



Minimizing the risk
of microbial contamination
in primary production
of berries

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Concept

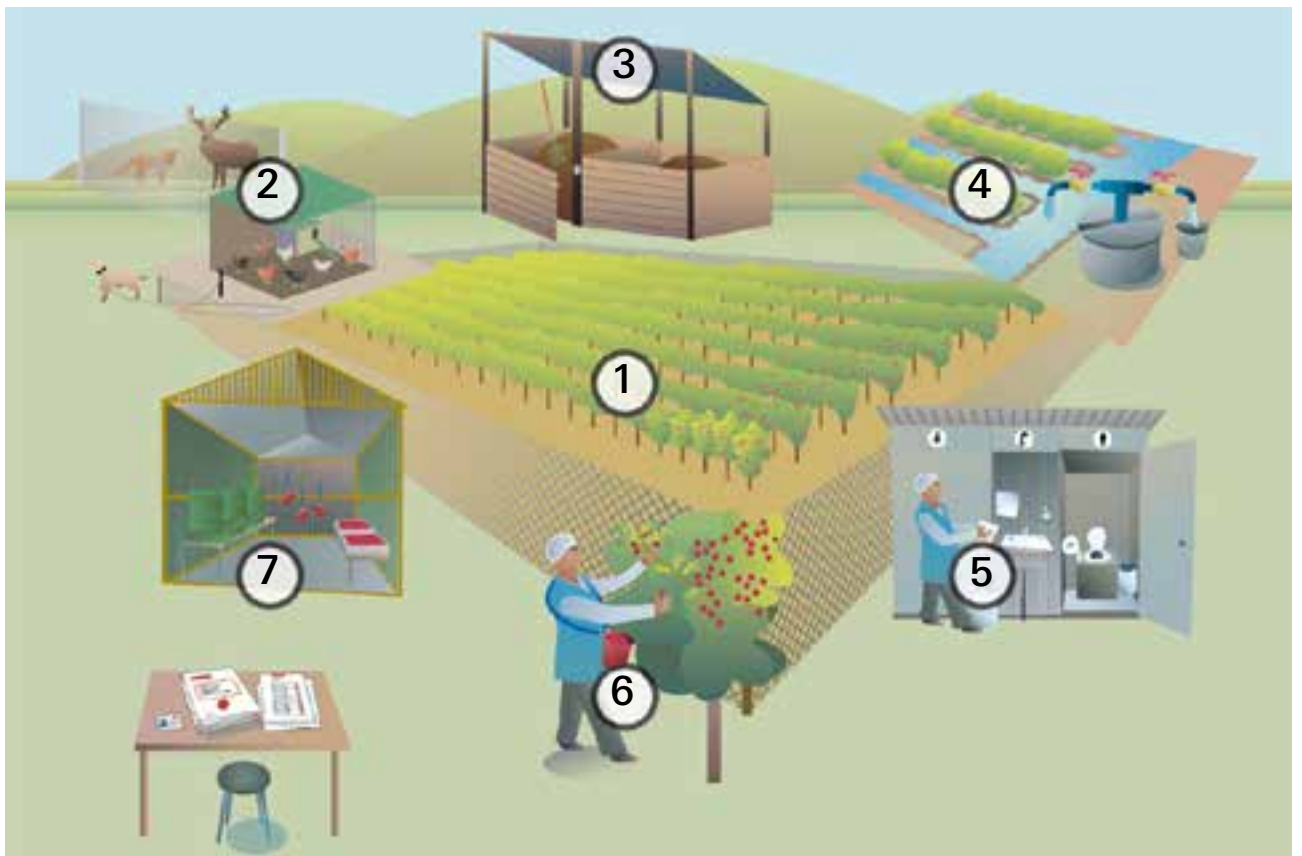
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The seven routes of microbial contamination in primary production of berries



In the recent past, fresh and frozen berries, grown in different regions of the world, were found to be contaminated with pathogenic bacteria such as *Escherichia coli* (*E.coli*) O157 or human viruses such as Hepatitis A or Norovirus. Consumers became sick from eating these berries, some even died.

Contamination can occur at different stages of the berry supply chain, particularly during primary production and harvesting. Therefore, it is very important to minimize the risk of microbial contamination at farm level.

Where does the contamination at farm level come from? Contamination can have several origins, these are the so-called "routes of microbial contamination". Seven routes have been identified, which are represented in the above illustration:

1. Growing field and adjacent land;
2. Animals;
3. Manure-based soil amendments;
4. Agricultural water;
5. Hygiene and human health;
6. Worker harvesting practices;
7. Harvesting equipment, storage areas and transportation.

(Continuation page 2)

Some of your activities are also important to record and/or should be supported by documents.












This training booklet comprises seven chapters, one per route of microbial contamination. Each chapter indicates good agricultural practices to follow during farm activities in order to minimize the risk of microbial contamination posed by this particular route. By following these practices, you will improve the safety of the berries you are growing and the safety of the people who are consuming them, as well as the health of your workers.

This document refers to the Nestlé Supplier Code and the Responsible Sourcing Guidelines. It is meant to go beyond compliance, supporting farmers and suppliers (berries purchasers) in continuous improvement and development.

The primary target audience is:




- Farmers**
- Farm workers (e.g. hand pickers, supervisory personnel in the field...)**
- Berries purchasers**

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Symbols

The following symbols will be used to guide the reader through the document

			
Detergent	Worker	Pathogenic Bacteria	Hand washing
			
Disinfectant/ sanitizer	Farmer	Pathogenic Viruses	Pesticides dilution
			
Hand soap	Competent super- visory personnel	Raw manure	Cleaning
			
Hand disinfectant	Competent professional	Treated manure	Training
			
Do/Don't do	Berries purchaser		

Symbols

The following symbols will be used to guide the reader through the document



Potable water



Harvested rain water



Irrigation



Non potable water



Municipal water



Drip irrigation



Surface water



Secondary treated sewage water



Furrow irrigation



Ground water



Disinfected water



Overhead irrigation



Flood irrigation

Definitions

Crop production area:

A plot of land where all growing and harvesting activities of berries are performed, including the growing field, storage areas, toilet and hand washing facilities.

Growing field:

A plot of land used to grow berries.

Storage area:

A facility/contained area inside the crop production area, used to store harvesting containers before use and/or harvested berries before their transportation to the processing plant (no more than 12 hours of storage for berries).

Agricultural water:

Water used for agricultural activities in the crop production area, such as: irrigation, pesticide dilution, cleaning of equipment and hand washing.

Potable water:

Water that meets the microbial standard for drinking water from World Health Organization (*E. coli* must not be detectable in any 100 mL sample).

Non potable water:

Water that does not meet the microbial standard for drinking water from World Health Organization.

Municipal water:

Potable water provided by the municipality.

Primary treated sewage water:

Sewage water treated with a primary treatment. A primary treatment aims to reduce any settleable solid within the sewage water via mechanical treatment (filtration and sedimentation).

Secondary treated sewage water:

Sewage water treated with primary and secondary treatment. Secondary treatment aims to decompose remaining suspended solids from the primary treated sewage water and to greatly reduce the microbial load via biological treatment (e.g. stabilization ponds).

Disinfected water:

Water treated (e.g. chlorination) to remove pathogenic microorganisms such as *Salmonella* and viruses. Secondary treated sewage water can be disinfected to remove remaining pathogenic microorganisms that were not removed by previous treatments.

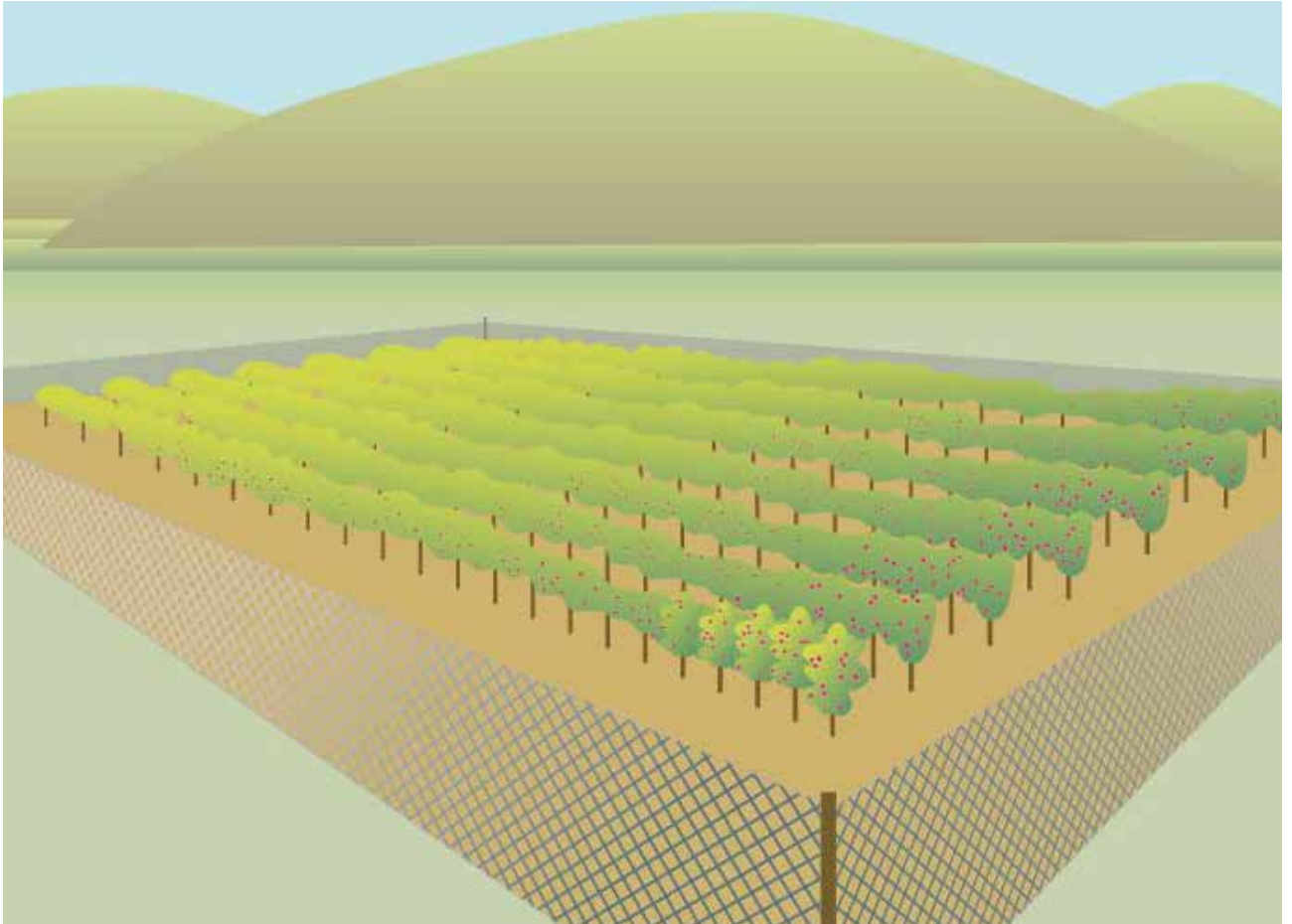
Turned pile/windrow composting:

Process to produce stabilized compost in which air is introduced into a manure pile or windrow by turning on a regular basis. Turning is performed with the specific intention of moving the outer, cooler sections of the manure being composted to the inner, hotter sections.

Static aerated composting:

Process to produce stabilized compost in which air is introduced into manure by a mechanism that does not include turning.

1. Growing field and adjacent land



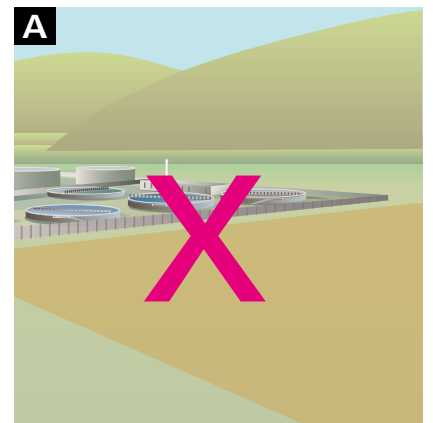
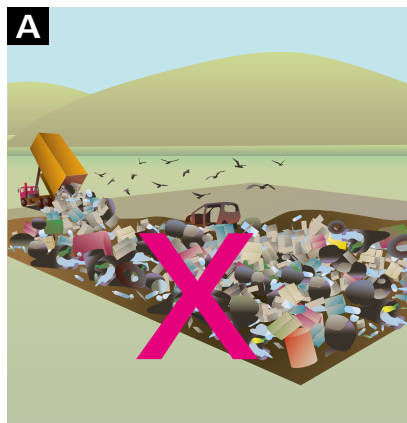
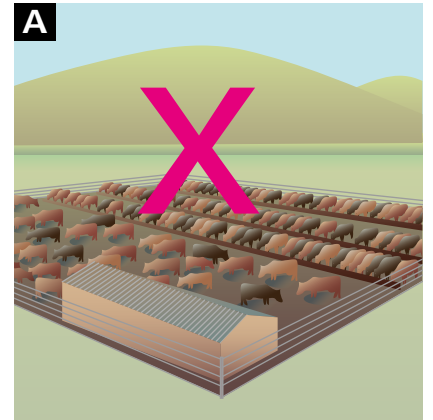
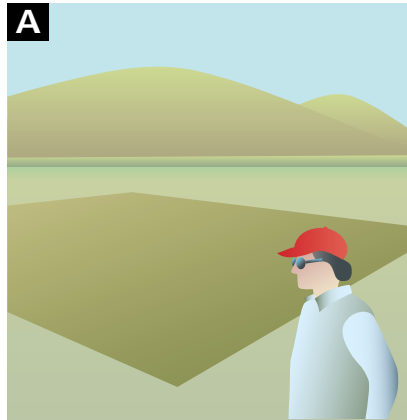
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Previous land use (land and adjacent land): Pathogens in the soil

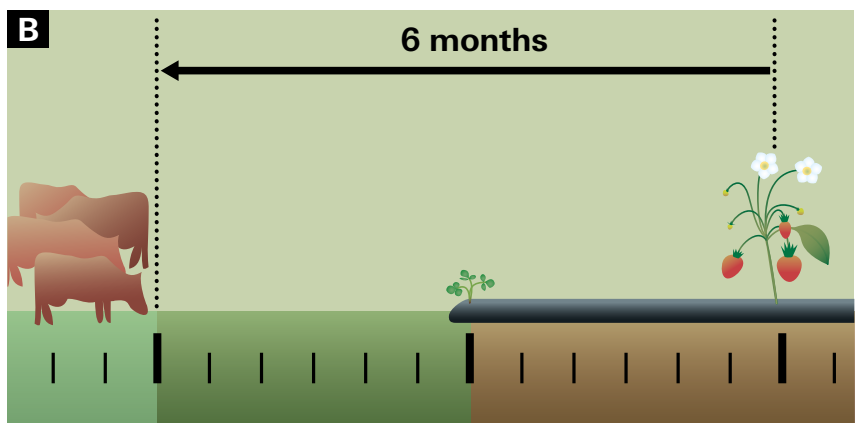
A Previous land use (land and adjacent land) should minimize the risk of microbial contamination of the soil: avoid use of land that may have been contaminated by microbial hazards, especially fecal contamination and contamination by organic waste (e.g. animal production site, municipal waste/sewage disposal or treatment sites...).



Select fields carefully to reduce the risk of microbial contamination.



B If livestock has been grazing in the field, ensure a time lapse between livestock grazing in the field and harvest of minimum six months.

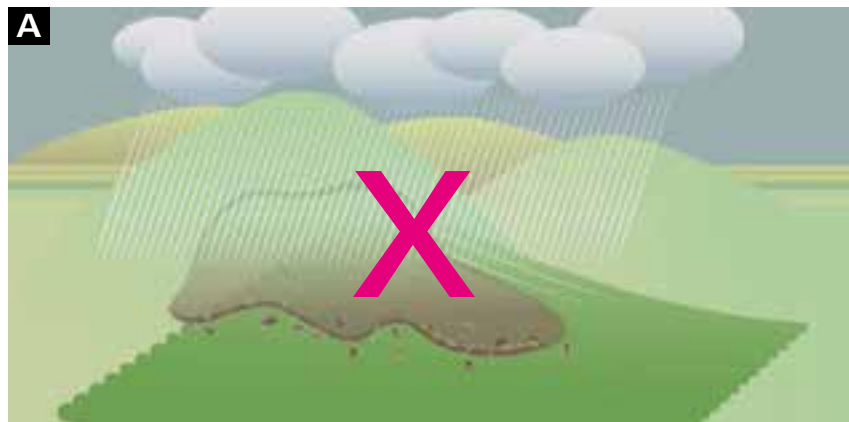


C Irrespective of previous land use, protect the crop from the soil whenever possible (e.g. plastic coverage or straw on soil for strawberries).



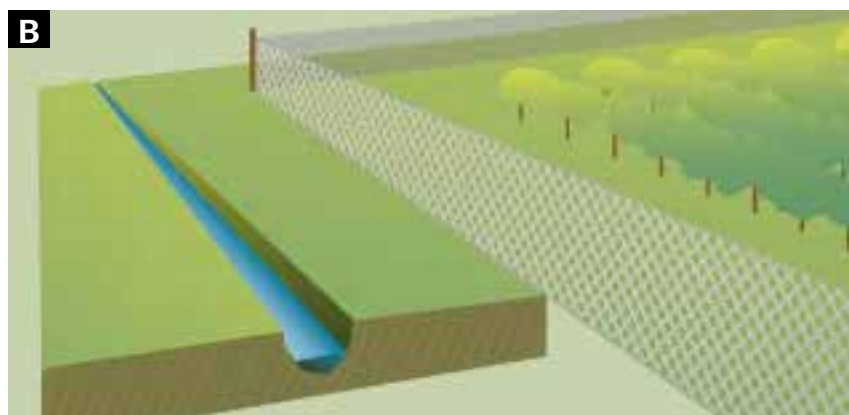
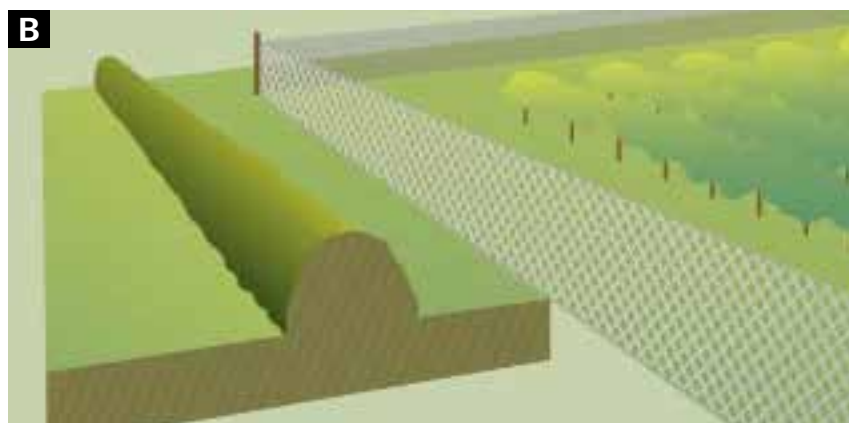
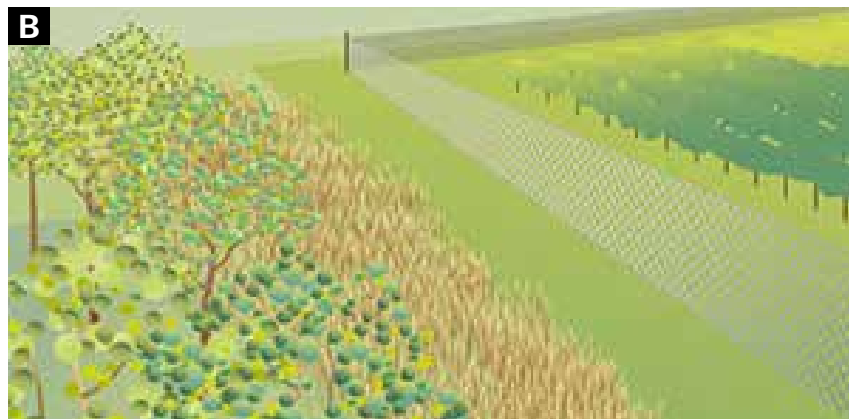
Water and/or soil run-off

A Avoid using land which may be subject to water and/or soil run-off from higher land/or neighbouring land.



B If water and/or soil run-off can occur, implement physical barriers between higher/neighbouring land and the crop production area such as:

- vegetative buffer areas e.g. grass land, trees or another crop production which is not sensitive to microbial contamination;
- mounds;
- ditches.



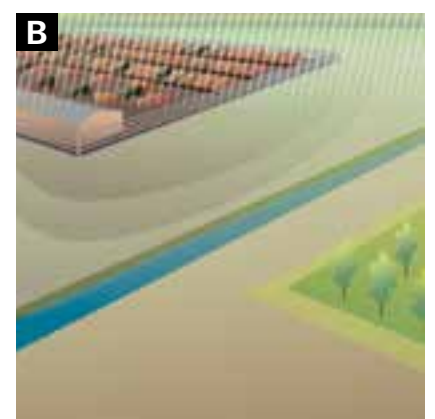
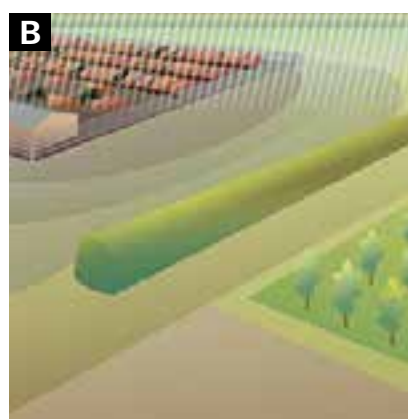
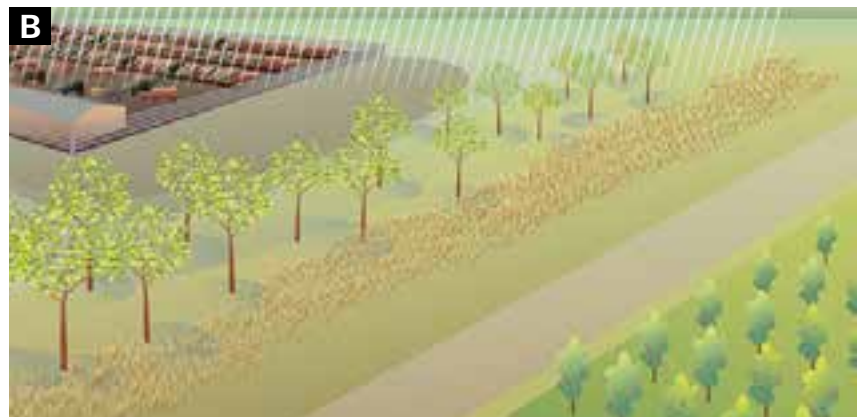
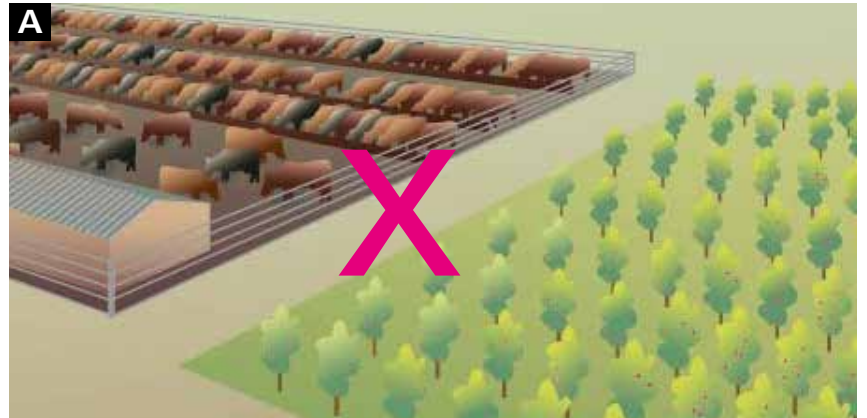
Adjacent land use: Livestock production facilities (cattle, poultry, pigs...)

A Avoid the use of land adjacent to animal production facilities.



It is reasonable to assume that increasing distance will help to reduce the risk, although distance by itself is not a guarantee of no risk.

B If there is a risk of animal waste contamination from land in the vicinity of the crop area (e.g. during heavy rains), implement physical barriers between adjacent land and the crop production area such as described in section B of "Water and/or soil run-off", page 10.

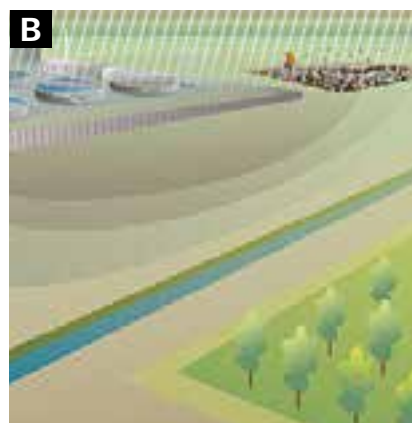
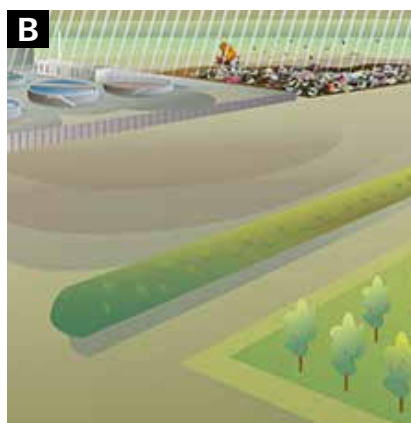
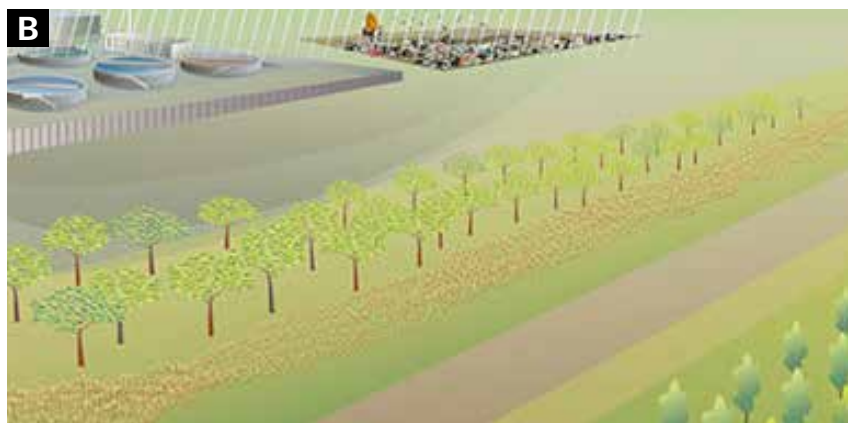


Adjacent land use: Industrial and urban activities

A Avoid the use of land adjacent to industrial and/or urban activities such as sewage treatment or municipal waste collection.



B If there is a risk of industrial and/or urban waste contamination from land in the vicinity of the crop area (e.g. according to the slope of adjacent land), implement physical barriers between adjacent land and the crop production areas such as described in section B of "Water and/or soil run-off", page 10.



Growing field and adjacent land: REMEMBER!

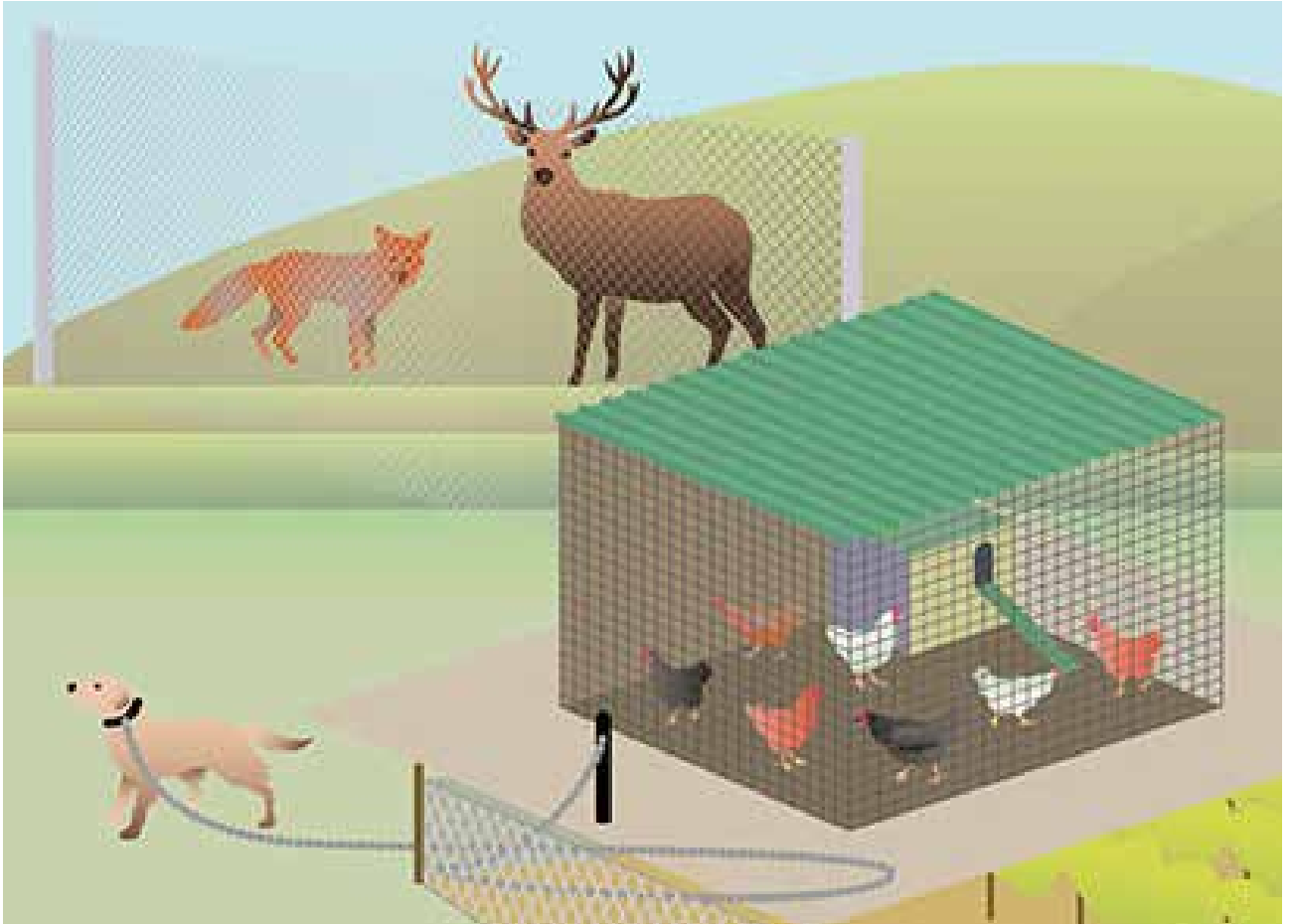
1. Select fields carefully to reduce the risk of microbial contamination.



2. If there is a risk of contamination from land in the vicinity of the crop production area (e.g. during heavy rains), implement physical (vegetative) barriers.



2. Animals (domestic, farm and wild animals)



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Farm animals (cattle, poultry, pigs...)	18
Wild animals (deer, wild pigs, birds, rabbits, reptiles, rodents...)	20

Domestic animals (dogs, cats...)

A Limit access of domestic animals to growing fields and storage areas during the growing season and during harvesting: their movements on the farm should be controlled and their fecal waste discarded outside the crop production area (e.g. buried).

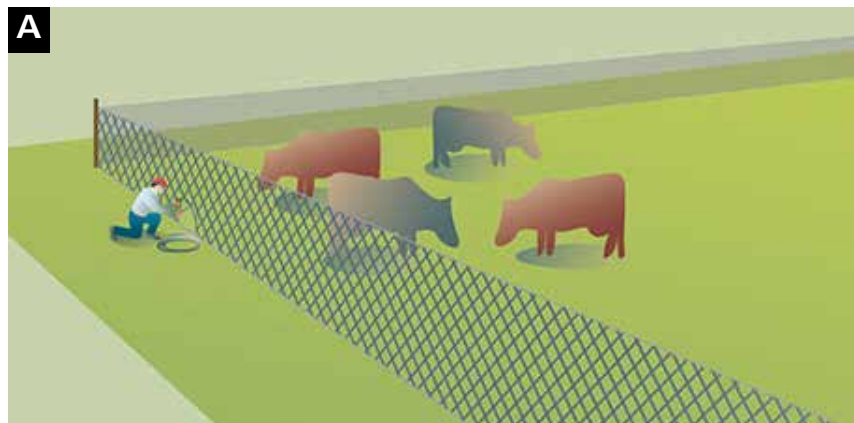
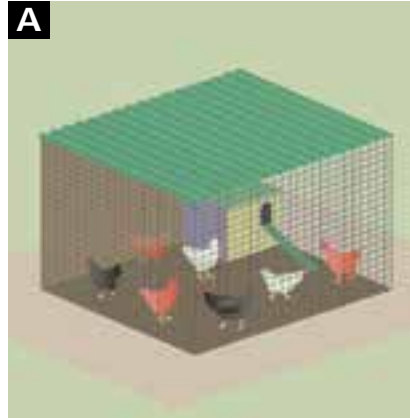


B Inform all workers that they are not allowed to bring animals onto the crop production area. Consider the use of signs to inform workers (e.g. as part of the general restrictions in the crop production area).

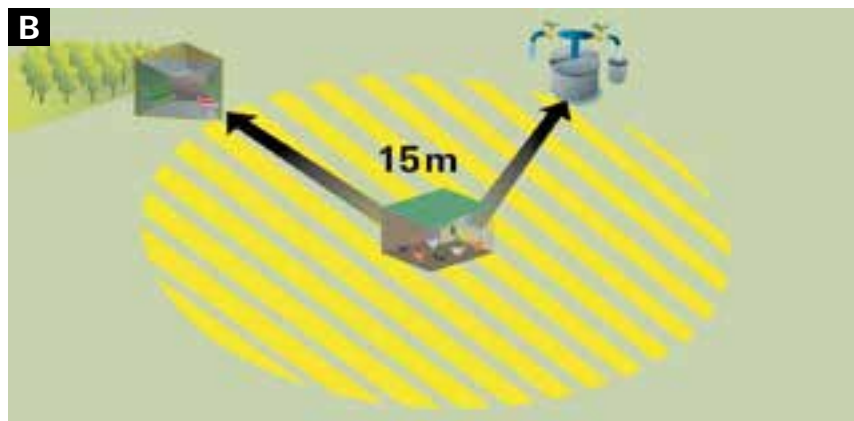


Farm animals (cattle, poultry, pigs...)

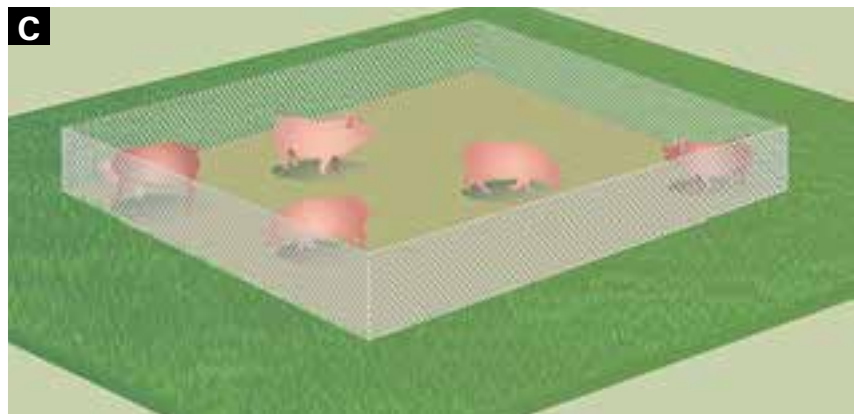
A Keep farm animals confined or prevent their entry in the crop production area using physical barriers (fences). Inspect the good condition of the fences and restore if necessary.



B Locate animals at least 15 meters (and if possible downhill) from agricultural water sources (e.g. ponds, wells), growing fields and storage areas.



C Consider the implementation of vegetated buffer strips (e.g. grass strips) around animal areas, to reduce contamination from runoff.



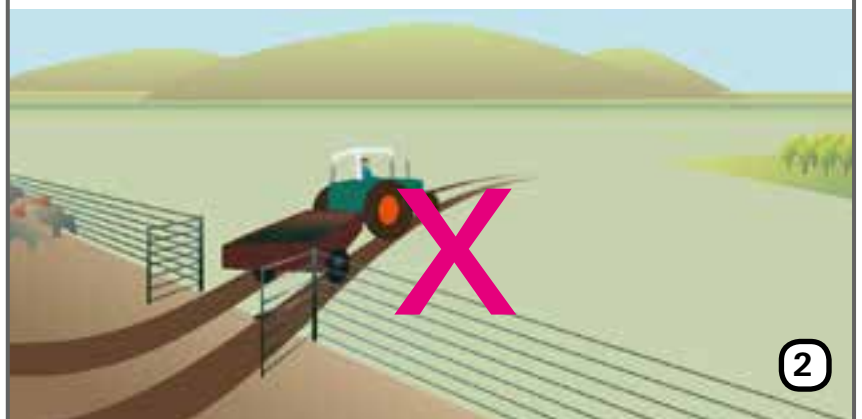
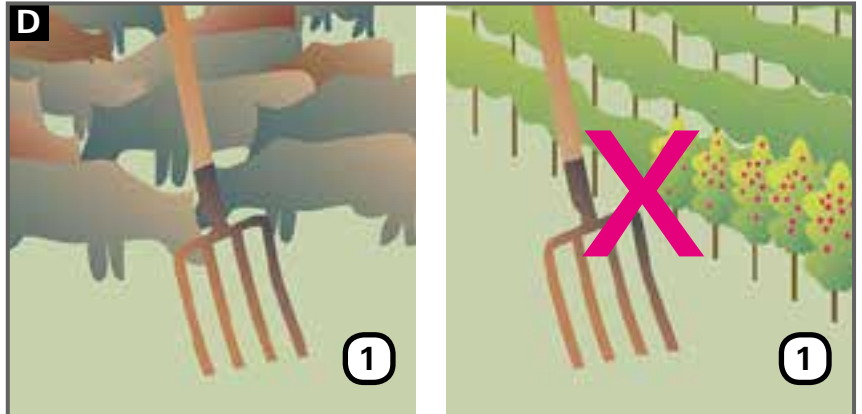
Farm animals (cattle, poultry, pigs...)

D Avoid cross contamination from farm animal activities to the crop production area by:

1. Not using utensils and tools from farm animal activities for activities related to crop production, unless they have been cleaned and sanitized. If possible, use dedicated tools for farm animal activities and for crop production;
2. Restricting vehicles associated with farm animal activities from entry to the crop production area;
3. Washing hands and changing boots (and changing clothes if necessary) while moving between animal and crop production area.



If farm animal activities cannot be conducted in ways which prevent animal fecal contamination of the produce (e.g. through run-off, aerosols...), these farm animal activities and berry productions should not be performed at the same farm!



Wild animals (deer, wild pigs, birds, rabbits, reptiles, rodents...)

Farmers should be careful to not endanger protected species or remove their habitat.

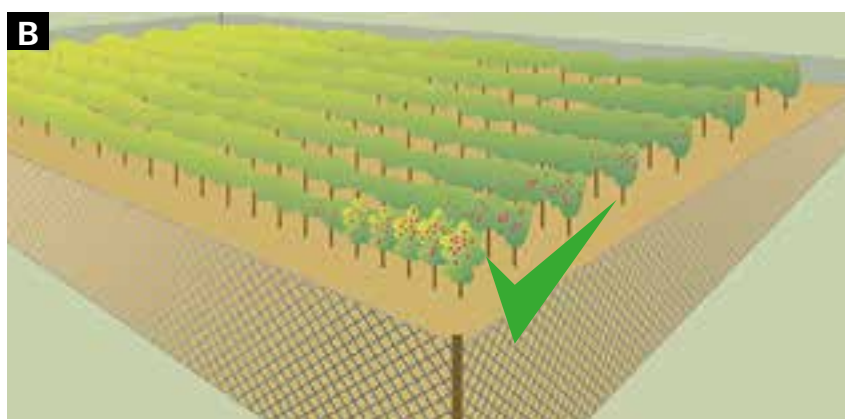
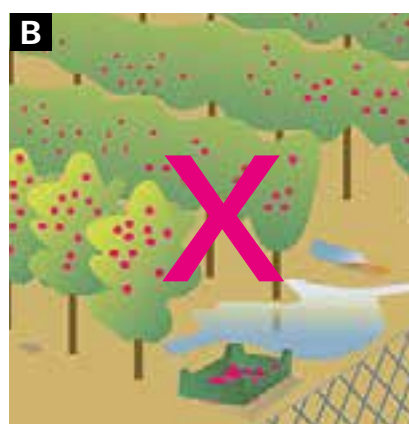
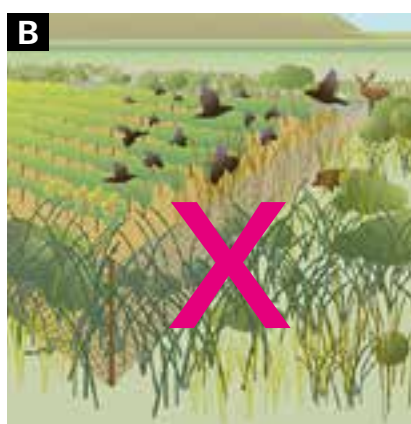
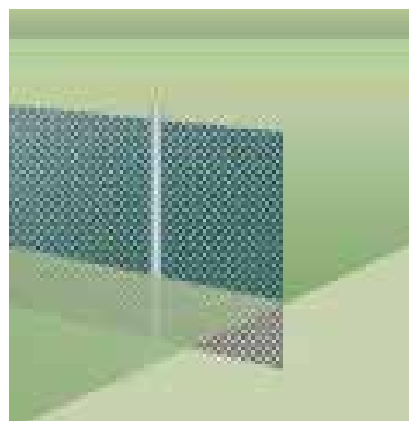
A Prevent the entry of wild animals onto the crop production area using fences (unless it has been demonstrated that there is no risk associated with wild life). Inspect the good condition of the fences and restore if necessary.



Fences are only effective for larger animals such as deer or wild pigs, but are not completely effective for birds or small terrestrial animals such as rodents and reptiles. Furthermore, it is best to build the fence into the ground to make it more effective against animals that can burrow into the ground (underneath the fence) such as rabbits.

B Minimize habitat, nesting, hiding places and feeding of birds and small terrestrial animals (e.g. rodents, reptiles) in and around the field:

- avoid bushes, cut the grass;
- remove waste and avoid stagnant water.



Wild animals (deer, wild pigs, birds, rabbits, reptiles, rodents...)

Farmers should be careful to not endanger protected species or remove their habitat.

C Deter birds from the crop field: Make use of visual repellants such as shiny ribbons, reflective strips, scarecrows, or acoustic repellants emitting unfamiliar loud noise, predator bird calls or bird distress calls. Ultrasonic devices are commonly ineffective for many types of birds.



Combined sight and sound repellants which are varied regularly are most successful, since birds can easily overcome repellants.

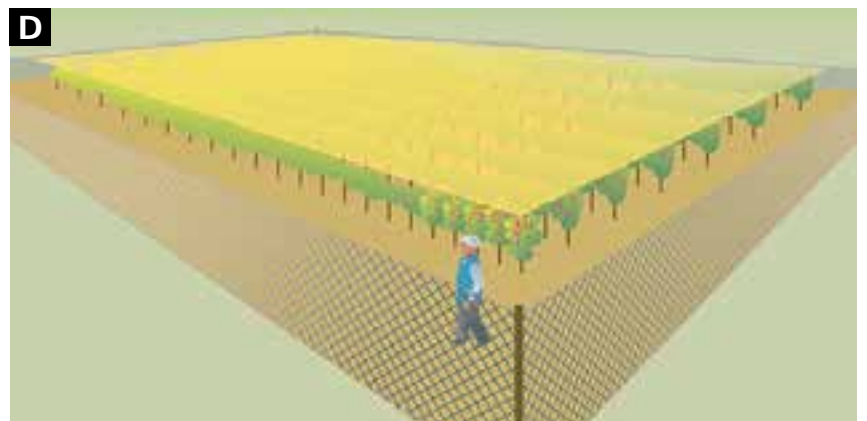
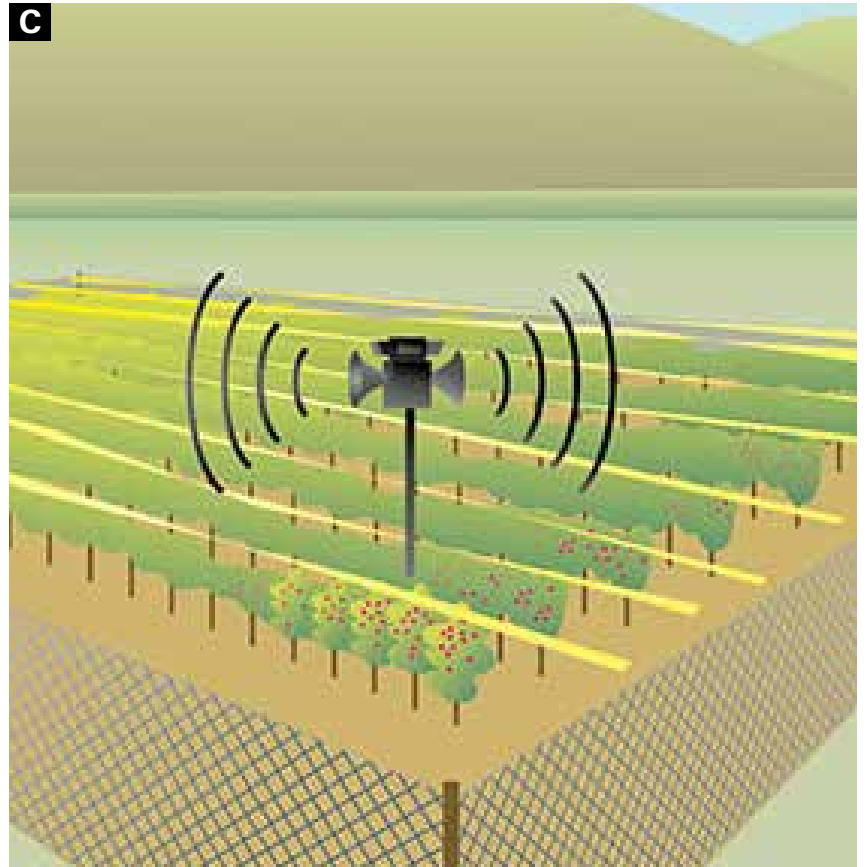


Do not use bird chemical repellants in the crop production area.

D If necessary, consider the use of nets to protect crop areas from bird invasion.



Use the right mesh size according to the bird species of concern. An inappropriate size could lead to ineffectiveness or bird injury such as wing damage.



Wild animals (deer, wild pigs, birds, rabbits, reptiles, rodents...)

Farmers should be careful to not endanger protected species or remove their habitat.

E Do not use rodenticides in the growing field, mainly because of the risk of secondary poisoning of other animals.



To prevent contamination from rodents, the focus should be on “restriction measures” minimizing hiding places and feeding, such as described in B.

F If restriction measures are not effective enough to control rodents in the growing field, traps may be used. These traps must be legal in the country of use and live traps (i.e. no killing) should be favored as far as possible.



A competent professional should be consulted to ensure the legality and design of the trap, so that the correct species is targeted. If you do not know whom to contact, discuss first with your berries purchaser.



Wild animals (deer, wild pigs, birds, rabbits, reptiles, rodents...)

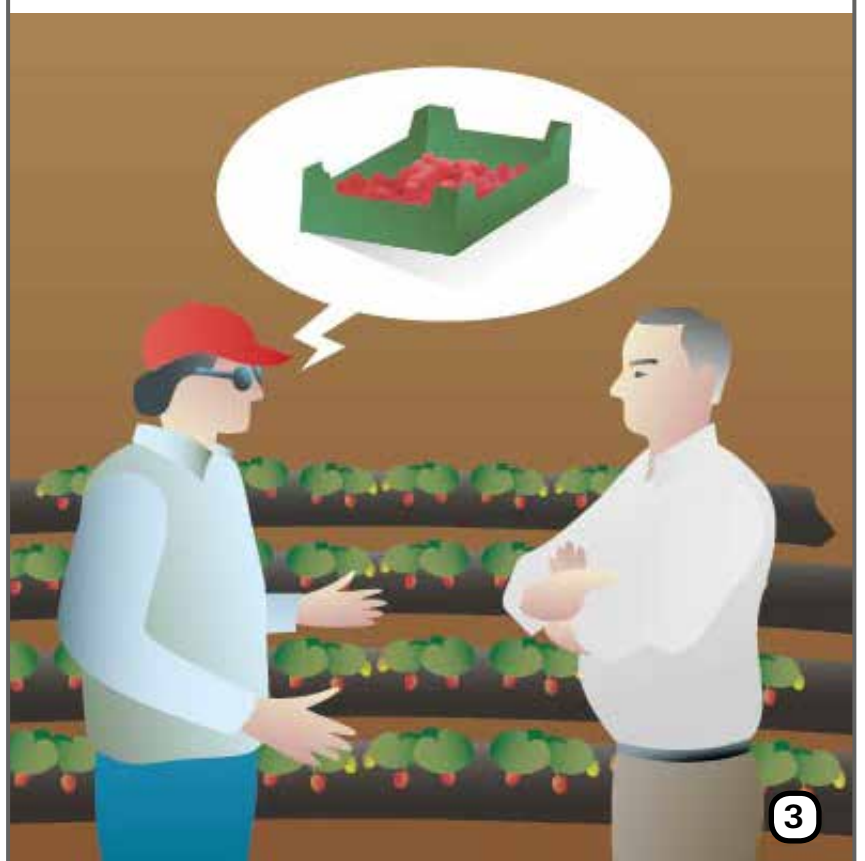
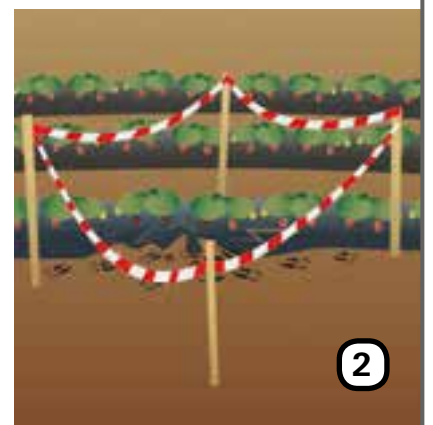
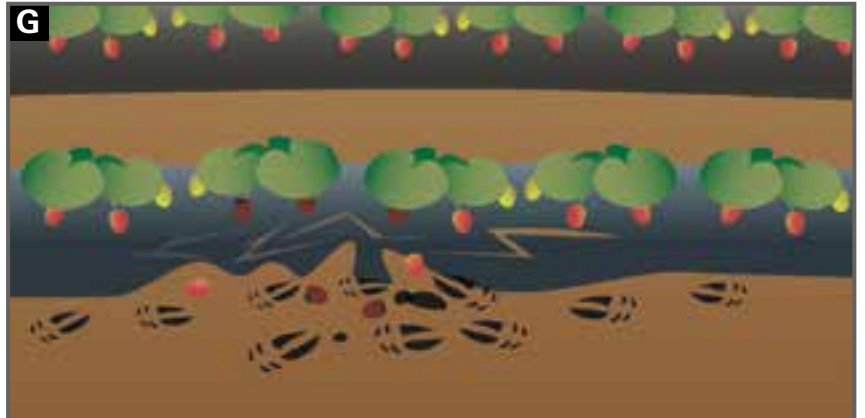
Farmers should be careful to not endanger protected species or remove their habitat.

G Before harvesting, scouting for signs of substantive intrusion in the field should be performed (e.g. tracks, gnawing, burrowing etc.). When clear evidence of intrusion is found:

1. This should be reported and recorded;
2. Access to this zone should be restricted and berries should be harvested separately;
3. Further use of berries from this zone should be discussed with your berries purchaser.



If animal faeces are found in the field, this area should not be harvested. The no-harvest buffer zone should have a 1.5 m radius.



Animals: REMEMBER!

1. Control movements of domestic animals.



2. Keep farm animals confined and far away from water sources, growing fields and storage areas.



3. Use dedicated tools for farm animal activities and berries.



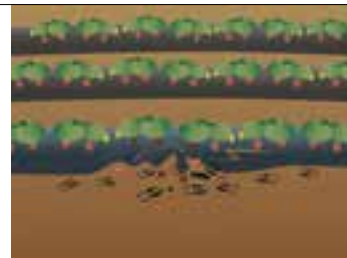
4. Prevent intrusion and minimize habitat of wild animals in the crop production area e.g. using fences and bird repellants, avoiding waste.



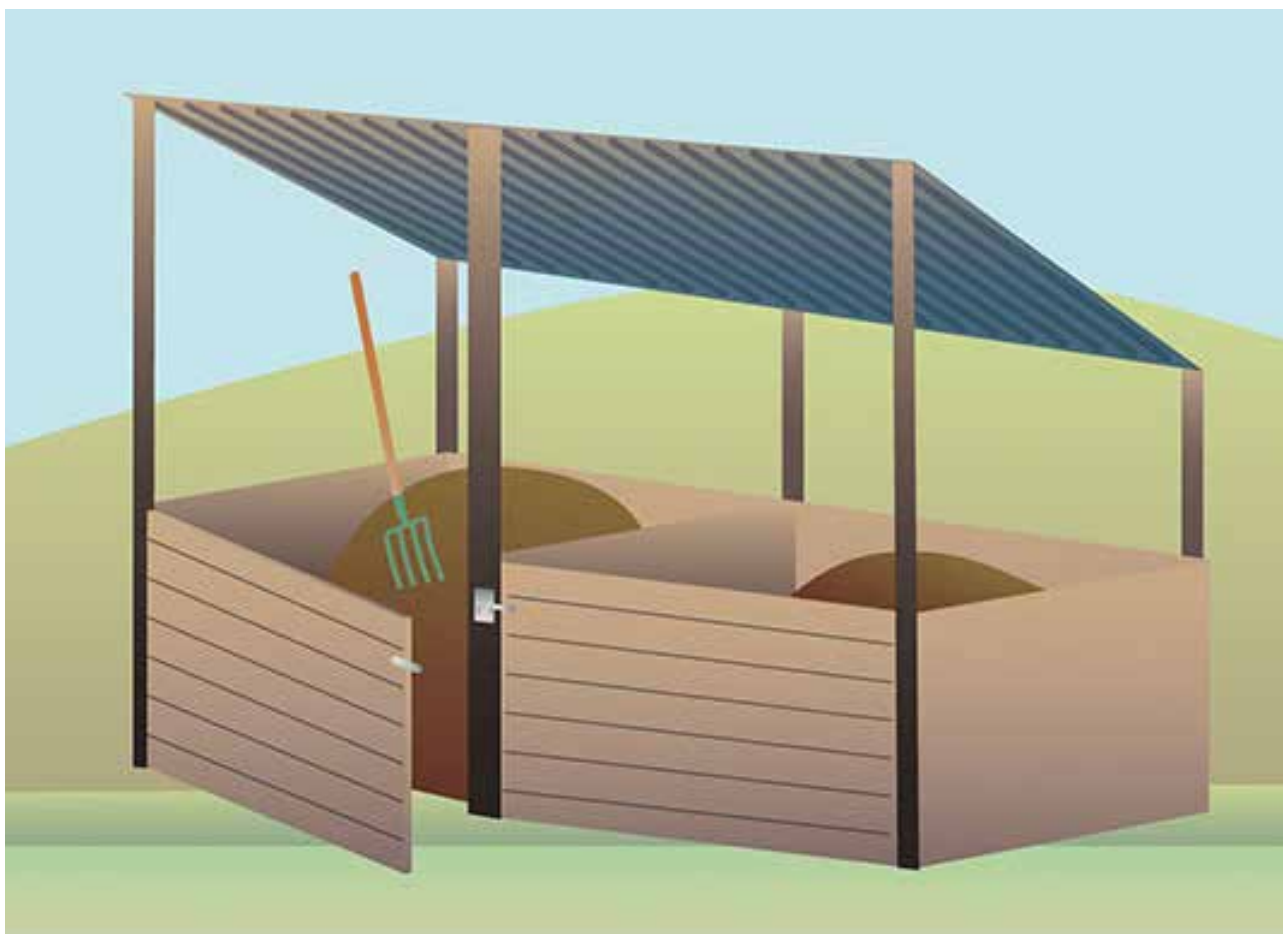
5. Do not use rodenticides or chemical bird repellants in the growing field.



6. Take corrective actions when clear evidence of animal intrusion in the field is found.



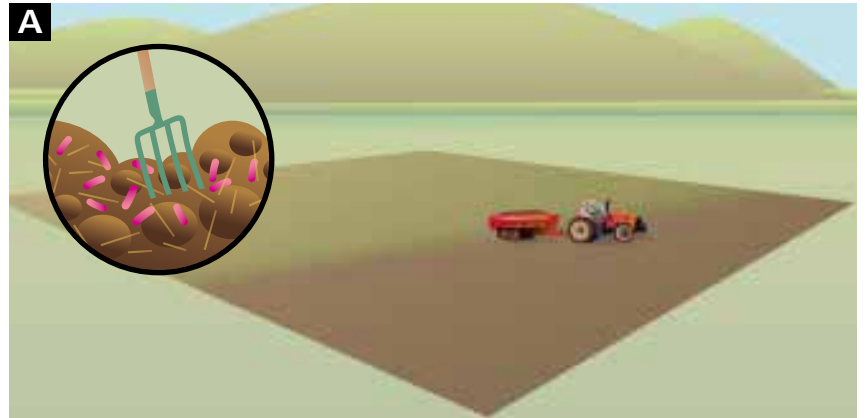
3. Manure-based soil amendments



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Use and application of raw manure in soil

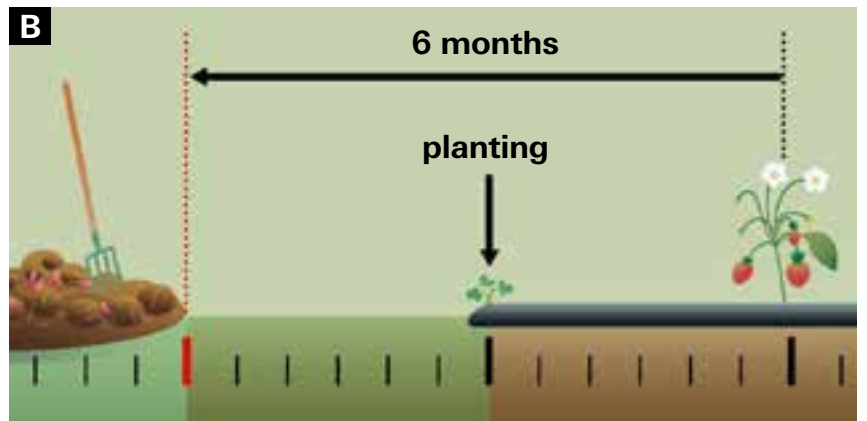
A Apply raw manure prior to planting (perform immediate incorporation of manure after spreading to get best effects of nutrients).



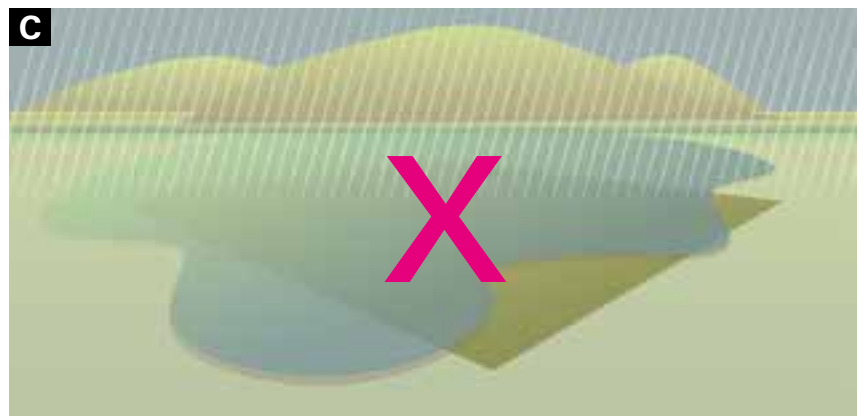
B Apply raw manure at least 6 months before harvest.



When it is not possible to apply this interval restriction, do not use raw manure.



C Do not spread raw manure on fields that are water saturated, prone to annual flooding/run-off, frozen or snow-covered.



Use and application of treated*

manure in soil

*treated by a scientifically valid controlled process (e.g. controlled composting)

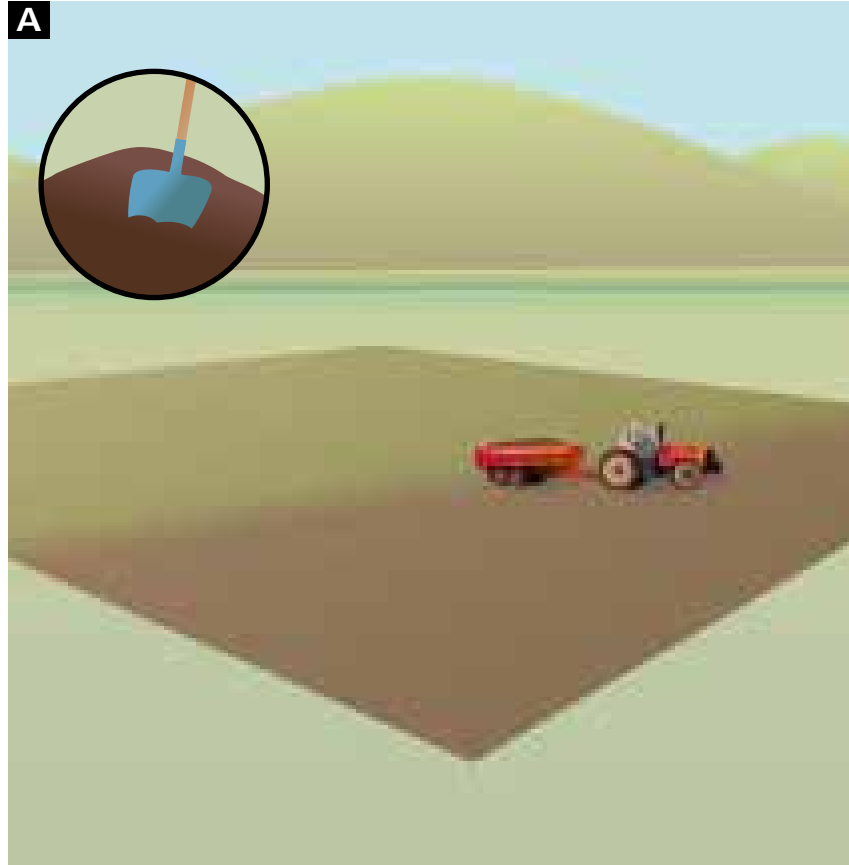
A Apply treated manure prior to planting. The 6 month interval restriction of raw manure (see B page 27) does not apply for treated manure.



For perennial crops (e.g. raspberries), when absolutely essential to the production system, treated manure can be also applied during the dormant period but only where edible part of the crop will not come into physical contact with the manure/soil.

B If treated manure is purchased from an external source (commercially treated), it should be purchased only from suppliers which provide information on:

- origin;
- treatment used;
- tests performed and test results showing that human pathogens of concern have been effectively controlled (see section E “On-farm composting of manure”, page 31).

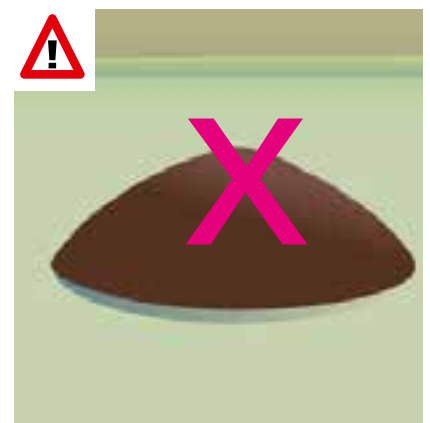
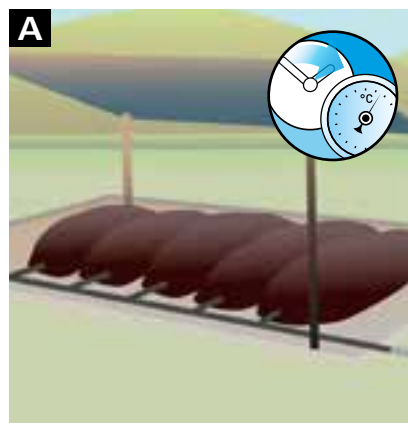
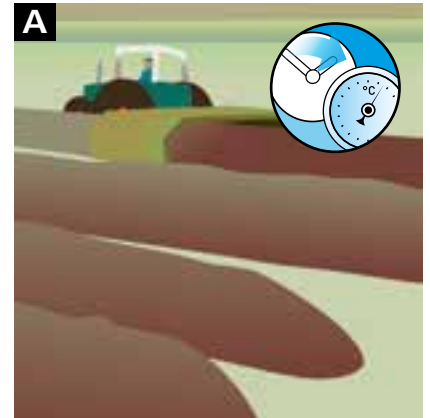
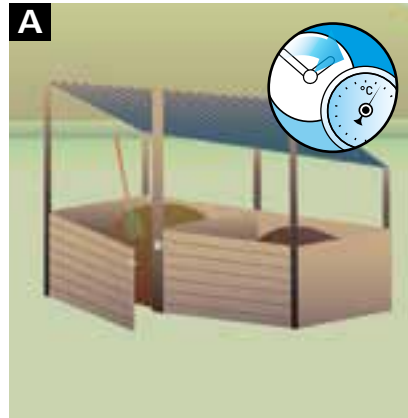


Treatment of manure: On-farm composting of manure with a controlled process

A For any type of composting (i.e. turned pile/turned windrow composting or static aerated composting), raw manure has to remain for a period of time at a designated temperature.



Simple stock piling is not appropriate to ensure that all pathogenic bacteria and/or viruses have been killed.



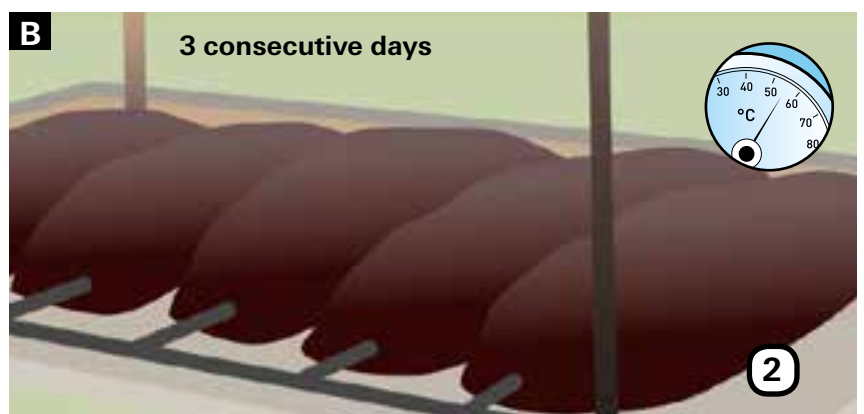
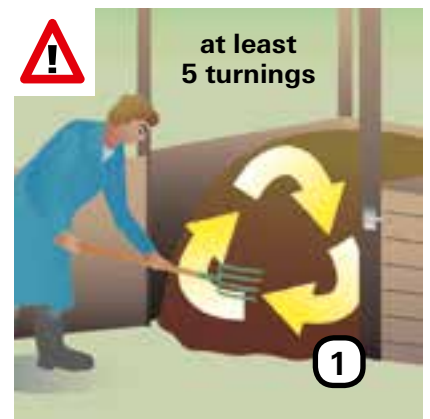
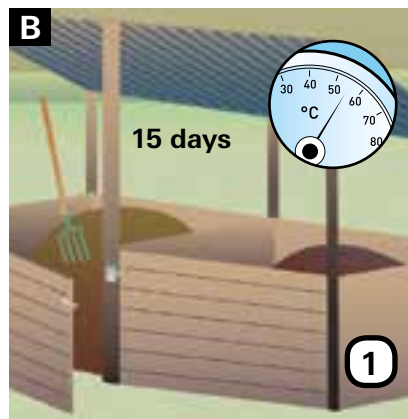
B The temperature needs to reach:

1. At least 55°C for 15 days (need not be consecutive) in the hot zone of a turned pile/turned windrow, with at least 5 turnings (around 3 times a week).



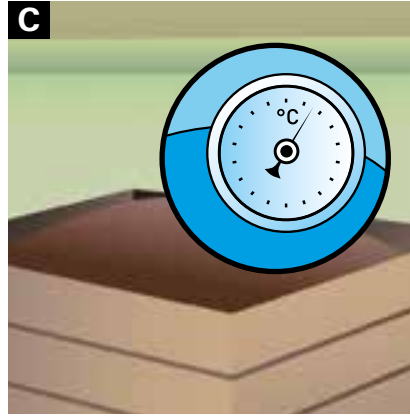
Piles/windrow should be turned so that the outer mass can be exposed to the highest temperature inside the pile.

2. At least 55°C for 3 consecutive days in a static aerated pile.

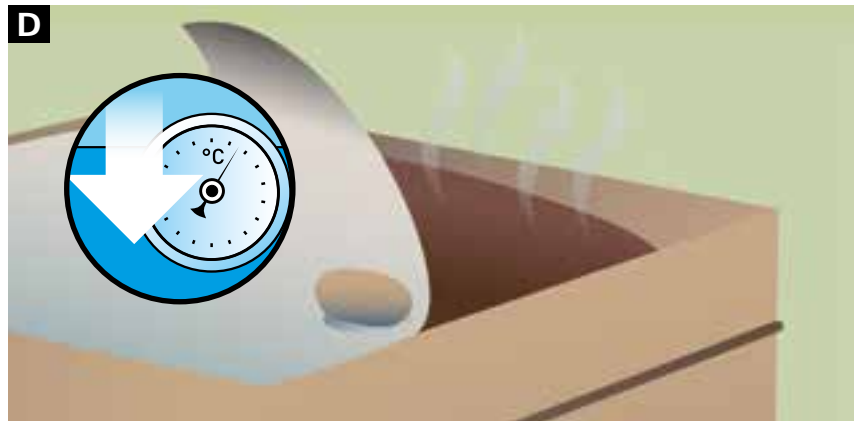


Treatment of manure: On-farm composting of manure with a controlled process

C Monitoring and recording of the temperature at selected places within the manure pile has to be performed, as well as recording of time (days) and number of turnings (when applicable).



D After the correct period of time at the designated temperature, allow temperature of the manure to decline gradually (approximately 45 days) to reach cooler conditions (the curing stage). This curing stage generates a stabilized compost which is dark brown, crumbly and earthy-smelling.



Treatment of manure: On-farm composting of manure with a controlled process

E Pathogen testing should be performed by a laboratory ISO 17025 accredited for method of testing (or one approved by an official government scheme), at least once to validate the compost process (at the end of the curing stage):

- *Salmonella* absence in 25g portion;
- And *Listeria monocytogenes* absence in 25g portion;
- And *E. coli* < 1000 CFU/g;
- Or according to local regulation.

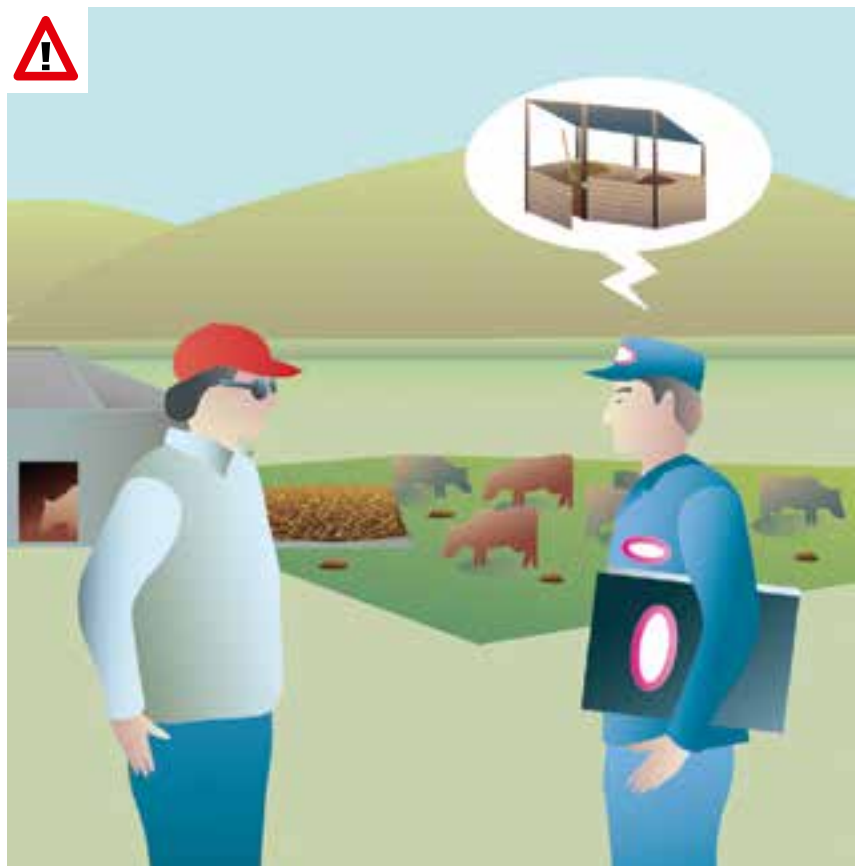


Before initiating on-farm composting, a competent professional should be consulted to ensure the treatment will produce stabilized compost that can meet the microbial standards. If you do not know whom to contact, discuss first with your berries purchaser.

E



Salmonella absence in 25g
L. mono absence in 25g
E. coli < 1000 CFU/g



Treatment of manure: On-farm composting of manure with a controlled process

F Compost tea (made from composted manure steeped in water) should be prepared with:

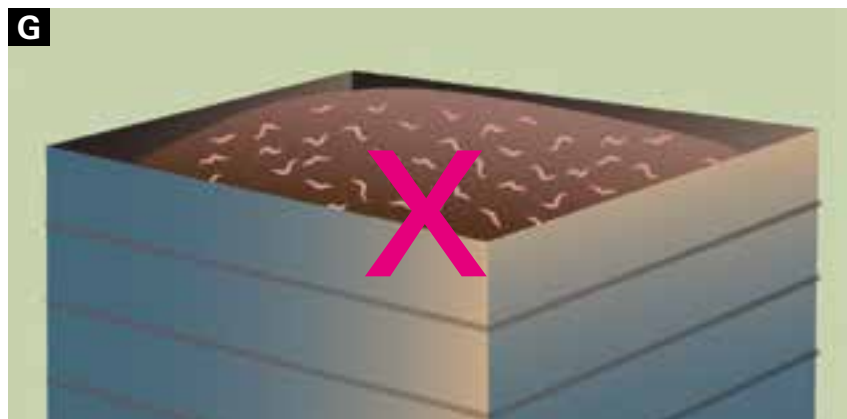
- Potable water (absence of *E. coli* in 100 mL);
- Properly composted manure (see A to E).



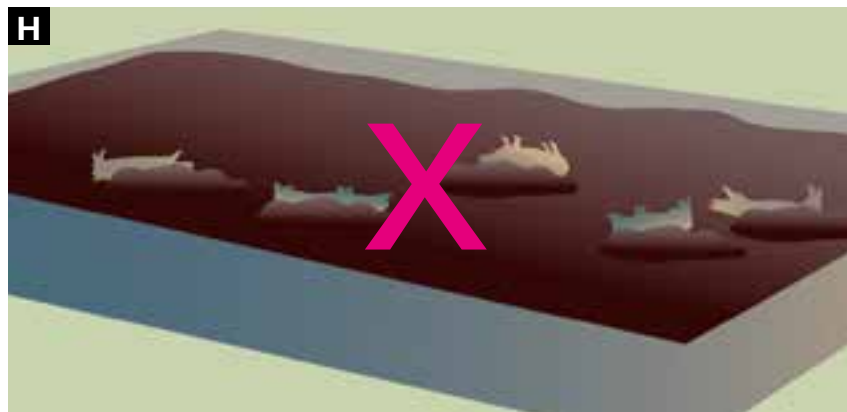
Do not use compost tea for which production process uses supplemental nutrients because these nutrients can support growth of even a few surviving cells of pathogenic bacteria.



G Do not use Vermicomposting of manure (worm composting), unless manure is pre-treated by a thermal method or significantly diluted (50% at least) before worm composting.

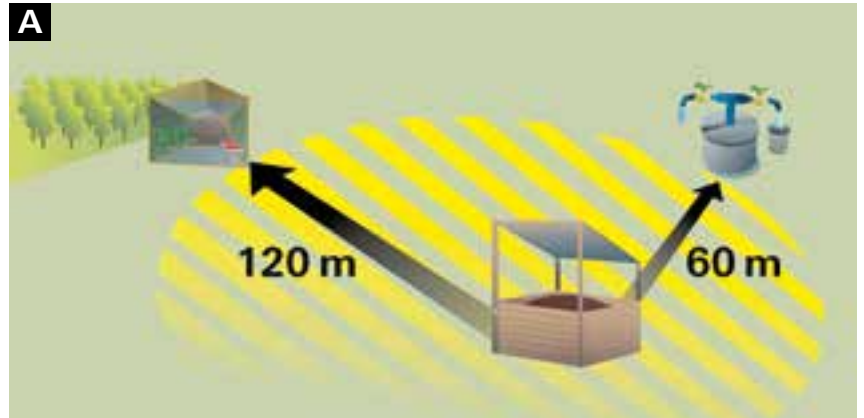


H Do not use carcass composted products or untreated human sewage sludge.



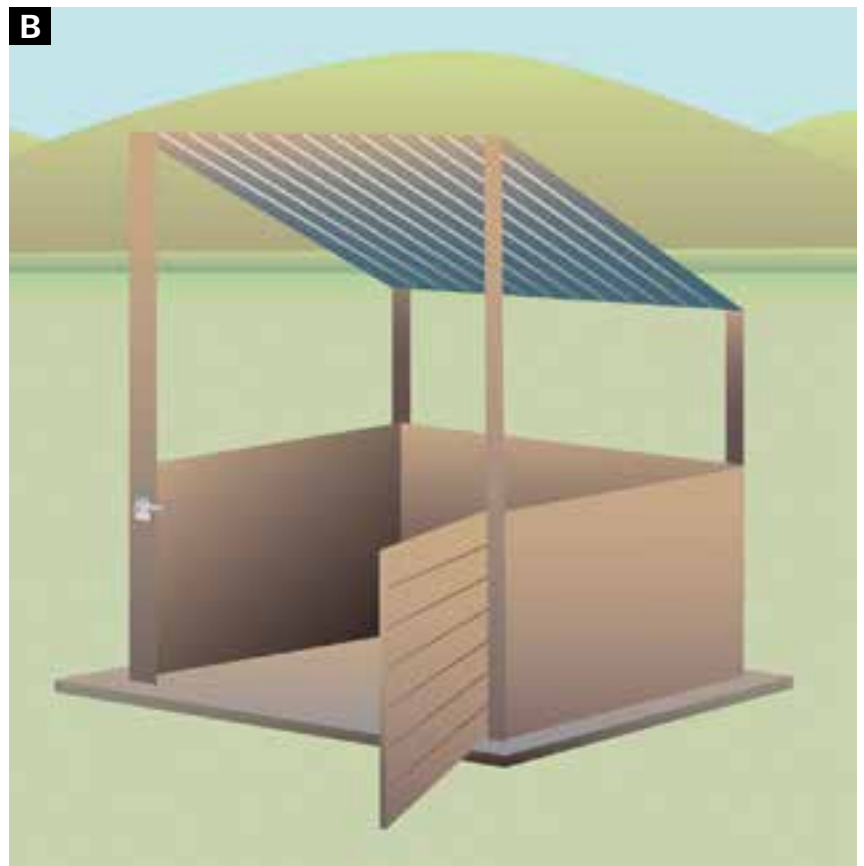
Cross-contamination between raw manure/composting activities and crop production area

A Keep raw manure storage and composting areas far away from growing field and harvested produce (at least 120 meters) and from water sources (at least 60 meters).



B Avoid any risk of leakage or wind spread of raw manure during composting by using:

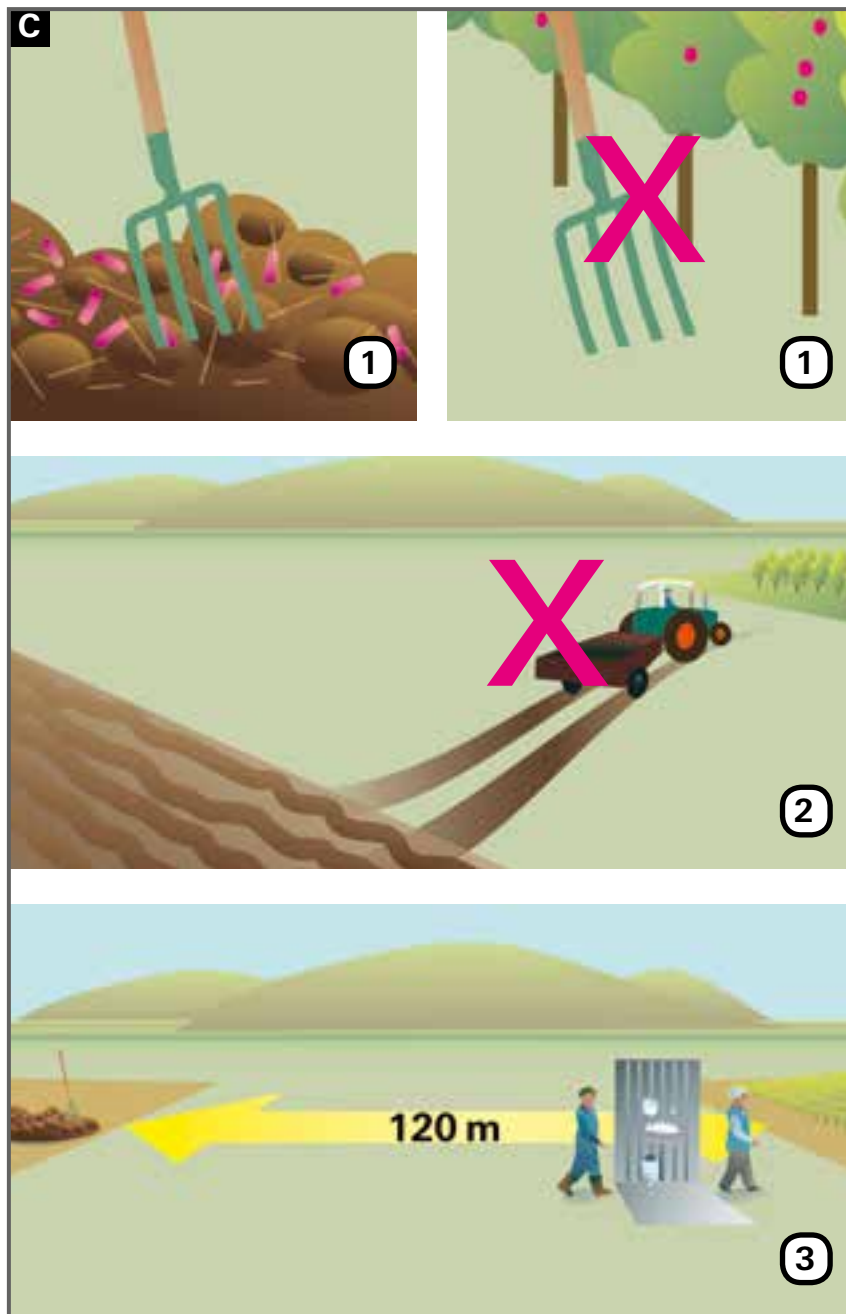
- Physical barriers such as wall, sheeting;
- Appropriate covering;
- A stabilized surface.



Cross-contamination between raw manure/composting activities and crop production area

C Avoid cross contamination from raw manure and composting activities to the crop production area by:

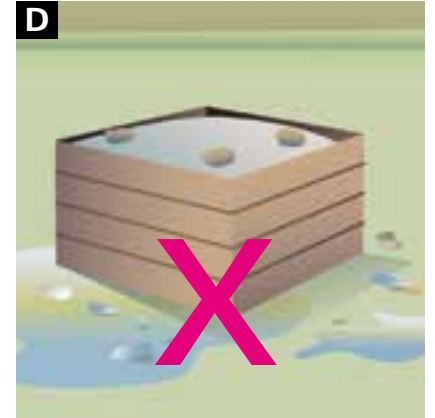
1. Not using utensils and tools from raw manure and composting activities for activities related to composted manure and plant produce, unless these equipment or tools have been cleaned and disinfected. If possible, use dedicated tools for raw manure/composting activities, for composted manure and for produce.
2. Avoiding vehicles from these raw manure and composting activities to enter the crop production area during growing season and harvesting.
3. Washing hands and changing boots (and changing clothes if necessary) when going from raw manure/composting area to crop production area during growing season.



Cross-contamination between raw manure/composting activities and crop production area

D Minimize for the potential recontamination of composted manure by:

- Using covered storage;
- Avoiding bushes and cutting the grass around storage to avoid pest nesting;
- Removing waste and avoiding stagnant water around storage.



E Train employees on the risk of raw manure and composting cross-contamination.



Do not discharge untreated or improperly treated manure and faeces into surface waters.

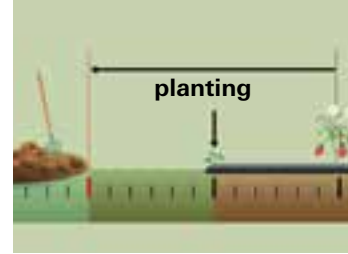


Manure-based soil amendments: REMEMBER!

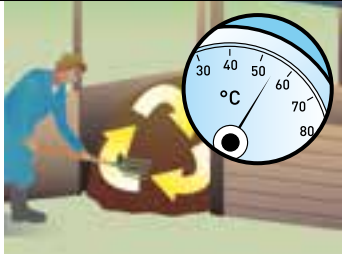
1. Apply manure prior to planting.



2. Apply raw manure at least 6 months before harvest.



3. Use composted manure which has followed controlled composting (rather than simple stock piling): record temperature, time and, when applicable, number of turnings.



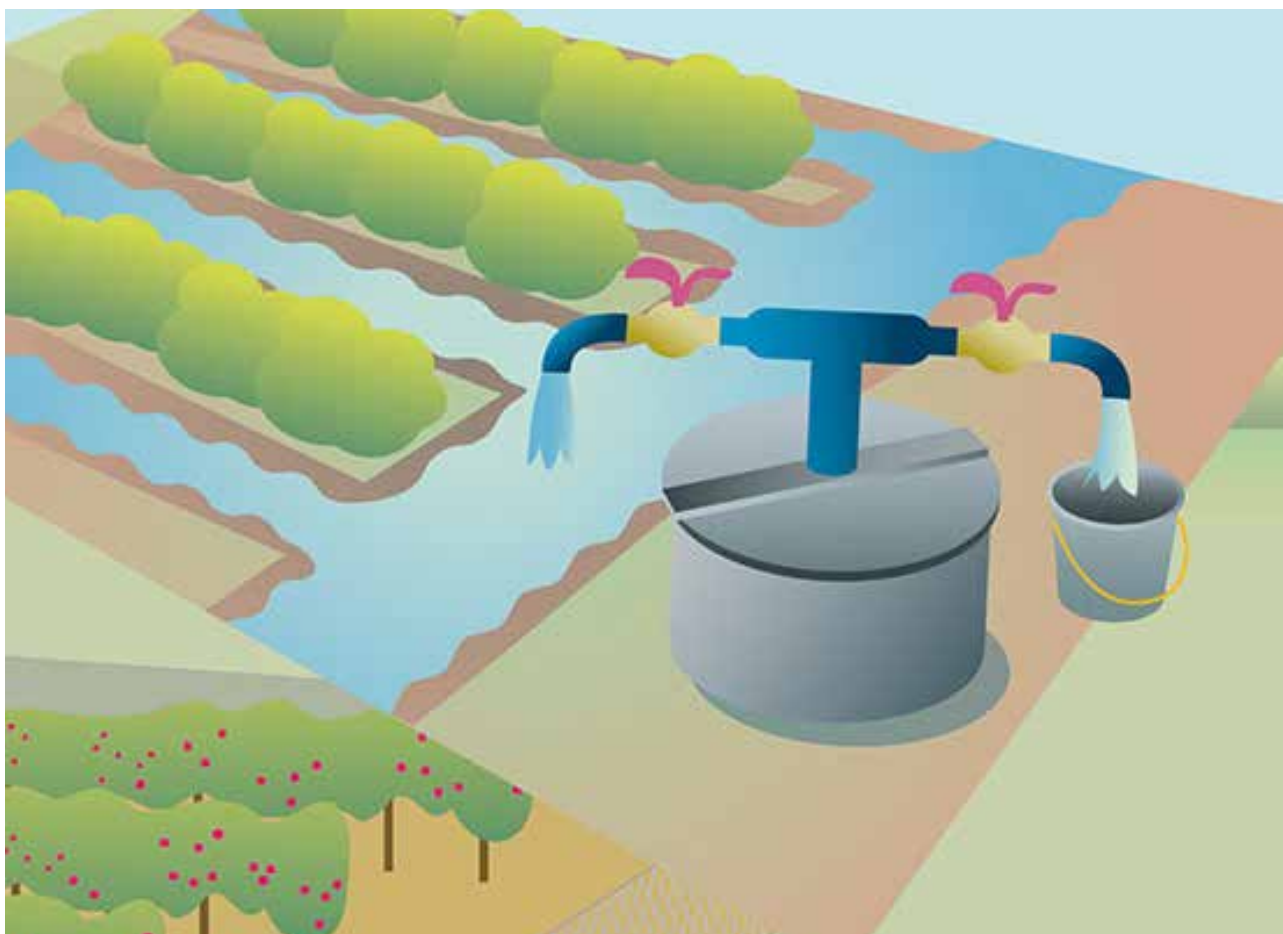
4. Validate on-farm controlled composting and/or ask for a certificate of compliance if you purchase treated manure from an external source.



5. Avoid cross-contamination between raw manure/composting areas and crop production area.



4. Agricultural water



Water source and irrigation method (Type A and Type B water)	39
Wells, water collection, storage and distribution systems (e.g. tanks, ponds, pipes)	42
Agricultural water testing	45
Water disinfection treatments	48
TABLE 1 Microbiological risk ranking of agricultural water according to water source and type of application	51
TABLE 2 Microbiological testing recommendations for type A agricultural water according to the water source	52

Water source and irrigation method (Type A and Type B water)

A Identify the source of the water to be used for applications listed in section B:

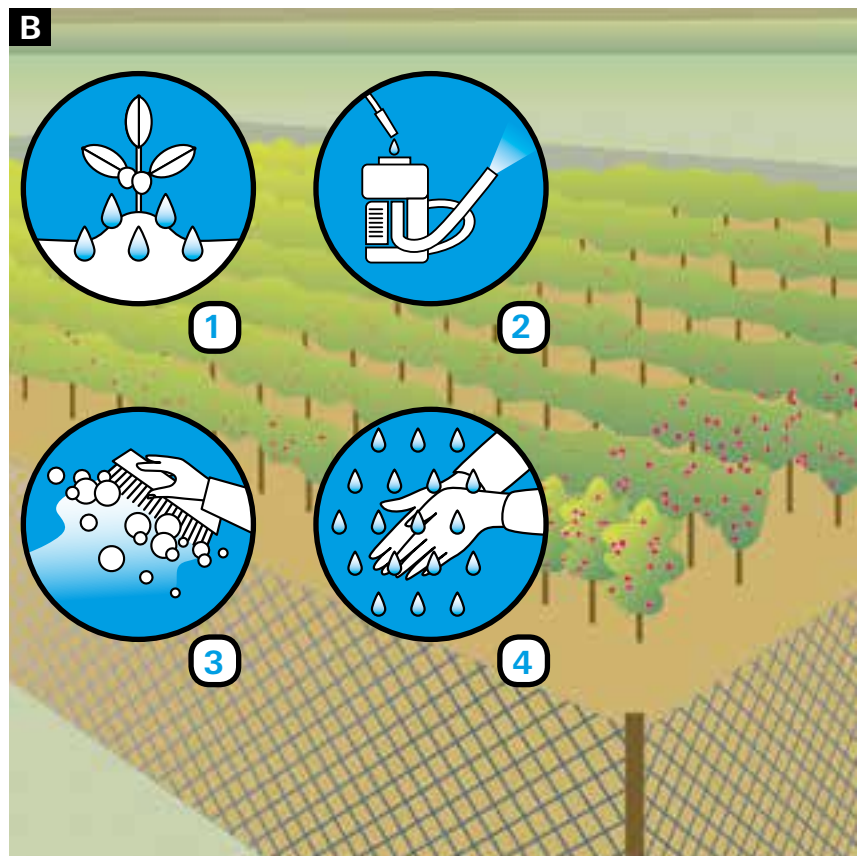
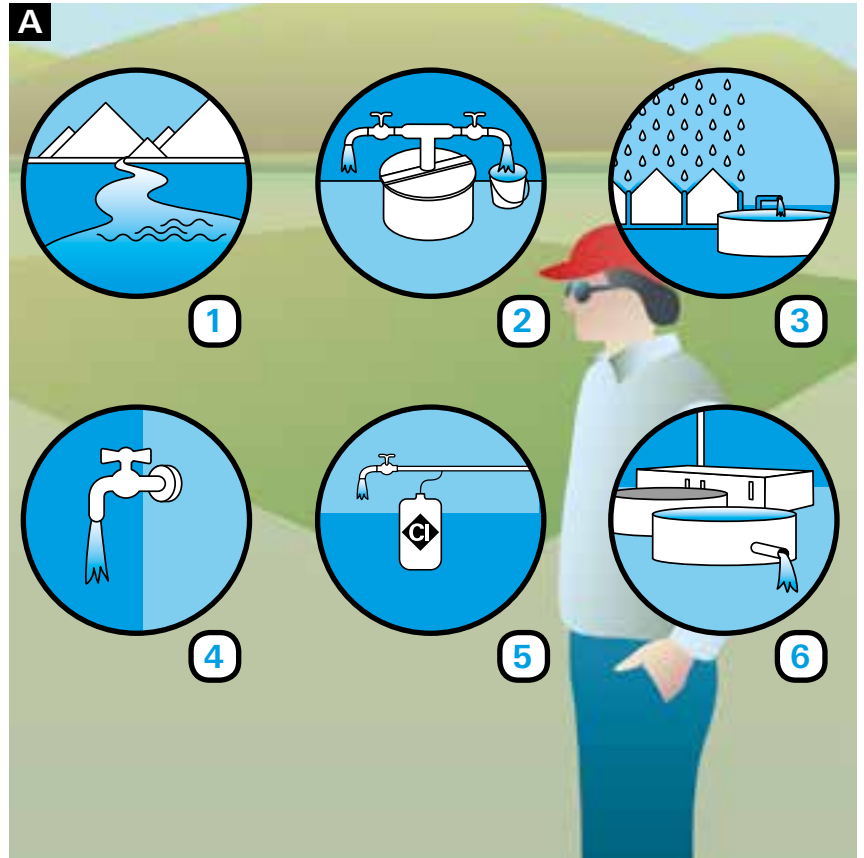
1. Surface water;
2. Ground water (= well water/borehole), either from deep or shallow well);
3. Harvested rain water;
4. Municipal water (i.e. potable water);
5. Disinfected water (e.g. chlorinated) on farm;
6. Secondary treated sewage water.



DO NOT use untreated sewage water as agricultural water.

B The identification of the water source has to be performed individually for the following water applications:

1. Irrigation;
2. Pesticide dilution;
3. Cleaning of equipment in contact with produce (e.g. harvesting equipment);
4. Worker hand washing.



Water source and irrigation method

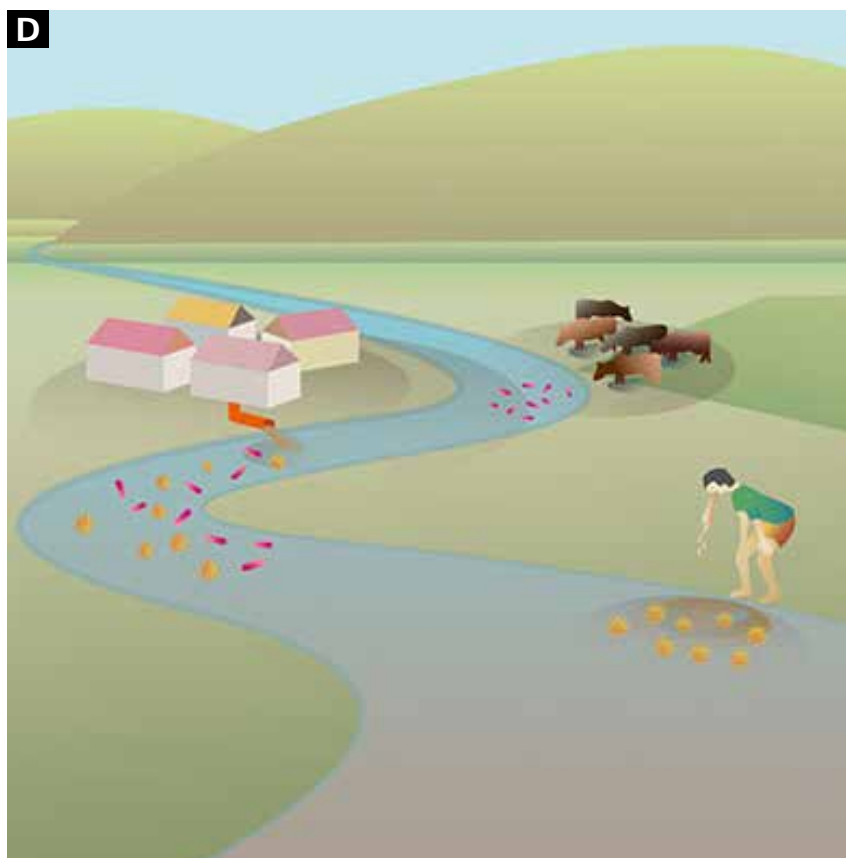
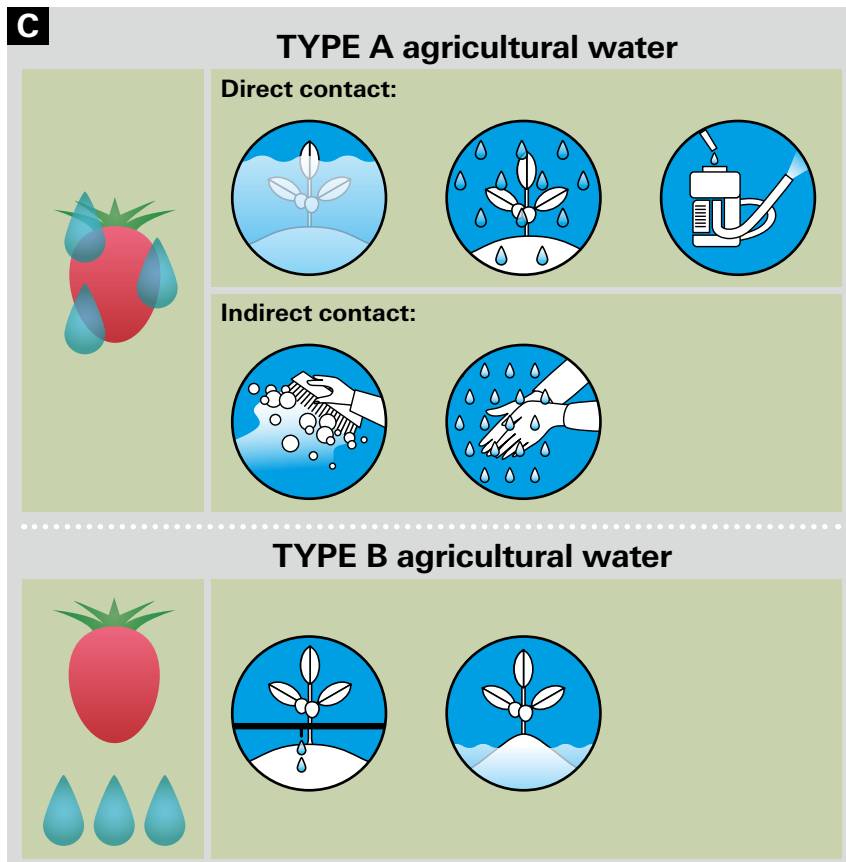
C Depending on its use, there are two types of agricultural water:

- **TYPE A agricultural water:** Agricultural water having direct or indirect contact with produce. Direct contact: e.g. water used for overhead or flood irrigation, water used for dilution of pesticides. Indirect contact: e.g. water used for cleaning of equipment in contact with produce, water used for hand washing.
- **TYPE B agricultural water:** Agricultural water having no direct or indirect contact with produce, e.g. water used for drip or furrow irrigation (provided there is no risk that water from the furrow splashes onto the produce).

D Surface water is vulnerable to microbial contamination from human and animal activities. Secondary treated sewage water (not disinfected) may still contain microbial pathogens.



Therefore, do not use surface water and secondary treated sewage water as type A agricultural water, unless treated (disinfected).

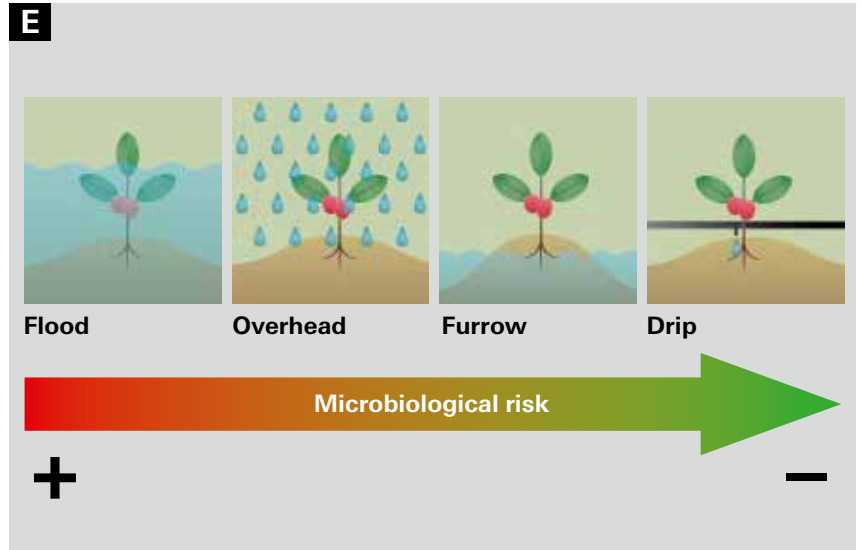


Water source and irrigation method

E The risk of microbial contamination will vary depending on the irrigation method, i.e. the risk will increase when there is contact between water and produce. Therefore:

- Use of drip or furrow irrigation of berries is recommended.
- Where possible minimize the use of overhead irrigation.
- Flood irrigation is not recommended, unless specifically used to assist harvesting (e.g. for cranberries).

Table 1 (see page 51) summarizes the level of microbiological risk according to the water source and its application type.



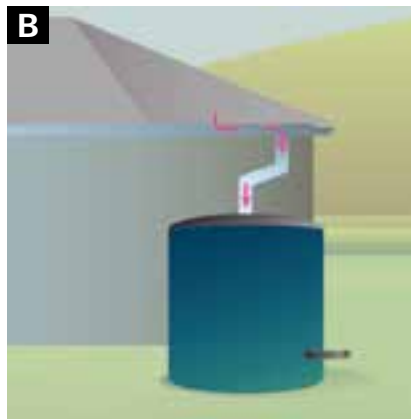
Wells, water collection, storage and distribution systems (e.g. tanks, ponds, pipes)

A Protect well (bore-hole) water from intrusion of surface water, run-off water and animals by:

- Using concrete wall construction with intact covering.
- Inspecting wells regularly for potential leaks or cracks and repair when needed.
- Elevating the edge of the well above the surrounding ground surface.



B Harvest rain water using a well maintained clean collection system (e.g. clean roofs without bird nesting, pipes and tanks clean).



Wells, water collection, storage and distribution systems (e.g. tanks, ponds, pipes)

C Prevent animal ingress into water collection and storage systems:

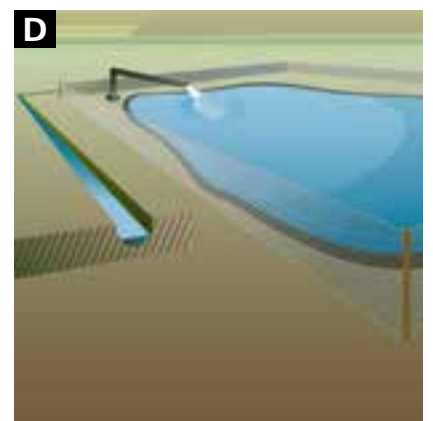
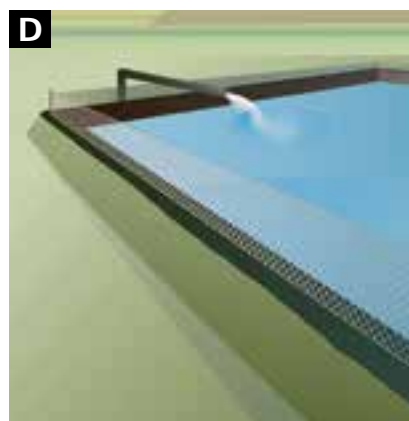
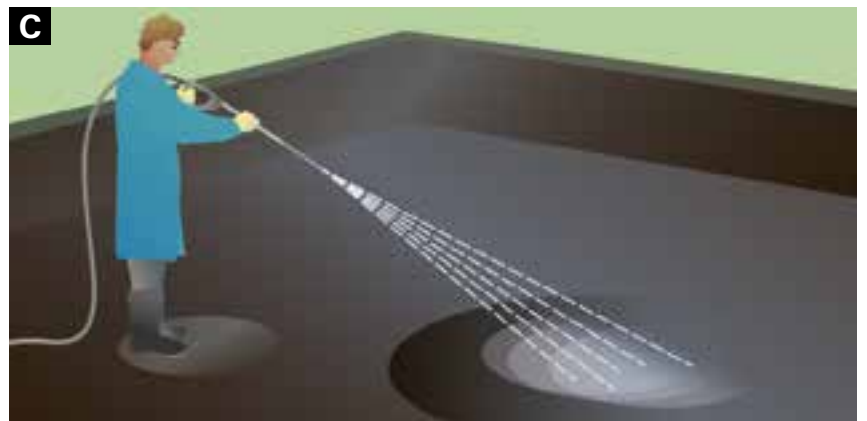
- Cover tanks;
- Fence ponds (and cover them if feasible);
- Empty and clean tanks and ponds at least once per year.



Ponds that cannot be covered are not fully closed storage systems. Care should be taken to ensure the hygiene and biosecurity of the pond is maintained (e.g. yearly cleaning, fences and construction design as defined in D).

D Build berms (raised soil or grass barriers) or ditches around ponds to prevent overland runoff of manure/compost and other contaminants into the ponds.

E Inspect the conditions of pumps, pipes, collection and storage systems regularly for leaks and cracks to ensure the integrity of the water system.



Wells, water collection, storage and distribution systems (e.g. tanks, ponds, pipes)



Repairing damaged equipment is very important: broken water distribution systems can turn a drip system into an overhead sprinkler, thereby bringing water in direct contact with the edible part of the crop.

F Minimize biofilm formation in pipes:

- Use black pipes that minimize growth of pathogens (including plant pathogens).
- Apply disinfection treatment to prevent biofilm formation in the pipes whenever necessary (at least once per year, e.g. before the start of the growing season, using a locally approved disinfectant). Competent personnel should be consulted to ensure type of treatment is fit for purpose (chemical component, concentration, flushing time, rinsing and frequency of treatment). If you do not know whom to contact, discuss first with your berries purchaser.

G Keep flood (if applicable) and furrow irrigation channels free of rubbish/waste.



Agricultural water testing

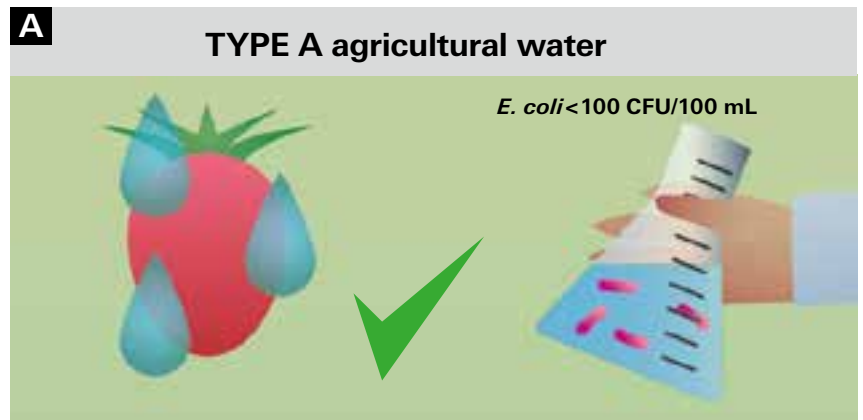
A For type A agricultural water, microbiological water testing for *Escherichia coli* is required (with target levels < 100 CFU/100 mL). The testing frequency will vary according to the water source (see Table 2, page 52–53).

B Microbiological water testing requires two steps:




- **STEP 1: Validation** of the water quality profile by taking at least 6 samples over two growing seasons (3 per season, one just before harvest). This step is not required for water supplied from a municipal source or for on-farm disinfected water.
- **STEP 2: Verification** of this water quality profile during each following season, by taking one to two samples per season (one for short harvest seasons and two for long harvest seasons).



Table 2 (page 52–53) gives recommendations on microbiological type A water testing frequency, limits and corrective actions in case of deviations (results above the limits) for all water sources, for both validation and verification steps.



B Microbiological water testing

STEP 1: Validation		STEP 2: Verification
Growing season 1	Growing season 2	Growing seasons 3, 4, etc.
 3 X	 3 X	 1–2 X

Agricultural water testing

C For type B agricultural water (see page 40), no microbiological testing is required.



However, in the event of an adverse situation where water has come into contact with the harvestable part of the crop, assess immediately the microbiological quality of the water using the same microbiological analysis and limits as for verification of type A water (see Table 2; *E. coli* < 100 CFU/100 mL).

D Water microbiological testing should be performed by a laboratory ISO 17025 accredited for methods of testing or one approved by an official government scheme.

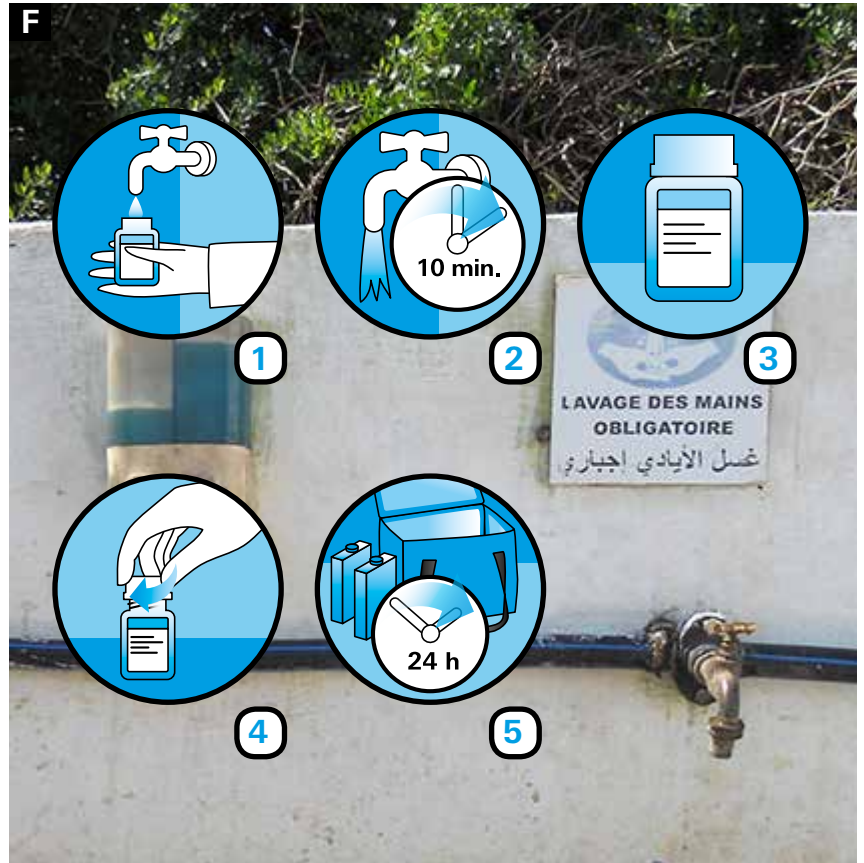
E For municipal water, request or ensure you have access to municipal water system results or certificates of compliance.



Agricultural water testing

F Tips to perform good water sampling:

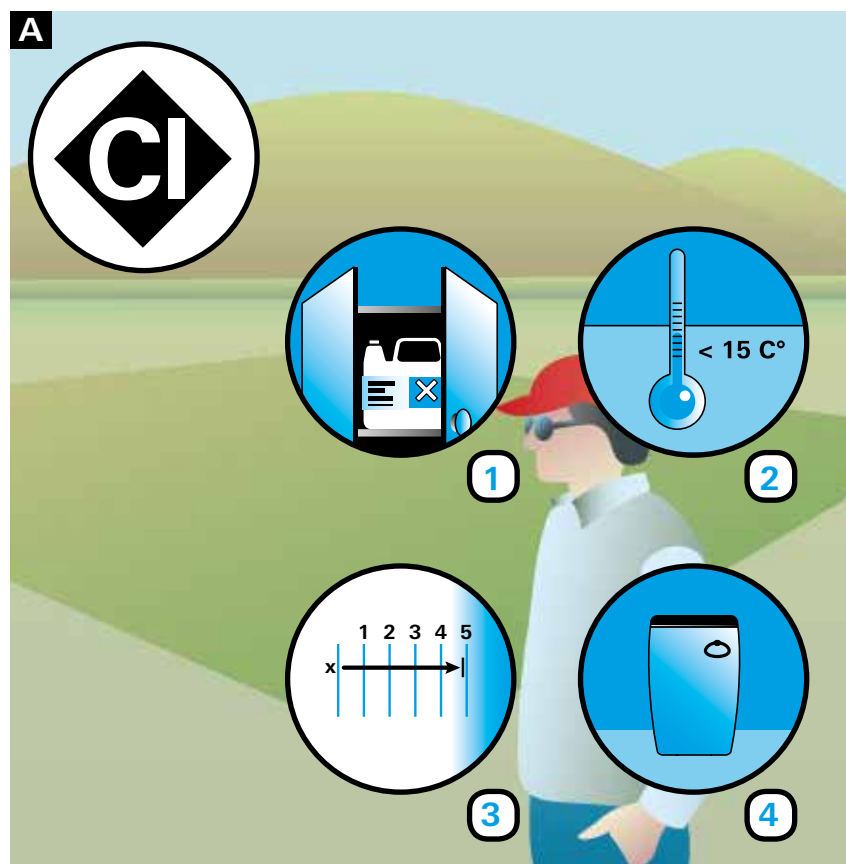
1. Perform the sampling at the nearest practical sampling point of water application (not on the source itself), e.g. from the sprinkler or at the tap for hand washing etc...
2. Run the irrigation system the amount of time needed to flush the "hold up" volume of the system plus additional 5–10 minutes, before the sample is taken. For distribution system taps, open the tap fully and allow the system to run for at least 10 minutes.
3. Use only sterile containers to collect water (might be provided by the testing laboratory). Do not rinse the sterile containers prior to taking samples.
4. Slowly fill the container and close it tightly.
5. The sample should be delivered to the laboratory as soon as possible after its collection (sent on the day of sampling for a delivery within 24 hours is the best practice) and in a cooler with ice or gel packs during transportation. Check with the laboratory for any additional procedure/recommendation (e.g. volume to be sent).



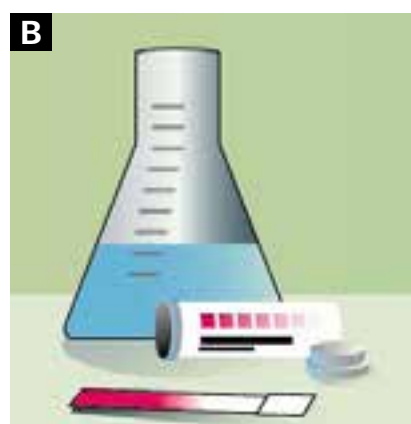
Water disinfection treatments

A If water chlorination is applied, avoid production of degradation products such as chlorite and chlorate by storing hypochlorite:

1. In the dark (dark packaging or dark room);
2. At cool temperature (below 15°C);
3. If possible in a diluted format (e.g. two times dilution of a 13 % bulk hypochlorite solution) and by using it within 5 weeks;
4. In a container made of Teflon, rubber, PVC, PET, plastic (to avoid storage in direct contact with carbon steel or stainless steel).



B If water chlorination is applied, monitor the free chlorine (e.g. once a week) at the nearest practical sampling point of water application using a commercially available chlorine test (e.g. dipstick) to verify that the free chlorine concentration is in the range of 0.2 to 1 ppm.



Monitor especially after specific events that may have an impact on the microbiological quality of the water (e.g. heavy rain, drought).

Water disinfection treatments

C When a disinfection treatment is implemented as routine or as part of a corrective action (see Table 2, page 52–53), a competent professional should be consulted. He will ensure type of treatment is fit for purpose and will give guidance on how to apply and monitor it (e.g. free chlorine level). He will advise on the corrective actions in case of deviation (e.g. deviation in the free chlorine level). If you do not know whom to contact, discuss first with your berries purchaser.



Disinfected water with *E. coli* results above 100 CFU/100 mL should not be used as type A agricultural water and investigation should be performed to find the source of the contamination (see Table 2, page 52–53).

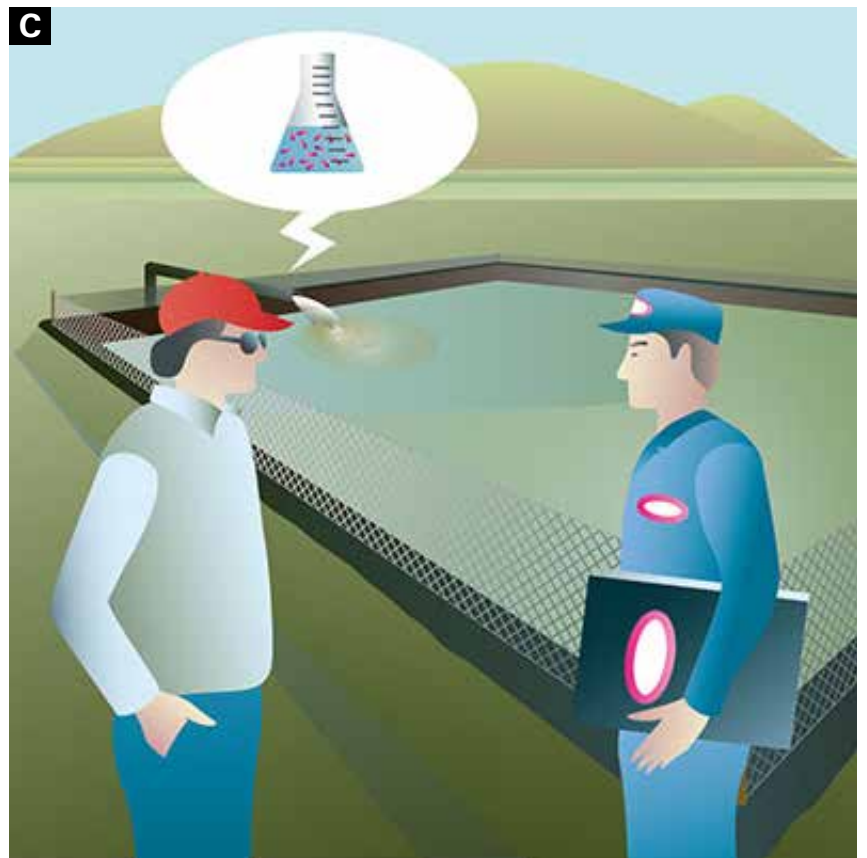


TABLE 1 Microbiological risk ranking of agricultural water according to water source and type of application

		WATER: TYPE OF APPLICATION					
		IRRIGATION				OTHER USE OF WATER	
		Flood irrigation	Overhead irrigation	Furrow irrigation***	Drip irrigation	Pesticide dilution	Cleaning of equipment and hand washing
WATER: SOURCE	Untreated Surface Water	High	High	Medium	Medium	High	High
	Secondary treated Sewage Water*	High	High	Medium	Medium	High	High
	Untreated ground Water	Medium	Medium	Medium	Medium	Medium	Medium
	Untreated rain Water	Medium	Medium	Medium	Medium	Medium	Medium
	On-farm disinfected Water**	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	Municipal Water	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

- High microbiological risk** – Untreated surface water is vulnerable to microbial hazard contamination; secondary treated sewage water may still contain pathogens.
- Medium microbiological risk** – Depends on the microbiological quality profile of the ground water and rain water (usually good – if installations for collecting and storing the water are in good condition and well maintained, see section “Wells, water collection, storage and distribution systems” page 42 for details).
- Negligible microbiological risk** – Either municipal or on-farm disinfected water or water which is never used in contact with the harvestable part of the crop e.g. furrow irrigation for raspberries or drip irrigation for strawberries.

* Secondary treated sewage water: sewage water treated with primary and secondary treatment, but not disinfected (disinfection = tertiary treatment). See definitions of primary, secondary and tertiary treated sewage water in “Definitions” section page 6.

** Disinfected water can be surface water or ground water or rain water or secondary treated sewage water which has followed a disinfection process at farm, such as chlorination.

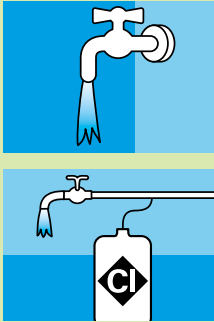
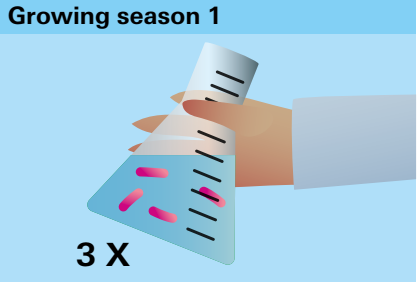

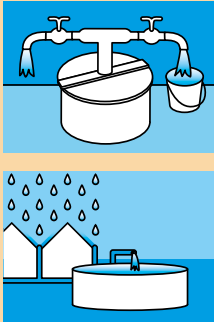
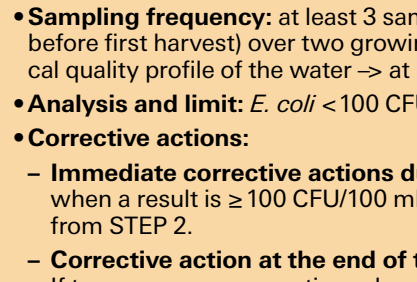
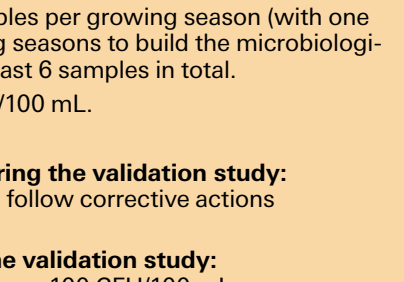

*** Negligible risk ranking when there is no risk that the irrigation water from the furrow splashes on the harvestable part of the crop. If there is a risk of splashing then the risk ranking becomes the same than Type A water.



If multiple water sources are mixed (e.g. in one storage) before application, the risk category of the higher risk water source should be applied.

TABLE 2 Microbiological testing recommendations for type A agricultural water* according to the water source

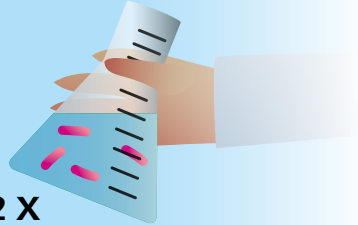
*Type A agricultural water: Agricultural water having direct or indirect contact with produce

	WATER SOURCE	STEP 1: Validation of the water quality profile	
		Growing season 1	Growing season 2
Negligible microbiological risk	<p>Municipal water and on-farm disinfected water</p> 		
	<ul style="list-style-type: none"> • Not required because water is disinfected. Start directly at STEP 2 (page 53). 		
Medium microbiological risk	<p>Untreated ground water, untreated rain water</p> 		
	<ul style="list-style-type: none"> • Sampling frequency: at least 3 samples per growing season (with one before first harvest) over two growing seasons to build the microbiological quality profile of the water → at least 6 samples in total. • Analysis and limit: <i>E. coli</i> < 100 CFU/100 mL. • Corrective actions: <ul style="list-style-type: none"> - Immediate corrective actions during the validation study: when a result is ≥ 100 CFU/100 mL, follow corrective actions from STEP 2. - Corrective action at the end of the validation study: If two or more consecutive values are ≥ 100 CFU/100 mL during validation, either: <ul style="list-style-type: none"> - Reduce the vulnerability of the water system if possible (e.g. construction work to have a deeper well, modification of rainwater collection system) then start a new validation study. OR - Switch to another water source of water if possible then start a new validation study. OR - Implement disinfection treatment of the water. • This validation should be repeated every 5 years or sooner if significant changes that may impact the water quality have occurred. 		
High microbiological risk	<p>Untreated surface water</p> 		
		<ul style="list-style-type: none"> • Not required as this water source should not be used as type A water. 	

WATER SOURCE

STEP 2: Verification of the water quality profile

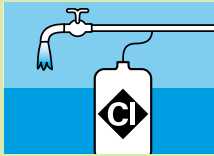
Growing seasons 3, 4, etc. (i.e. for any following season)



1-2 X

Negligible
microbiological risk

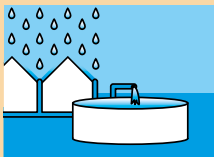
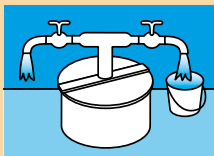
Municipal water and on-farm disinfected water



- Done to verify that there is no recontamination of water through irrigation equipment and/or distribution pipes and to verify effectiveness of on-farm disinfection treatment.
- **Sampling frequency:** One sample per growing season, during period of use and as close as practical to harvest.
- **Analysis and limit:** *E. coli* <100 CFU/100 mL.
- **Corrective actions:** If results are above the limit, do not use water as type A water until actions are taken to find the source of the contamination and to correct it, i.e. verify disinfection parameters, integrity from distribution pipes and irrigation equipment and initiate disinfection if necessary. Retest the water to verify that the problem has been solved before using it as type A water.

Medium
microbiological risk

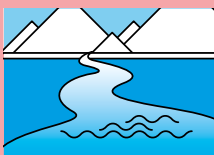
Untreated ground water, untreated rain water



- Done for verification of the microbiological water quality profile.
- **Sampling frequency:** One or two samples per growing season (one as close as practical to harvest and a second one for long harvest seasons).
- **Analysis and limit:** *Escherichia coli* <100 CFU/100 mL.
- **Corrective actions:** If results are above this limit, do not use as type A water until actions are taken to find the source of the contamination and to correct it, e.g. verify integrity of wells and of collection, storage and distribution systems. Retest the water to verify that the problem has been solved before using it as type A water.

High microbio-
logical risk

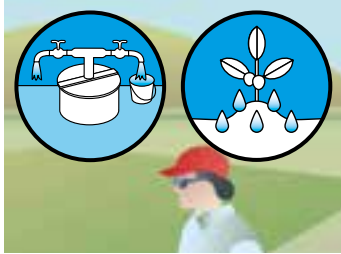
Untreated surface water



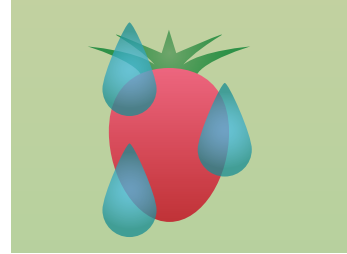
- Not required as this water source should not be used as type A water.

Agricultural water: REMEMBER!

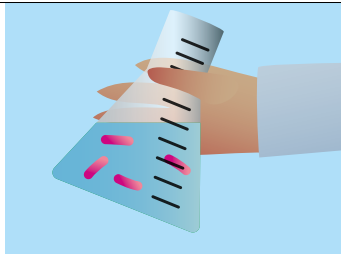
1. Identify the source of the water (e.g. surface, well, municipal...). Perform this identification for all water applications (e.g. irrigation, hand washing etc...).



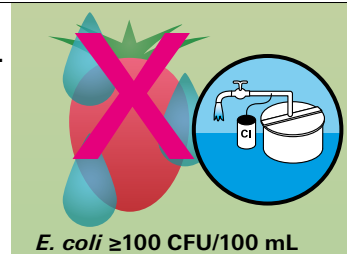
2. Type A agricultural water is agricultural water having direct or indirect contact with produce and requires microbiological testing for *E. coli* in 100 mL.



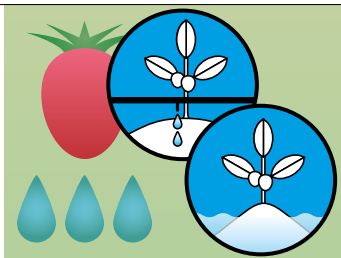
3. The testing frequency of type A water will vary according to the water source (see Table 2, page 52–53).



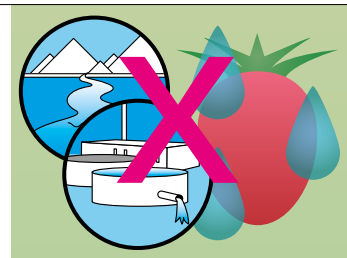
4. Water with *E. coli* ≥ 100 CFU/100mL cannot be used as type A water until actions are taken to find the source of the contamination and to correct it, and until testing shows compliance. If it is not possible to have *E. coli* < 100 CFU/100 mL, water can be treated e.g. chlorinated on-farm.



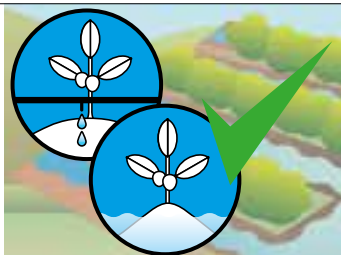
5. Type B agricultural water has no direct or indirect contact with produce and does not require testing.



6. Do not use surface water and secondary treated sewage water as type A water, unless treated.



7. Use of drip or furrow irrigation of berries is recommended.



8. Prevent contamination of water in wells and in water collection/storage systems: cover wells and water tanks, fence ponds etc...



5. Hygiene and human health

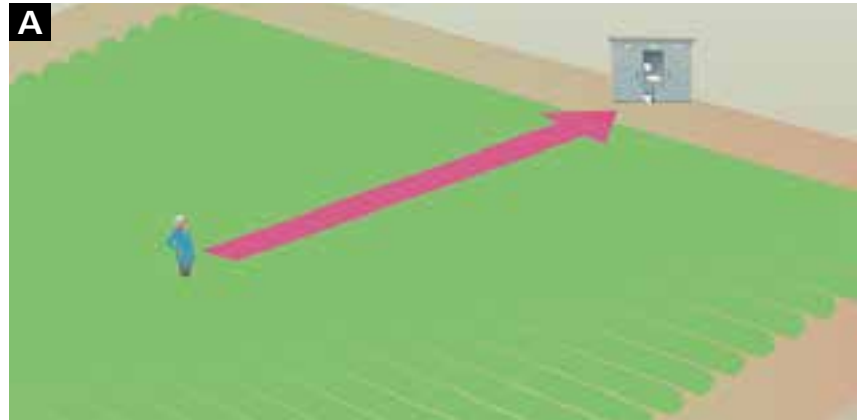


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Toilet facilities

(fixed and mobile)

A Toilets should be accessible in close proximity to the field, i.e. not only when workers are on break.



B Toilets should be in sufficient numbers to accommodate personnel, 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)

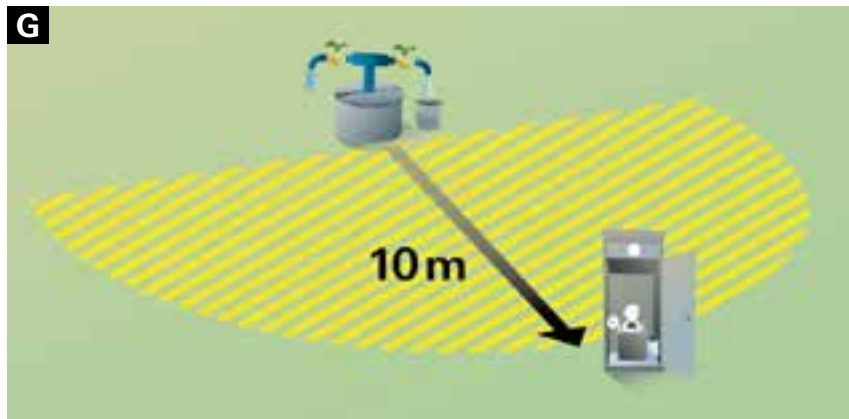
E Toilets should be cleaned daily and preferably constructed of materials that are easy to clean. Cleaning waste water should be discharged directly in the bowl or outside the crop production area in a place where it can be quickly infiltrated in the soil.



F Use caution with mobile toilets! Waste water from mobile toilet facilities that may drain into growing field can contaminate produce. 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).



 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).



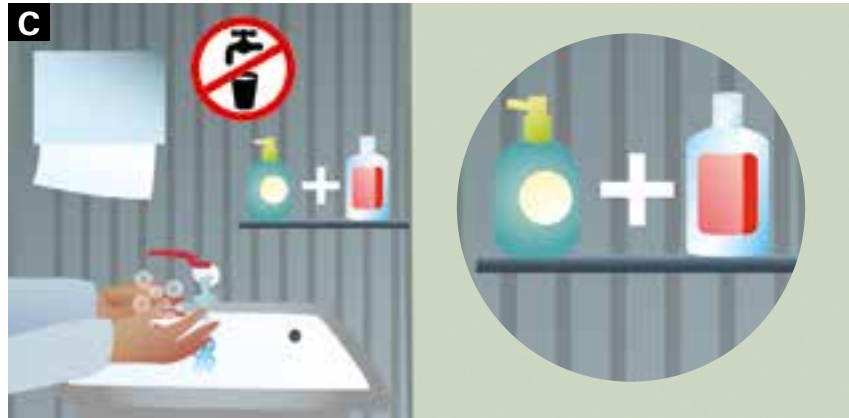
 **Hand sanitizers alone (hand disinfectants) are not an acceptable alternative to water, soap and disposable paper towels.**



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 microbiological quality of that used for produce contact (i.e. type A agricultural water, see section "Agricultural water" page 40/45) → *E. coli* < 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, runny noses and sweat;
 - 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

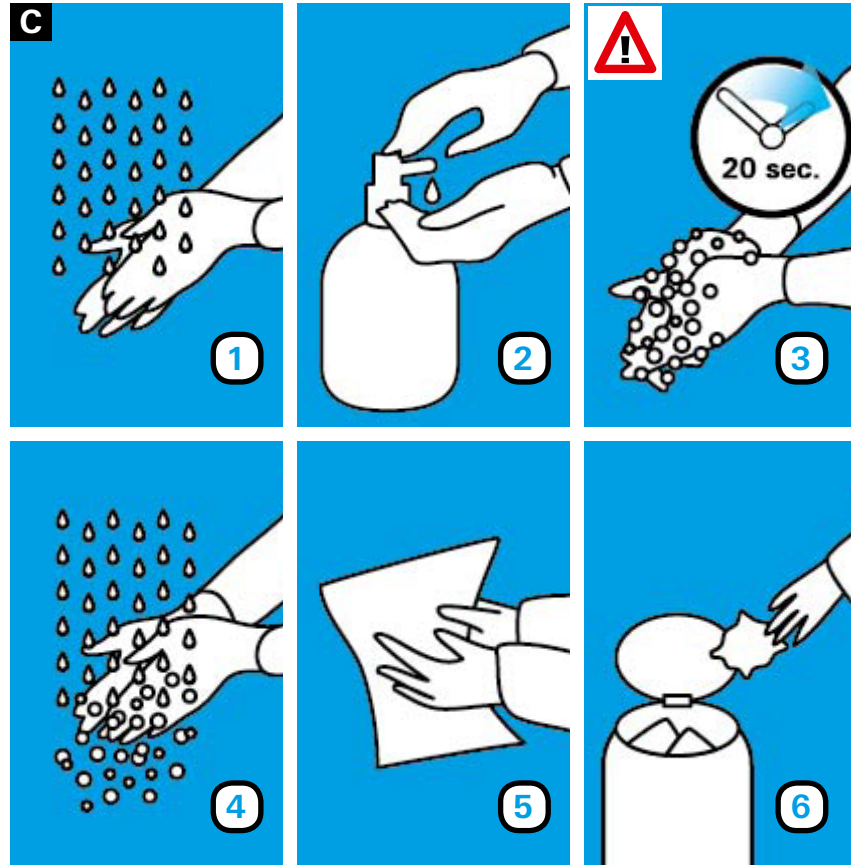
(when and how)

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

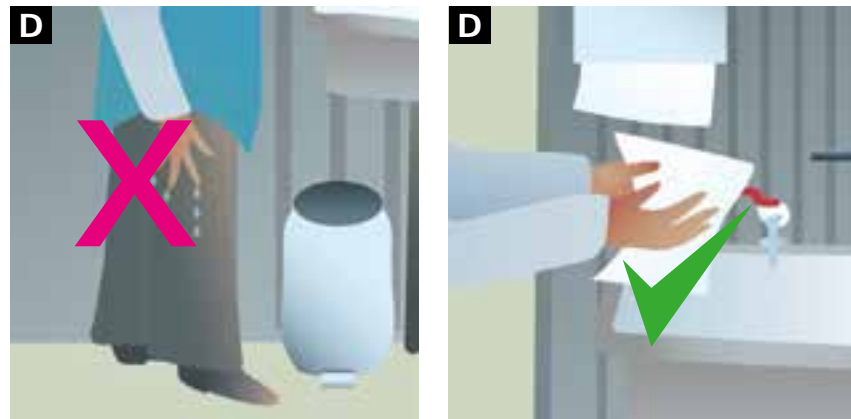
1. Wet hands with potable water
2. Apply soap
3. Scrub hands, between fingers and under fingernails, and top of your hands for at least 20 seconds –

⚠️ 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

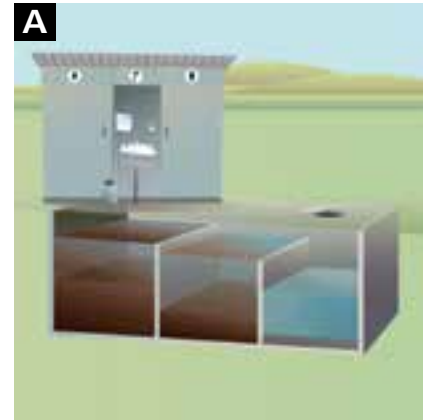
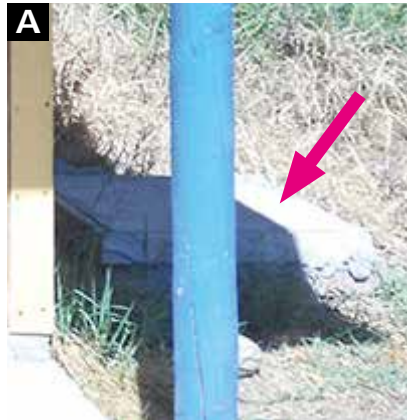
A Toilets should be connected to a sewage disposal system (either municipal sewage system or septic tank system) or a storage tank emptied through a sewage transport truck.

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.



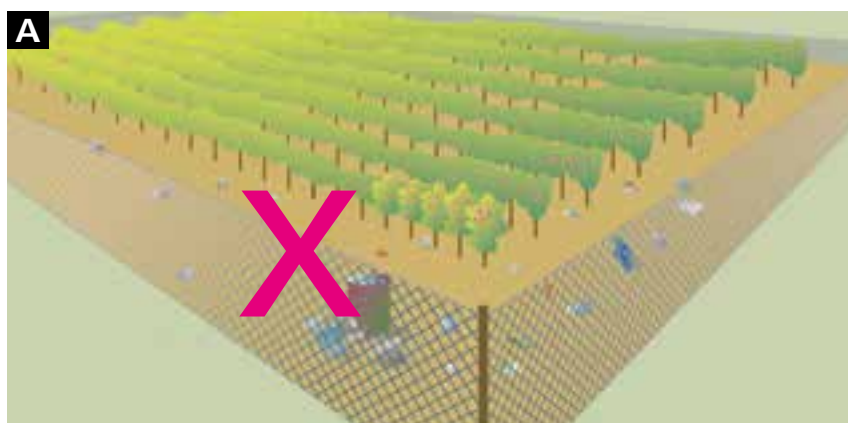
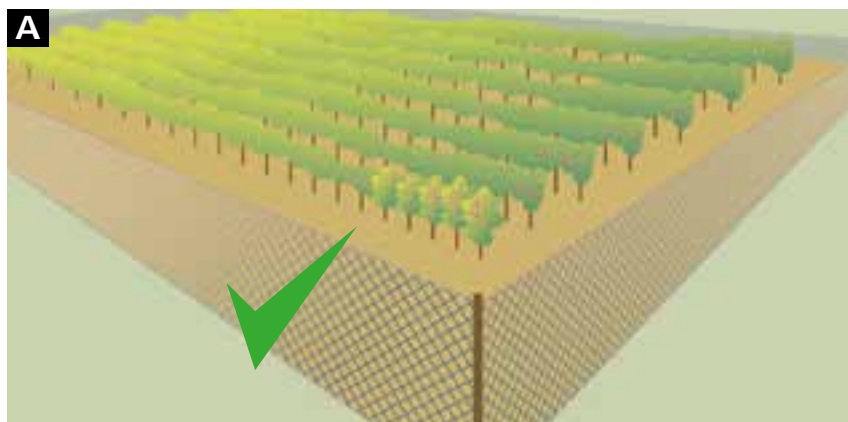
If there is no disposal system, water should at least infiltrate quickly into the soil, without any risk of run-off (e.g. hole in the soil).

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 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.



Restrictions in growing fields and in storage areas

A Jewelry and visible body piercings are prohibited.



B 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 produce.



C Children should not be present in growing fields and storage areas where produce and/or equipment are stored.

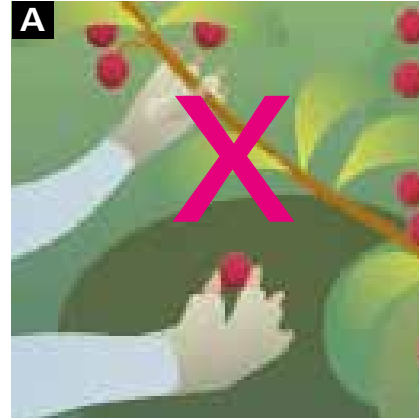
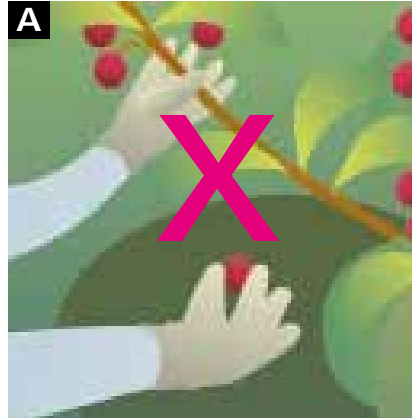


D Use signs showing restrictions.

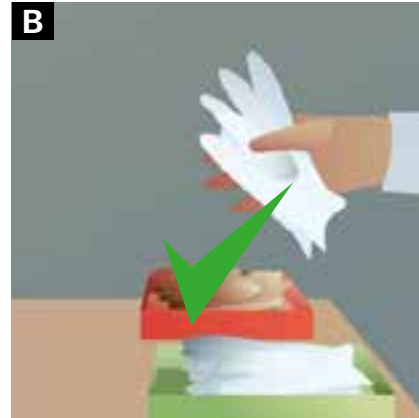
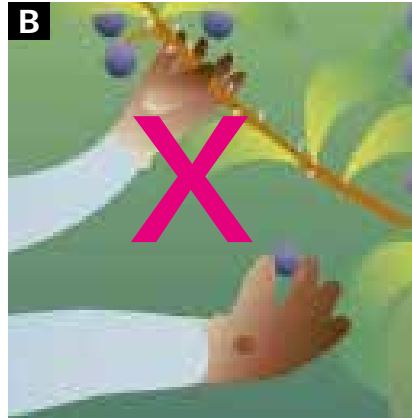



Glove policy

A The use of gloves (unexposed and exposed fingers) are mostly prohibited for harvest operations, unless otherwise stated (e.g. by regulation).



B Where gloves are considered necessary for the safety of the worker (e.g. some raspberry bushes might be thorny), clean gloves, in good repair should be provided by the farm. Gloves should be replaced when they become torn, soiled or otherwise contaminated.



 The wearing of gloves or the use of hand sanitizers 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).



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



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.

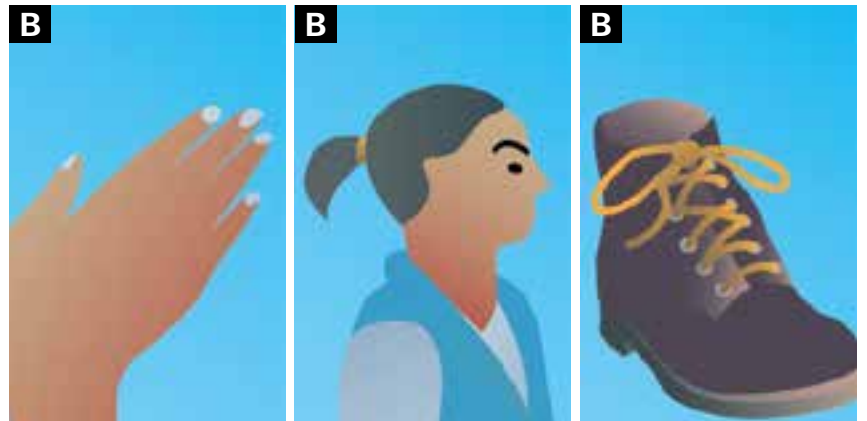


Personal hygiene and clothes

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 It is advisable to use hair coverings for field workers.



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

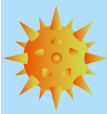


 **Conventional household washing detergents have a good virucidal efficiency at or above 40°C.**

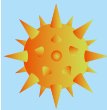


Worker illnesses and open lesions

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.

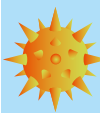


B Any worker showing symptoms of an infectious illness should not have direct or indirect contact with produce and therefore should be excluded from the crop production area.



Worker illnesses and open lesions

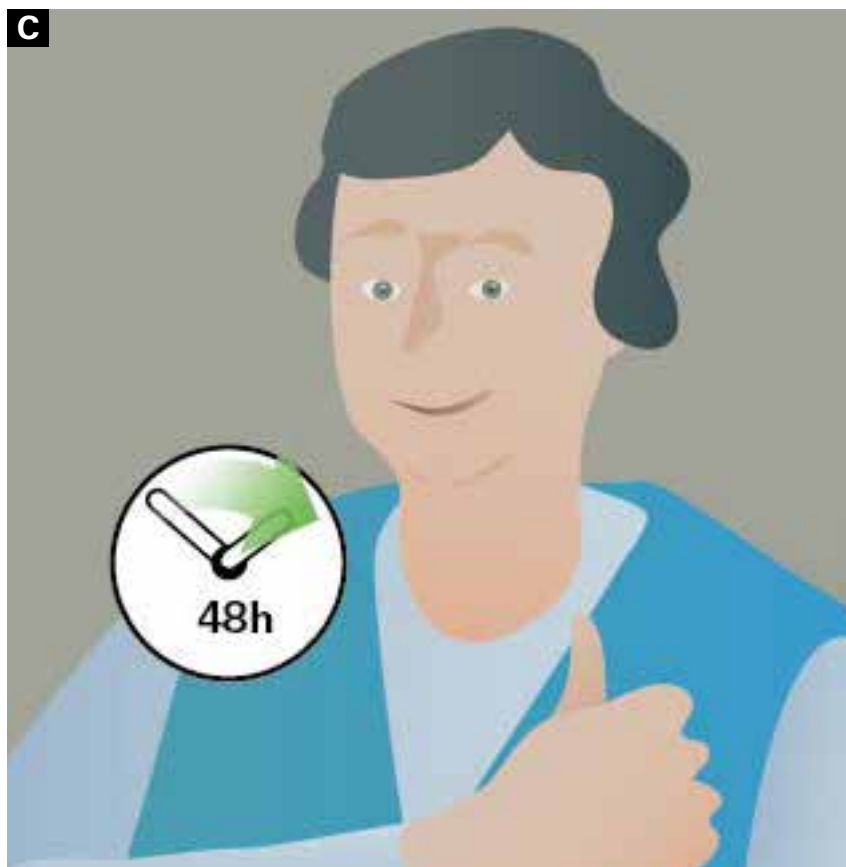
C Workers with symptoms of gastroenteritis or with symptoms of acute Hepatitis A should only be allowed to return to work 48h after disappearance of symptoms of vomiting and diarrhea and after disappearance of jaundice for hepatitis.

 **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 they are covered with a non-permeable covering bandage or glove (in compliance with glove policy).

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 produce or harvesting equipment, the worker should not have direct contact with produce or equipment.



Body fluid policy

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

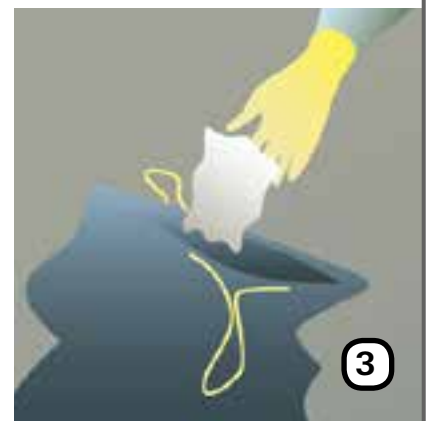
1. The contaminated produce should be segregated and disposed of;
2. The contaminated area should be confined, cleaned and disinfected immediately;
3. Contaminated equipment should be cleaned and disinfected immediately;
4. Stock of material to clean up and disinfect after spillage should be maintained (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 (≥ 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).

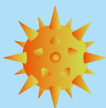
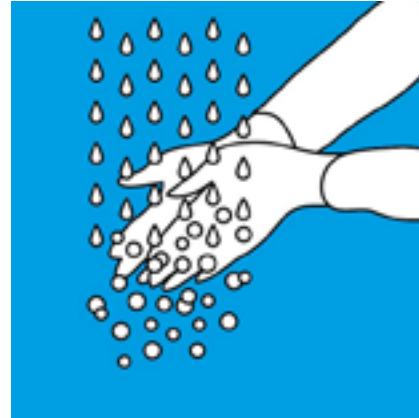
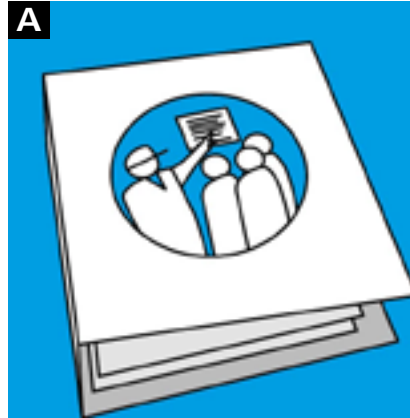


C Drinking cups (single-use) or water bottles should not be shared.



Training

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



The virus risk (Norovirus and Hepatitis A) should be included.



An educational poster titled "فيروس التهاب الكبدى أ (بوصفير) Virus d'hépatite A". It features a central illustration of a human torso with the liver highlighted in red. The poster is divided into sections: "الوقاية" (Prevention) with icons for a toilet and water tap, "تعريف" (Definition) with text explaining the virus, "الأعراض" (Symptoms) with icons for a stomach, cough, and eye, and "طرق انتقال الفيروس" (Transmission routes) with icons for direct contact, food, and water. A circular inset at the bottom left shows a training session icon.

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!

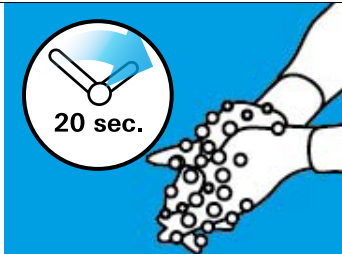
1. Provide clean toilets with toilet paper, which are connected to a sewage disposal system.



2. Provide hand wash station with soap, with either potable water or type A water, 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

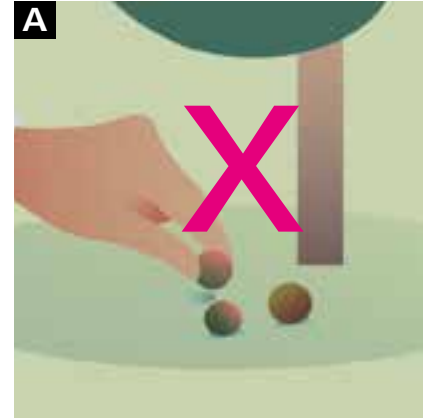
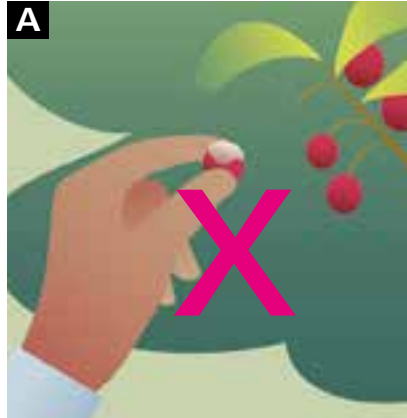
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Workers instructions and supervision

83

Hand harvesting practices

A Do not pick berries that have signs of contamination (e.g. bird droppings or moulds) or that have fallen on the ground.



B Avoid overfilling your hands, do not squeeze or roll the fruits.



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

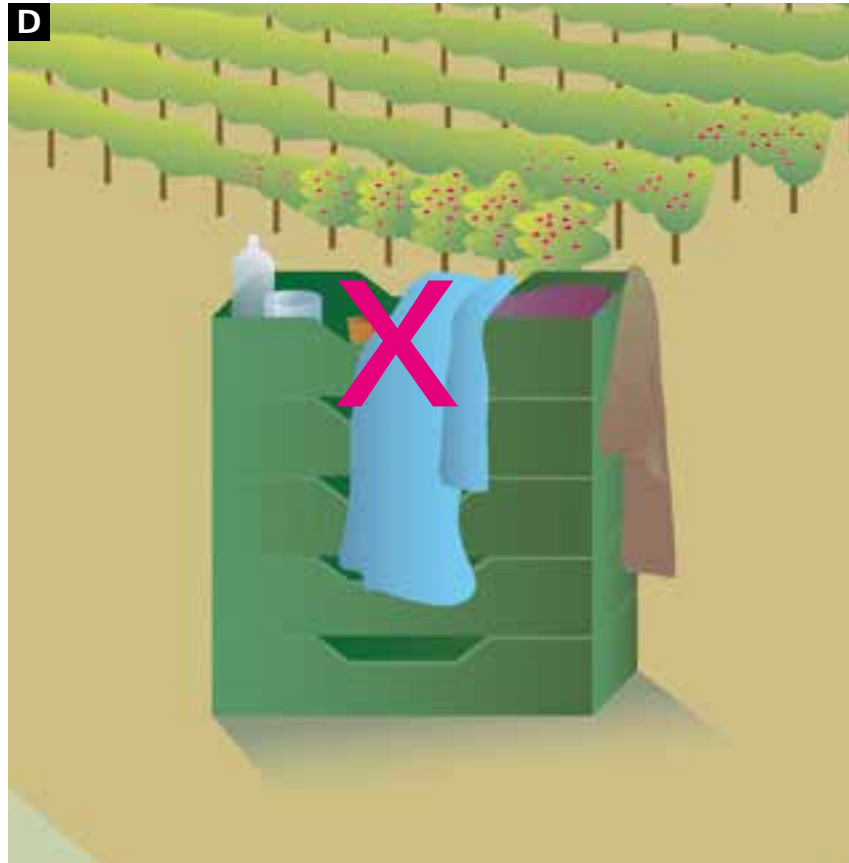


Hand harvesting practices

D 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.



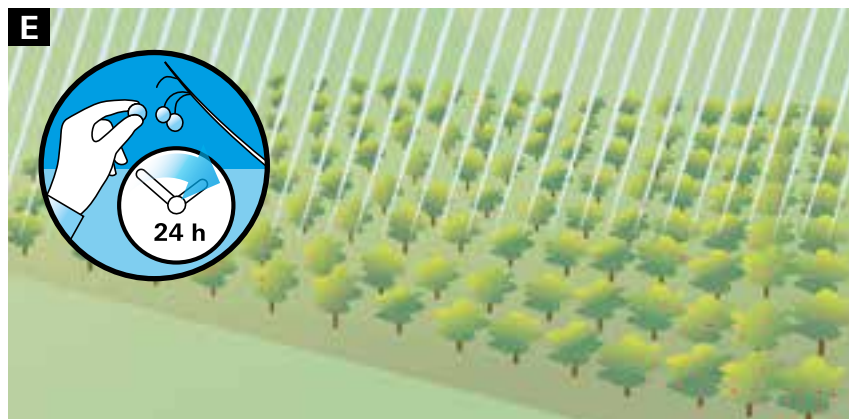
Harvesting containers should be made of material which can be easily cleaned such as plastic. Do not use wood containers.



E It is advisable to wait 24 hours after a rain to harvest non-covered berries which are grown on soil (e.g. strawberries).



If berries have come into contact with floodwater, record the incident. Further use should be discussed with your berries purchaser, according to the extent of the flooding. In the event of a severe flooding with berries submerged, these berries should not be harvested.

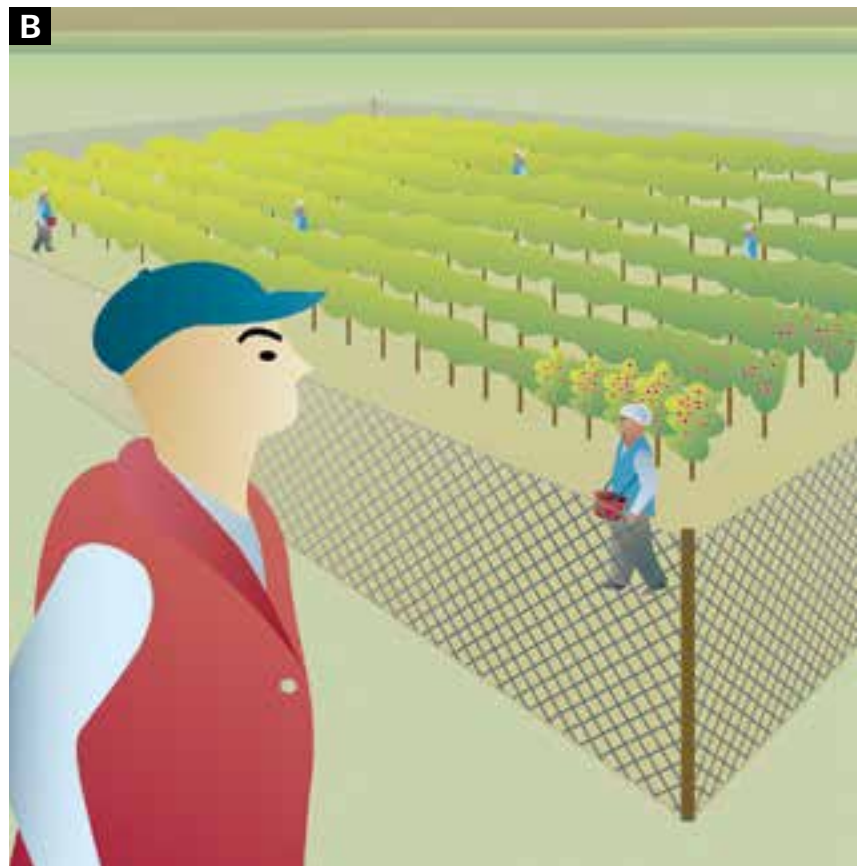


Workers instructions and supervision

A Hand pickers are trained on hand harvesting practices (see previous section, A to D).



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




Worker harvesting practices: REMEMBER!

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



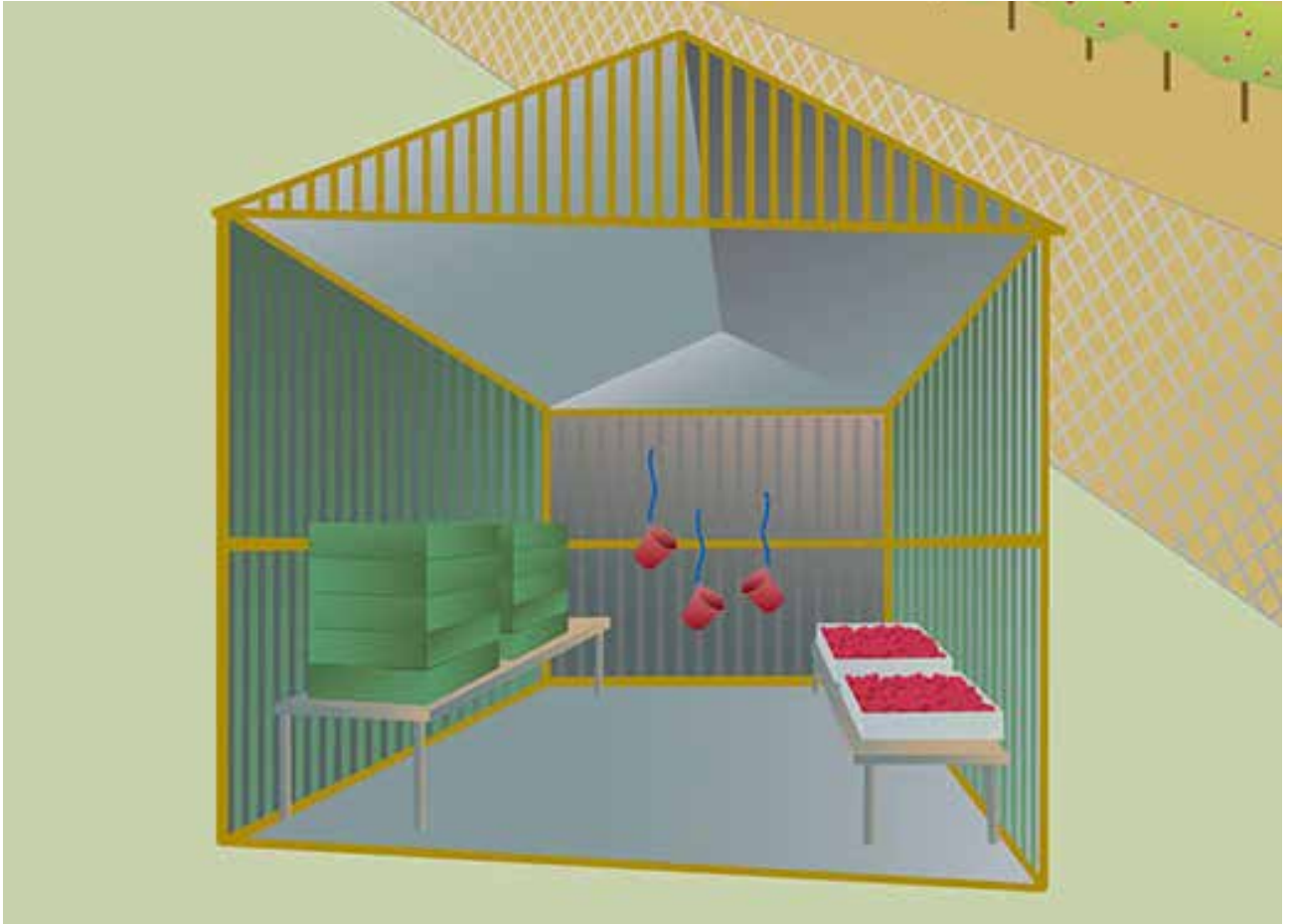
2. Train workers on hand harvesting practices e.g. do not pick berries that have signs of contamination.



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



7. Harvesting equipment, storage areas and transportation



Best practices for cleaning	87
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Best practices for cleaning (harvesting containers, utensils/tools, harvesting 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.

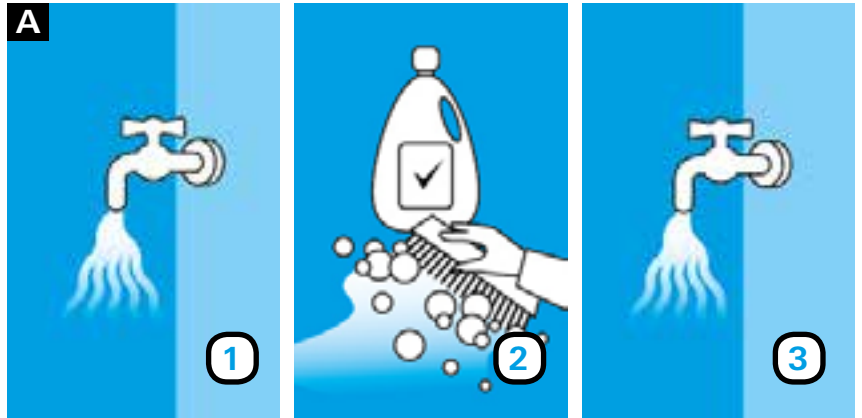


Water quality should be potable water (absence of *E. coli* in 100 mL).

If not possible to use potable water, water should have microbiological quality of that used for produce contact (Type A water) with adequate testing regime (see chapter on Agricultural water, Table 2, page 52–53).

B 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.

Contact your berry purchaser if you need some recommendations on which detergent and/or sanitizers to use.



TYPE A water



Best practices for cleaning (harvesting containers, utensils/tools, harvesting machines, storage area and transportation vehicles)

C For materials/surfaces that cannot be cleaned with water (e.g. compact soil ground in a storage area), 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.



D All cleaning (and sanitizing) activities are conducted away from produce to reduce the potential for contamination.



Harvesting containers, utensils/tools and harvesting machines

A Before use, keep harvesting containers off the floor or ground (e.g. on pallets, carts or shelves) in a sufficiently contained area.



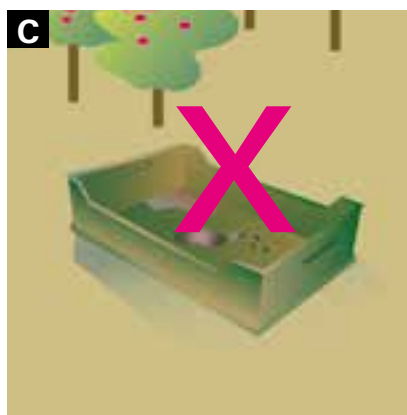
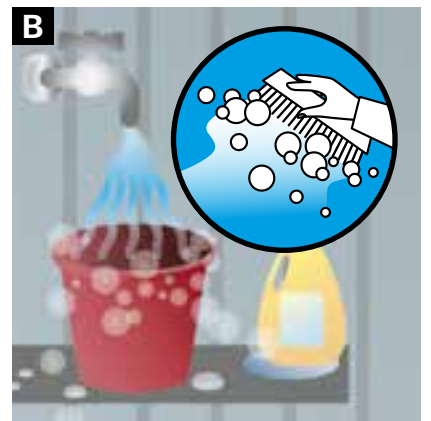
If they are stored outside without being properly protected, they have to be cleaned and sanitized before being used.

B Clean all harvesting containers and utensils/tools that come in contact with berries (e.g. baskets, crates) regularly during the harvesting season. Baskets belonging to the farmers should be cleaned daily, crates should be cleaned after each delivery to the processing plant.



After cleaning, sanitizer can be applied if practical (e.g. to crates at the processing plant which are under the berry purchasers responsibility).

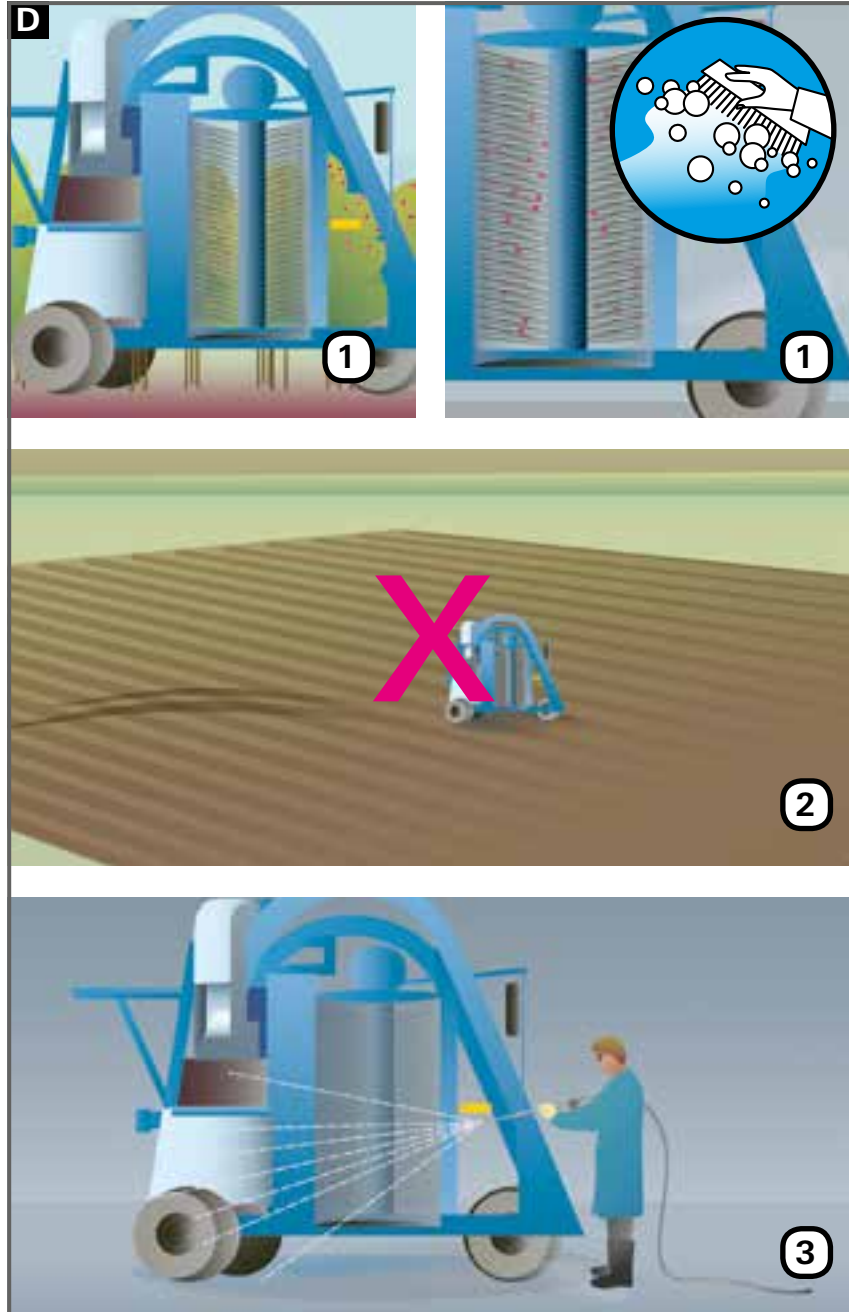
C Do not use harvesting containers which have not been properly cleaned.



Harvesting containers, utensils/tools and harvesting machines

D When machines are used in the harvesting process (i.e. mechanical harvesting):

1. Clean all machine surfaces that have been in contact with berries between consecutive harvests.
2. Avoid moving these machines across fields where raw manure or compost was applied.
3. Clean them completely when needed and at the end of the season (e.g. if the machine runs over an area with heavy animal intrusion or faecal deposits).



Storage areas

For on-farm storage areas where berries are stored for no longer than 12 hours

A Storage areas should be sufficiently contained (roof, door, walls or at least a net!) to protect berries and harvesting equipment from external contamination (e.g. from pest animals).



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



To prevent contamination from pest animals, the focus should be on exclusion and restriction measures, such as described in A and B.



Storage areas

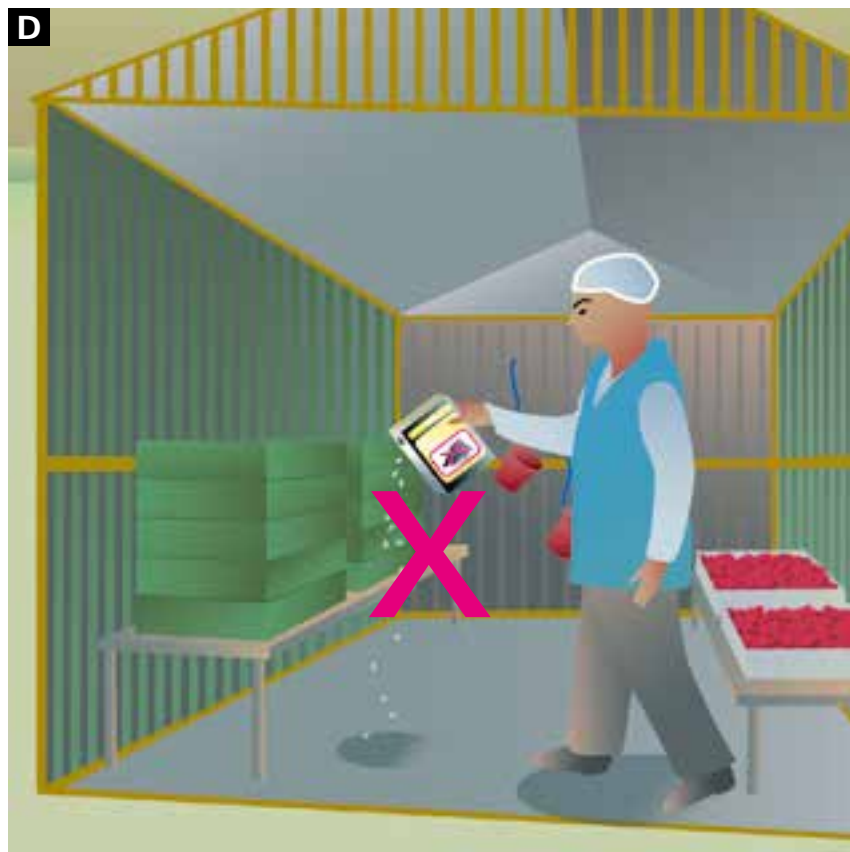
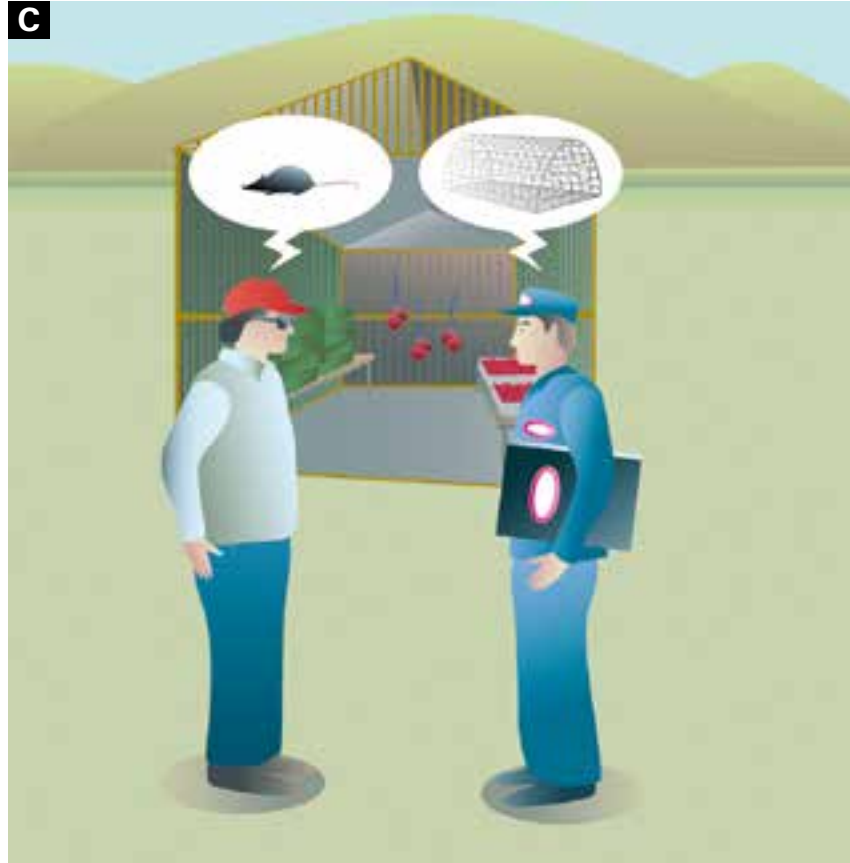
For on-farm storage areas where berries are stored for no longer than 12 hours

C If the above restriction measures are not effective enough to control pest animals in storage areas, traps may be used. These traps must be legal in the country of use and live traps (i.e. no killing) should be favored if possible.



A competent professional should be consulted to ensure the legality and design of the trap, so that the correct species is targeted. If you do not know whom to contact, discuss with your berries purchaser first.

D Do not use rodenticides in storage area unless they are needed to control an infestation and are legally permitted. As for traps, a competent professional should be consulted to ensure correct, safe and effective use.



Transportation from crop production area to processing plant

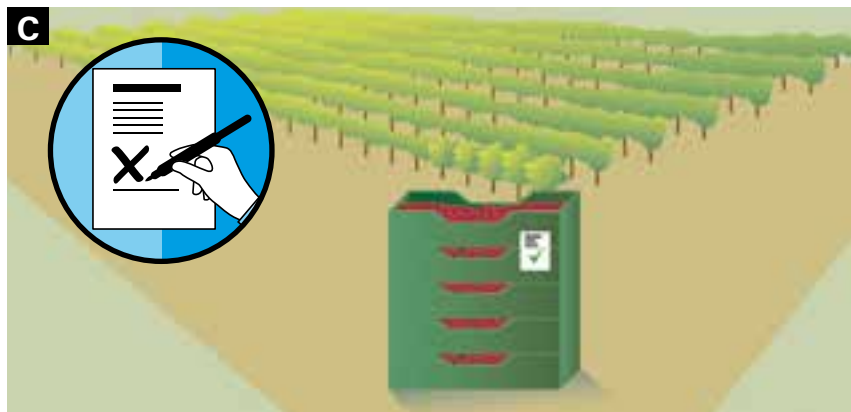
A Transportation vehicles used to move produce from crop production area to processing plant should be cleaned (and sanitized if practicable) at the beginning of the harvesting season and then as much as needed afterwards.



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

B If the transportation vehicle is not closed, use covering such as tarpaulin to protect berries during transport.

C Label produce moving out of the field to enable traceability.

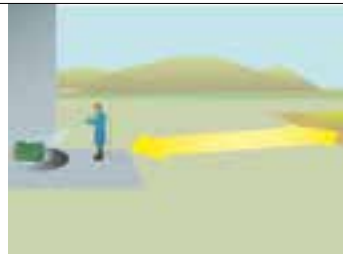


Harvesting equipment, storage areas and transportation: REMEMBER!

1. Perform cleaning of harvesting equipment, utensils/tools in contact with produce, storage areas and transportation vehicles.



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



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



4. Produce storage areas should be sufficiently contained to protect berries from external contamination (e.g. from pest animals).



5. Use transportation vehicles which are closed or at least with a covering such as tarpaulin.



Records and Documents



Records

97

Documents

99

Records

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

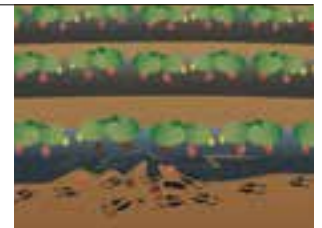


Records are important to show an action is taken (e.g. regular cleaning of toilets). Therefore, the following actions/data should be recorded and a person should be responsible to maintain the records in a timely manner. Records should include the date, person responsible and procedure/document used 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...).

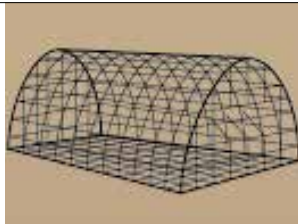
A Microbiological water analyses results (*E. coli* in 100 mL) from the laboratory.



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

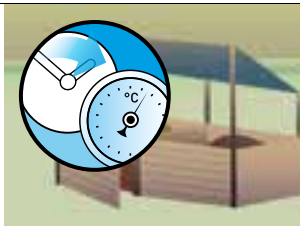
I Free chlorine level monitoring, if water is chlorinated at farm due to *E.coli* ≥ 100 CFU/100 mL.



J Manure application.



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



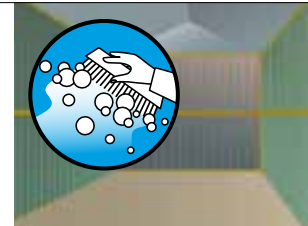
L Validation results of the composting process (on-farm composting) or certificate of compliance (compost from supplier).



M Cleaning of toilets.



N Cleaning (and sanitizing) of storage areas.



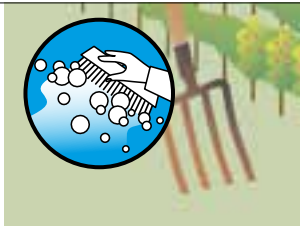
O Cleaning (and sanitizing) of transportation vehicles.



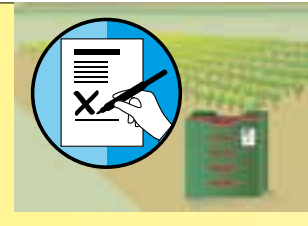
P Cleaning (and sanitizing) of harvesting equipment (harvesting containers, harvesting machines...).



Q Cleaning and sanitizing of tools and utensils used for both composting and berry activities and/or for both animal and berry activities.



R Labelling of produce moving from the field to the processing plant (i.e. unique ID number).



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 Training material (e.g. pictures) showing harvesting practices (i.e. not pick berries that have signs of contamination).



E Procedure for cleaning (and sanitizing) of harvesting equipment, storage areas and transportation vehicles.



Think about foreign bodies!

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

From produce 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.
- Storage areas for harvested berries and harvesting container as well as transportation vehicles are maintained and inspected to not be a source of foreign bodies (e.g. glass, metal, stones and wood).

