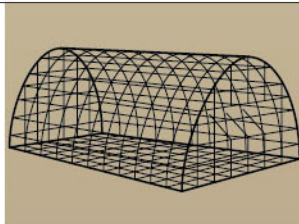
**A** Microbiological water analyses results (*E. coli* in 100 mL) from the laboratory.



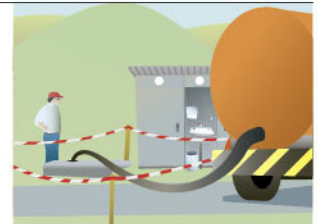
**B** Intrusion of animal in the growing field (when, which animal, where) and corrective actions taken.



**C** Pest management: if traps are used in the crop production area, records of inspections and animal found.



**D** Sewage disposal (e.g. by a sewage transport truck).



**E** Workers training on good hygiene practices: list of workers who followed the training.



**F** Workers training on cleaning and disinfection of infectious material: list of workers who followed the training.



**G** Worker illnesses (date of exclusion from crop production area and date of return).



**H** Body fluid event (when, who, where...) and corrective actions taken.

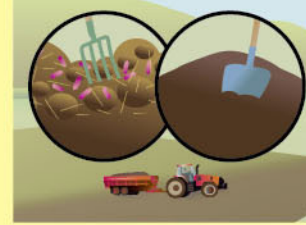


# Records

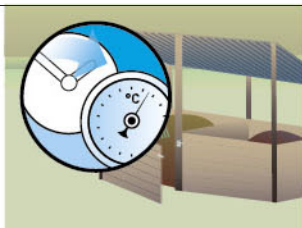
**I** Free chlorine level monitoring, if water is chlorinated at farm.



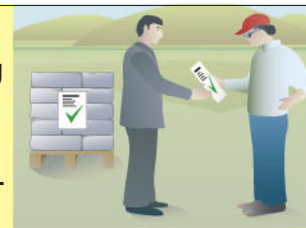
**J** Manure application.



**K** Composting process temperature, time and number of turnings (for on-farm composting).



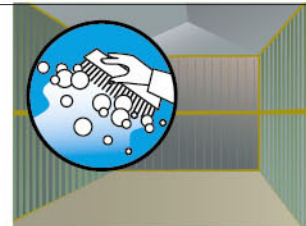
**L** Validation results of the composting process (on-farm composting) or certificate of compliance (compost from supplier).



**M** Cleaning of toilets.



**N** Cleaning (and sanitizing) of storage areas and post harvest premises.



**O** Cleaning (and sanitizing) of transportation vehicles.



**P** Cleaning (and sanitizing) of harvesting/post-harvesting equipment, tools and machines.



**Q** Labelling of product moving from the field to the processing plant (i.e. unique ID number).



**R** Monitoring of temperature in refrigerated transport trucks.

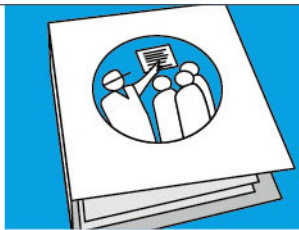


# Documents



Documents are important to show conformance to a requirement.

**A** Training material on good hygiene practices (i.e. content of the training).



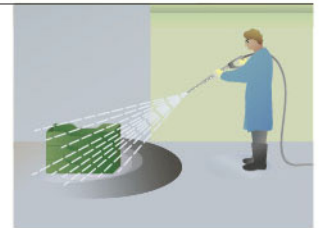
**B** Restrictions in crop production area (training material or signs).



**C** Procedure for cleaning and disinfection of infectious material (training material, poster...).



**D** Procedure for cleaning (and sanitizing) of harvesting/post-harvesting equipment, tools, machines, storage areas, post-harvest premises and transportation vehicles.



**E** Procedure for agricultural water sampling (i.e. Who, when, where, how).





# Think about foreign bodies!

This reminder is not linked to microbial contamination, but...

From crop harvesting to transportation to processing plant, the risk of foreign bodies should be minimized, e.g.:

- Damaged crates/buckets/tools should be properly repaired or disposed of.
- Sun-drying areas, storage areas and transportation vehicles should be maintained and inspected to not be a source of foreign bodies (e.g. plastic, stones, insects, wood...).

