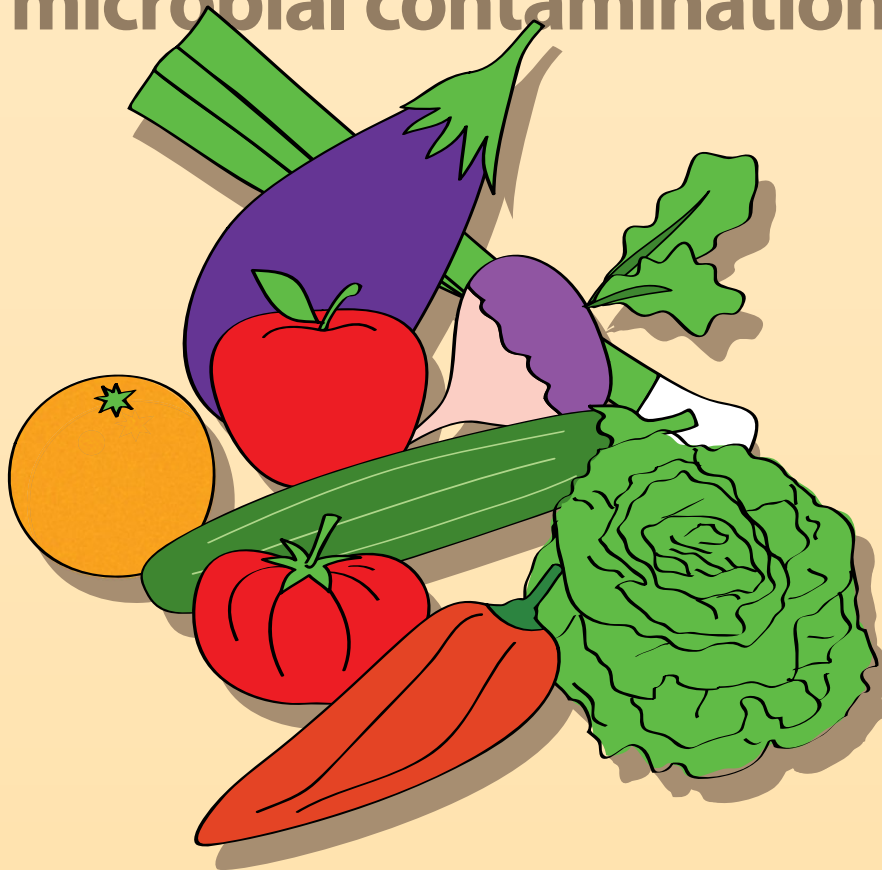




Five keys to growing safer fruits and vegetables: promoting health by decreasing microbial contamination



Trial edition for field testing

June 2011



World Health
Organization

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Introduction

The problem

The importance of fruits and vegetables in nutritious, healthy diets is well recognized, and in recent years consumers have been encouraged to eat more of these products. For many countries, particularly developing countries, these products have become a valuable commodity.

At the same time, food safety problems linked to the consumption of fresh fruits and vegetables contaminated with microorganisms are increasing. Recent foodborne outbreaks linked to the consumption of leafy greens, tomatoes, sprouts and green peppers clearly demonstrate that the consumption of contaminated fruits and vegetables represents an important source of foodborne disease. Efforts to minimize the microbial contamination of fresh fruits and vegetables are essential and timely.

The World Health Organization response

The World Health Organization (WHO) develops global risk communication messages and training materials to assist countries in strengthening their food education programmes. The WHO Five Keys to Safer Food global message and training materials¹ were developed to educate all food handlers, especially consumers preparing food for their families in the home. These materials are now recognized as an international source for conducting national food safety education programmes.

In May 2010, the 63rd World Health Assembly (WHA), the top governing body of the WHO, reconfirmed that foodborne disease continues to represent a serious threat to the health of millions of people in the world, particularly those in developing countries...and endorsed the importance of food safety education by adopting the resolution: “*Advancing food safety initiatives*”², which urges Member States “*to continue to develop and maintain sustainable preventive measures, including food safety education programmes, aimed at reducing the burden of foodborne diseases*”.

Objectives and contents of this manual

In 2008, a joint Food and Agriculture Organization of the United Nations (FAO)/WHO Expert Meeting on the microbiological hazards in fresh leafy vegetables and herbs³ reviewed the scientific data and made recommendations for limiting the risks associated with microbial contamination of these products. An important recommendation from the meeting was that the WHO develop training and educational materials based on the Five Keys to Safer Food concept. This concept is that a simple global message based on scientific evidence must be easy to use, adopt and adapt so that community and health educators can tailor the training materials to meet local needs. The manual ***Five keys to growing safer fruits and vegetables: promoting health by decreasing microbial contamination***, is designed to support food safety education of rural workers (including small farmers⁴) who grow fresh fruits and vegetables for themselves, their families and for sale in local markets.

With this manual, WHO is extending the Five Keys to Safer Food concept to cover additional groups across the farm to table continuum to promote safe food handling practices and prevent foodborne diseases.

The manual describes key practices to reduce microbial contamination of fresh fruits and vegetables during planting, growing, harvesting, and packaging and raises awareness of the links between the health of humans, animals and ecosystems and how failures in good hygienic practices in one sector can affect the others.

¹ The WHO Five Keys to Safer Food at www.who.int/foodsafety/consumer/5keys/en/index.html

² Advancing food safety initiatives at http://apps.who.int/gb/ebwha/pdf_files/WHA63/A63_R3-en.pdf

³ Microbiological hazards in fresh leafy vegetables and herbs at www.who.int/foodsafety/publications/micro/mra_fruitveges/en/index.html

⁴ Major industrial farmers would refer to the Good Agricultural Practices (GAP) developed by the FAO

The Five keys practices are:

1. Practice good personal hygiene
2. Use safe water for irrigation
3. Protect fields from faecal contamination by animals, including birds
4. Use treated manure and treated faecal waste
5. Keep harvest equipment, containers and storage facilities clean and dry

- *It is important to note that the key practices discuss reducing rather than eliminating contamination of fruits and vegetables from dangerous microorganisms. Knowledge and technologies that can eliminate all food safety problems associated with the microbial contamination of fruits and vegetables do not exist.*
- *The key practices presented in the manual aim at reducing microbial contamination only.*

The course also describes the reasons why these practices are important, and offers practical recommendations on how to carry out the key practices in the growing fields. The information is accompanied by training exercises and discussion points that emphasize and review these practices. The course also contains information for the trainer related to planning the training session(s), ideas for locations, and suggested methods for presenting the information.

The course is designed to be used by health educators conducting health promotional teaching in rural communities. However, the manual can also be used by sanitarians, producers, environmental engineers, agriculture school teachers and health professionals, or by rural workers themselves. Trainers are encouraged to adapt the teachings and safe food messages to the local conditions. However, the key learnings are based on science and must stay constant in order to remain consistent with international food standards.

Sharing experiences and testing solutions

The concept of the training course was presented to health educators in Belize in 2009 prior to the development of the manual. The manual was subsequently pilot-tested in Guatemala in 2010 in collaboration with the Pan American Health Organization (PAHO) country office through the organization of two training sessions in rural communities.

This edition of the manual is a trial edition for field testing. WHO welcomes comments from countries on the manual and feedback from training sessions. These comments will be incorporated in the manual prior to finalization scheduled by the end of 2011.

Comments should be sent to foodsafety@who.int

Acknowledgments

The technical and financial support of the United States Food and Drug Administration (USFDA) in developing the manual and piloting the training sessions is gratefully acknowledged.

Planning the training sessions

This section provides suggestions for planning the training. Use it as a guide to understand your audience and prepare for your upcoming training session(s).

Choosing a training location

Various places are good locations to hold discussions or make a presentation. Explore the availability of possible locations for the training. These might include:

- Community centres
- Churches/places of worship
- Clinics/health facilities
- Schools
- Rooms/gathering spaces at the worksite
- Home visits

In some communities, it may be appropriate and/or customary to visit with the town or church leaders to obtain their support prior to setting up a training session. These community leaders often serve as decision-makers for programmes in the community.

Once you've identified a location, determine the resources that are available to conduct the training, such as the availability of easels/flip charts, computers, copying machines, and meeting rooms. For sensitive topics, such as the discussion of proper personal hygiene or diapering practices, many trainers find one-on-one home visits to be most comfortable. Trainers may wish to plan home visits as part of the training session.

Learning about the participants

Learning about the participants — and being sensitive to their lives and situations — can help you be more effective in getting them to adopt safer practices for growing fruits and vegetables. By watching and listening to what is currently happening in the growing fields, you can offer solutions that make it easier for people to incorporate these practices in their daily lives.

- For example, if soap and clean, safe water are not located near toilet facilities, hand washing after toileting is not feasible or practical. In this instance, a solution would be to move the soap and clean, safe water near the toilet.

In order to get to know the participants, there are some basic questions to consider. Obtaining the answers to these questions will enable you to plan the most successful and effective training experience for the group. For example, you can explore:

Who are the members of the group?	→	Gender, employers, parents, spouses, workers
Where are they located?	→	Can they come to you, or do you need to go meet them in their location?
How many participants are attending?	→	Plan your space and materials accordingly
What language(s) do they speak?	→	Do you need someone to translate? Should you enlist a trainer that speaks a different language?
What is the group's reading level?	→	Can you use flyers/posters to invite community members? Or, are verbal invitations more appropriate?
To what organizations do they belong?	→	Do these organizations/groups have meeting space available? Will they welcome your presentation?

In some cases, you may be new to an area, or may be reaching out to a group within the community with whom you are less familiar. If so, exploratory neighborhood walks and speaking with the people and community leaders may help you get to know the participants and their neighborhoods better.

Special sensitivities

Given the nature of health and hygiene education, the topics of this course may invoke special sensitivities. It is important to handle these sensitive topics carefully. Smaller sessions may be more effective for discussing issues such as toileting, hygiene, and the presence of children in the growing fields.

In addition, be aware that factors such as gender, customs, and role/position within the growing fields can affect the dynamics and comfort level of the group.

- Women may be less willing to speak openly about hygiene or child-rearing practices in front of men.
- Employees may hesitate to “speak up” in front of their employers.
- Various customs or special situations could impact effective communication with the participants.

For example: workplace issues, such as the ability to make changes to a farm’s standard practices or equipment; or the willingness of people to change routines/adopt new practices during busy planting and harvesting times.

Be sure to choose a presentation method and approach that is appropriate for the audience and the available meeting space. In addition, take all potentially sensitive factors into account while planning your presentation(s):

- Longstanding practices, attitudes and social taboos
- Education and prior training
- Infants/children in the growing fields
- Diversity in the audience (cultural, social, traditional, gender-based)
- Education level
- Language/dialects
- Physical setting: making the actions realistic and easy to implement
- Willingness to raise awareness around symptoms and signs of disease
- Importance of training when new crops are being grown for the first time

Once you have reviewed the training manual/materials, secured your training location(s) and considered the needs and sensitivities of the participants, you can tailor the training sessions to the local conditions and facilities, and needs/skill level of your audience.

The next step is to conduct the training session(s). A suggested agenda follows.

Training day agenda

On training day, it is helpful to follow a specific agenda to ensure that all the important material is covered. The suggested agenda below follows the design of the manual and allows for the fullest use of the material. The programme is designed to be completed in one day; however, you can split it up into several short sessions if you prefer. Also, keep in mind that some of the more detailed Keys, such as “Use safe water for irrigation”, may take longer and lead to extended discussions.

If you'd prefer, you may distribute the **Five keys to growing safer fruits and vegetables** mini-poster illustration at this point if you feel it will help the group understand the educational messages of this training. Otherwise, distribute it at the end of the training, as described in Step 5 below.

1. Welcome and introductions

Use the beginning of the training to introduce yourself and visit with your audience to make them feel comfortable. This will help make the course discussion and participation easier, and will facilitate learning. Have everyone introduce themselves. Conduct the Opening exercise/Icebreaker.

2. Review the course objectives

Take time to briefly go over the objectives of the course so everyone has a common understanding of the purpose of the training. Stress the importance of the training for the health of the participants, their families, and the community.

Training objectives

- Understand how contamination of fruits and vegetables occurs
- Learn good personal hygiene practices to prevent contamination of food
- Use irrigation methods that minimize food contamination
- Understand how to minimize faecal contamination of fruits and vegetables
- Learn how to properly treat and apply manure to growing fields
- Develop harvesting techniques to create a safer food supply
- Protect the health of their family and the community

3. Summarize basic concepts section

As the trainer, you should be familiar with all the information presented in the basic concepts section. This will enable you to answer questions that may come up during your training sessions. However, keep in mind that not all of the basic concepts material provided in this manual needs to be presented in the training. Depending on specific issues in your area, you may choose to spend more or less time on a particular basic concept. However, it is important to give a brief overview of what dangerous microorganisms are, where they come from and how they can contaminate fruits and vegetables in order to establish the relevance of the training.

4. Discuss the key learnings for each of the Five keys, then perform its related training exercise.

Review the key learnings and why for each key with the group, and then perform the exercise related to each key. If the group is too large to complete the exercises effectively, break up into smaller groups to complete the exercises.

5. Hold a question and answer session after discussing each key.

Make sure to give time for questions and answers after discussing each of the Five keys. This will help ensure that the participants fully understand the material. Do the same for all Five keys, and then summarize them with the group at the end.

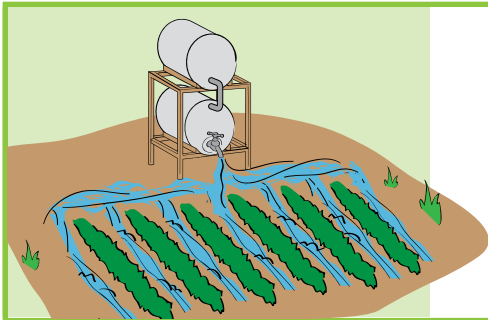
If possible, make copies of the **Five keys to growing safer fruits and vegetables** mini-poster and hand them out to each participant at the end of the training. Suggest that the participants post their copy somewhere near the growing fields, such as in a shed or storage facility, for use as a reminder.

Now that you are familiar with the agenda, it's time to proceed with the training.

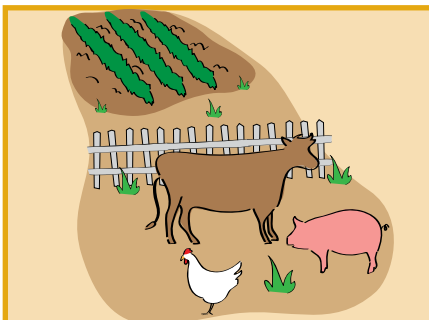
Five keys to growing safer fruits and vegetables



Practice good personal hygiene



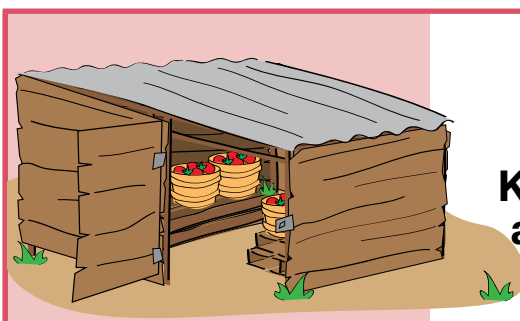
Use safe water for irrigation



Protect fields from faecal contamination by animals, including birds



Use treated manure and treated faecal waste



Keep harvest equipment, containers and storage facilities clean and dry



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Training exercise

Opening exercise/icebreaker: About me – Fact or Fiction?

Objectives

This exercise serves to help familiarize participants with each other and get them “chatting” comfortably. It also introduces the Fact or Fiction? approach that is the format used in later exercises.

Supplies needed: paper and pens/pencils

Steps

1. Divide the participants into groups of four. Give each participant a small piece of paper and a pen/pencil.
2. Invite each person to write down one true fact about themselves/their family. Then, have them write down one “myth,” or lie, about themselves/their family. (Remind them that the lie should be something believable.)
3. Have group members share their truths and lies with each other, and guess which is which. This is a great opportunity for participants to find out about each other, and share some camaraderie as they debate fact versus fiction.
4. As a wrap up, go around the room and have each participant share their true statement with the group.

Basic concepts

What is foodborne disease?

Every day, people all over the world get sick from the food they eat. This sickness is called foodborne disease and can be caused by dangerous microorganisms.

Eating fruits and vegetables contaminated with dangerous microorganisms is a source of foodborne disease.

Preventing microbial contamination is the best way to prevent disease and improve your health and that of your family and community.

Training tip:

For simpler language, use the terms “germs” for microorganisms.

What are microorganisms?

Microorganisms are very small living things. In fact, they are so small that they cannot be seen with the naked eye.

There are three different types of microorganisms: the good, the bad and the dangerous.

Good microorganisms are useful. They are used to:

- Make food and drinks (e.g. cheese, yoghurt, beer and wine)
- Make medicine (e.g. penicillin) ; and
- Help digest the food you eat

Bad microorganisms, or spoilage microorganisms, usually do not make people sick. However, they cause food to look, smell and taste bad.

Dangerous microorganisms make people sick and can even cause death. These microorganisms are called “pathogens”.

Most dangerous microorganisms do not change the appearance of the food—so you usually can’t tell that the food is contaminated with dangerous microorganisms by just looking, smelling or tasting it.

Training tips:

Become familiar with dangerous microorganisms in your region.

Stress that microorganisms cannot be seen.

Providing pictures or actual examples of mouldy fruit may add interest, but be sure to stress the important point that dangerous microorganisms may not always make the food smell, taste or look bad.

How does microbial contamination occur?

Microorganisms are everywhere.

All living things have microorganisms associated with them.

Animals including humans carry microorganisms in their mouths, gut and on their skin including hands and feet.

Many dangerous microorganisms are excreted in human and animal faeces.

Microorganisms rely on someone or something to move them around. The transfer of microorganisms from one surface to another is called “contamination”.

Hands are a common method of transferring dangerous microorganisms.

In the growing field, contamination with dangerous microorganisms comes directly from faecal material and indirectly from:

- Poor personal hygiene practices of workers
- Contaminated water applied directly to the fruits and vegetables
- Untreated manure used as fertilizer
- Human and animal faeces, including bird droppings in the growing fields and
- Use of dirty harvest equipment, containers, and storage facilities

Training tip:

Give a demonstration of contamination by touching your hand to your face and then touching some food with that same hand.

How do microorganisms grow?

Most microorganisms “grow” by multiplication. To multiply, microorganisms need:

- Food
- Water
- Time
- Warmth

One dangerous microorganism can become 2 in just 15 minutes. This means that within 6 hours, 1 bacterium can multiply to over 16 million.

To become harmful, some dangerous microorganisms need to grow to large numbers. Other dangerous microorganisms can cause illness when they are present in very low numbers.

Under favourable environmental conditions, dangerous microorganisms can survive and multiply for long periods of time (even months) on the surface of fruits and vegetables. This is particularly dangerous to health because fruits and vegetables are often eaten raw.

Dangerous microorganisms may be on the outside of the fruits or vegetables, in which case washing the fruits and vegetables with safe water before eating will remove some dangerous microorganisms.

In other instances, dangerous microorganisms are inside the fruits or vegetables, and cannot be removed by washing.

Training tips:

- Discuss local foods that do and do not provide the ideal conditions for growth of microorganisms.
- Demonstrate the concept of microbial growth using dried beans, pebbles or other objects.
- Start with one object. In 15 seconds make it two objects, in another 15 seconds make it 4 objects and in another 15 seconds make it 8 objects, etc. (double the number of objects you have every 15 seconds).

Note: For this demonstration, 15 seconds is used instead of 15 minutes, which is the actual time it takes for most bacteria to multiply. This enables you to show how dangerous microorganisms multiply, working within the time constraints of a training session.

What are the symptoms of foodborne disease?

Every year, billions of people experience one or more episodes of foodborne disease, without ever knowing that it was caused by food.

The most common symptoms of foodborne disease are:

- Stomach pains
- Vomiting
- Diarrhoea

The symptoms depend on the cause of the disease. Symptoms may occur very quickly after eating the food, or may take days or even weeks to appear. For most foodborne diseases, symptoms occur 24 -72 hours after the food has been eaten.

It is estimated that 3% of foodborne disease cases can lead to long-term health problems. Very severe diseases, including arthritis and neurological disorders can be caused by contaminated food.

Some foodborne diseases can be transferred from person to person. Caregivers can become sick from family members with a foodborne disease.

For infants, the sick, pregnant women and the elderly, the consequences of foodborne disease are usually more severe and more often fatal.

What to do if you get sick?

Try not to handle or prepare food while you are sick, and for 48 hours after your symptoms stop. However, if this cannot be avoided, wash your hands with soap and water before and frequently during food preparation.

Mouth masks are recommended for people who may cough or sneeze while handling food. Gloves can be used to cover any cuts or lesions and should be changed frequently.

Advice on treatment of foodborne disease differs between countries and should be adapted to the local region.

However, as a general rule, one should drink plenty of fluids to maintain hydration during diarrhea and seek medical advice when bowel movements are very frequent, very watery or contain blood, or when symptoms last beyond 3 days.

Keep fruits and vegetables safe: You can make a difference!

Follow the *Five keys to growing safer fruits and vegetables*:

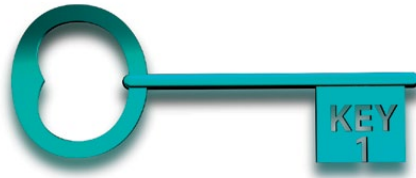
1. Practice good personal hygiene
2. Use safe water for irrigation
3. Protect fields from faecal contamination by animals, including birds
4. Use treated manure and treated faecal waste
5. Keep harvest equipment, containers and storage facilities clean and dry

It is very important to follow the *Five keys to growing safer fruits and vegetables* to keep you, your family and your community healthy and to prevent the spread of foodborne diseases.

A word about pesticides

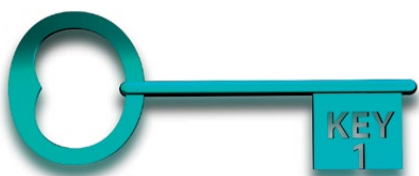
Pesticides are chemicals that can be used to kill pests that damage crops or that carry and spread diseases. They are intended to repel, destroy or control pests, including unwanted plants and animals that cause harm or interfere with the production, processing, storage, transport, or marketing of agricultural products.

The use of pesticides as well as resulting residues on fruits and vegetables can harm farm workers and consumers. However, this manual does not deal with chemical contamination of fruits and vegetables derived from the use of pesticides or the presence of chemicals in the environment. This manual deals with microbial contamination only.



Key 1: Practice good personal hygiene

Key learnings	Why?
<ul style="list-style-type: none">• Wash and dry hands with a clean, dry towel after toileting and diapering a child• Do not defaecate in growing fields• Cover cuts, lesions and wounds with a glove or bandage	<ul style="list-style-type: none">• Dangerous microorganisms are found in faecal waste and infected wounds, and are transferred to fruits and vegetables by hands.• Good personal hygiene practices help prevent the transfer of dangerous microorganisms and decreases the risk of diseases for workers and their families.
<p>How to practice good personal hygiene</p> <ul style="list-style-type: none">• Wash hands using the proper hand washing procedure before entering the field.<ol style="list-style-type: none">1. Wet hands under clean, safe running water. Add soap.2. Wash hands, wrists, in between fingers and under nails in clean, safe water using soap. Continue to rub hands together with soap for at least 20 seconds.3. Rinse hands under clean, safe running water.4. Dry hands thoroughly with a clean, dry towel. If possible, use a paper towel.• Use a toilet or dig a latrine to urinate and defaecate. Wash hands with the proper procedure after using the toilet or latrine.• Properly dispose of all used toilet tissue and feminine hygiene products in the toilet, latrine or in a covered bucket designated for waste (sometimes called a “honey bucket”) in communities that lack a sewage system.• Avoid working in the fields when sick with diarrhoea or other infections to prevent contamination of fruits and vegetables.• Keep faeces that have been removed from the home away from fields where fruits and vegetables are growing. <p style="text-align: right;">Reinforce these teachings with the training exercise for Key 1.</p>	



Key 1: Training exercise

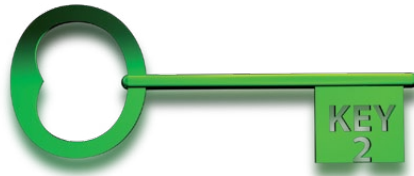
Practice good personal hygiene

Overview

Toileting practices can be passed down from one generation to another. When this happens, it's easy to overlook the effect these traditional practices have on the health of families and communities. It is important to know that simply by following good personal hygiene practices, people can help prevent contamination of fruits and vegetables—and help prevent the spread of disease!

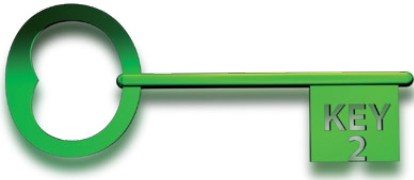
This exercise will focus on current personal hygiene practices dealing with faeces and identify ways to improve these practices.

The problem	Objectives
<p>Dangerous microorganisms in human and animal faeces can be transferred to fruits and vegetables from hands, clothing, and other surfaces, contaminating food, and causing foodborne diseases. This is called contamination. These microorganisms can survive for long periods of time (even months) on the surface of fruits and vegetables.</p>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> • Explain the importance of good personal hygiene practices to prevent spread of disease • Explain good personal hygiene practices when toileting • Identify barriers to good personal hygiene practices • Motivate family, friends and the community to adopt good personal hygiene practices
<p>Training plan:</p> <ol style="list-style-type: none"> 1. Review Key 1: Practice good personal hygiene 2. Have the participants talk about how personal hygiene is practiced in their homes or communities, and about the current toilets and latrines in the community. Encourage participants to talk about both good and poor practices. <ul style="list-style-type: none"> Some questions that can be asked to start the discussion: <ul style="list-style-type: none"> • What practices have you witnessed/experienced in your homes or communities? For example: good practices versus practices that could pose a health risk. <ul style="list-style-type: none"> • How might you reinforce good practices in your community? • How might you influence people to change the poor practices? 3. Restate the most important points with the group. <p>Note: If the group is large, divide participants into groups of 4 or 5. Allow groups 10 – 15 minutes to come up with their lists of what they can do to improve personal hygiene and how they might reinforce good practices and influence those around them to change the poor practices. Bring the entire group back together and ask one person from each group to report on their discussion.</p>	



KEY 2: Use safe water for irrigation

Key learnings	Why?
<ul style="list-style-type: none"> • Prevent animals, including poultry and cattle, from defaecating in water used for irrigation • Store manure, faecal waste and fertilizers away from water used for irrigation • Locate latrines downhill or away from water used for irrigation • Do not rinse or wash soiled diapers in water used for irrigation 	<ul style="list-style-type: none"> • Dangerous microorganisms in faecal waste from animals can be transferred to the soil and crops through the use of unsafe and contaminated water. • Manure and faecal waste from humans, animals and fertilizers are a common source of water contamination. • Locating latrines downhill or away from the growing field prevents contamination during heavy rainfall or natural flooding. • Infant faeces still contains dangerous microorganisms. Cloth diapers should be placed in a waterproof bag or container until an appropriate washing facility can be found.
<p>How to deal with water for irrigation</p> <p>Ideally, all water used on fruits and vegetables should be safe. Typical sources of water for growing fields are rainwater, groundwater from wells, and surface waters including rivers, streams, irrigation ditches, ponds, reservoirs and lakes.</p> <p>Rainwater is safe to use for irrigation when it is collected in clean tanks.</p> <ul style="list-style-type: none"> • Cover the tanks to prevent contamination from birds or other animals. <p>Groundwater from deep, well-constructed wells is safe.</p> <ul style="list-style-type: none"> • Inspect the condition of wells, pumps and pipes regularly for leaks and cracks to ensure their integrity. <p>Surface waters safety is highly variable and difficult to predict because surface waters are very susceptible to contamination from human and animal faeces.</p> <p>If the quality of the water is not known, or cannot be controlled, there are a number of ways to minimize crop contamination with dangerous microorganisms found in the water.</p> <ul style="list-style-type: none"> • Maximize the interval between irrigation with water of unknown quality and harvest (at least one month). • Do not use overhead sprinklers or intentional flooding. • Create a drip irrigation system by using valves, pipes and tubing that allows water to drip slowly to the roots of plants. <ul style="list-style-type: none"> ▪ This method reduces the risk of crop contamination because the edible parts of most crops do not come into direct contact with the water but it is costly and may be impractical for smaller farms. ▪ This method should not be used for root vegetables such as carrots and radishes. If the soil or water used for irrigation is contaminated, it can contaminate the edible portion of the root vegetable. • Create a furrow system by digging small, parallel channels along the length of the field in the direction of the biggest slope. Put water in the top end of each furrow and gravity will enable it to flow down the field. The crop is planted on the ridge between the furrows. The space between the furrows depends on the crop.. <p>Considerations for the trainer:</p> <p><i>If the water supply is known to be contaminated with dangerous microorganisms follow WHO Guidelines for the safe use of wastewater, excreta and greywater. Volume 2: Wastewater use in agriculture, and Volume 4: Excreta and greywater use in agriculture available on-line at http://www.who.int/water_sanitation_health/wastewater/gsuweg2/en/index.html http://www.who.int/water_sanitation_health/wastewater/gsuweg4/en/index.html</i></p> <p style="text-align: right;">Reinforce these teachings with the training exercise for Key 2</p>	



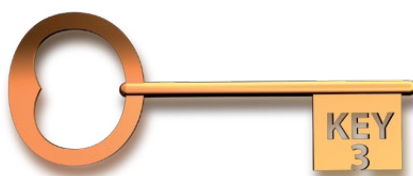
Key 2: Training exercise

Use safe water for irrigation

Overview

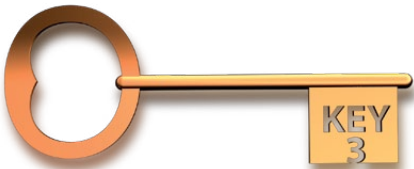
Using safe water for irrigation is critical for growing fruits and vegetables, whether in large fields or in home gardens. This exercise focuses on how to keep water safe from dangerous microorganisms that cause foodborne diseases.

The problem	Objectives
<p>Water that comes in direct contact with the edible portion of fruits and vegetables needs to be safe, or treated to make it safe. Surface water may become contaminated with dangerous microorganisms which can, in turn, contaminate fruits and vegetables directly or indirectly by contaminating the soil close to the plants. Both can lead to foodborne diseases when the contaminated fruits and vegetables are consumed.</p>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> • Explain safe sources of water for irrigation • Know how to protect water sources • Differentiate between safe methods of irrigation versus those that increase the potential for contamination
<p>Training plan:</p> <ol style="list-style-type: none"> 1. Review Key 2: Use safe water for irrigation 2. Have the participants relate their current irrigation practices to the information presented in Key 2. For example: discuss if rinsing diapers in irrigation streams is a common practice. 3. Ask participants to discuss how they can use water to help keep fruits and vegetables safe so that their families, and the people who buy their fruits and vegetables, can be protected against foodborne diseases. 4. Encourage participants to add to the points given to foster a lively discussion. 5. Reinforce learning by using the information provided to emphasize the most important points. Discuss which points participants have control over, and those which they do not. <p>Note: If the group is large, divide participants into groups of 4 or 5. Allow groups 10 – 15 minutes to come up with their lists of what they can do to help keep fruits and vegetables safe, and how they might reinforce the importance of using safe water for irrigation.</p> <p>Pull the entire group back together and ask one person from each group to report on their discussion.</p> <p><i>If a flip chart is available:</i></p> <ul style="list-style-type: none"> • Write the points given as each group presents. Ask them to identify which points they have control over, and which they do not. • Use a different colored marker to check off which ones they can control, and which ones they can't control (for example, if they are an employee at a large farm). 	



KEY 3: Protect fields from faecal contamination by animals, including birds

Key learnings	Why?
<ul style="list-style-type: none"> • Keep livestock downhill from growing fields • Prevent domestic animals, including poultry and pets, from roaming in growing fields • When feasible, separate animals from the growing fields with a fence or pen • Remove trash from around the growing fields 	<ul style="list-style-type: none"> • Dangerous microorganisms in animal faeces can contaminate crops directly, or through contamination of the water and soil. • Keeping pets, livestock and wild animals away from the growing fields helps prevent faecal contamination. The risk of contamination from livestock and wild animals increases with the number of animals present. • If it is not possible to prevent all animals from entering the growing fields, limit the number of animals that enter the growing fields to minimize contamination. • Trash, food and water attract animals and birds. Removing these attractions will help limit the number of animals in the growing fields.
<p>How to protect fields from animals</p> <ul style="list-style-type: none"> • Place items that look scary or make noise (such as a scarecrow or windmill) around the outside of crops to keep animals out of the growing fields. • Put shiny ribbons around the growing fields to scare away birds. • Keep animals out of the growing fields, especially close to harvest time. <ul style="list-style-type: none"> ▪ Putting animals in a fenced area or pen prevents them from entering the growing fields. ▪ If feasible, do not use livestock for harvesting fruits and vegetables that are eaten without cooking. ▪ Remove trash from around the growing fields to keep animals and birds away. • Reinforce these teachings with the training exercise for Key 3. 	



Key 3: Training exercise

Protect fields from faecal contamination by animals, including birds

Overview

Allowing animals in the field or in the yard near a garden is a relatively common practice. However, doing so can have a serious impact on the safety of fruits and vegetables and the health of those consuming them.

By practicing simple steps to keep farm, domestic and wild animals and their faeces away from crops, you can help prevent contamination of your fruits and vegetables—and help prevent the spread of disease.

The problem	Objectives
<p>Livestock and wild animals can contaminate fruits and vegetables before and during harvest time if allowed in or around the growing fields. Animal faeces contain dangerous microorganisms that can contaminate crops.</p>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> • Explain proper location for animals in relation to the growing fields or backyard gardens • Explain the importance of keeping animals out of the fields to prevent spread of disease • Differentiate between proper and improper locations for animals • Motivate family, friends and the community to work to keep farm animals, domestic animals, and wildlife separated from crops
<p>Supplies needed (optional): paper and pens/pencils</p> <p>Training plan:</p> <ol style="list-style-type: none"> 1. Review Key 3: Protect fields from faecal contamination by animals, including birds 2. Tell participants that this is a simple <i>Fact or Fiction?</i> exercise. They will be asked to raise their hands to indicate “fact” or “fiction” as you proceed through the quiz questions. 3. Read the <i>Fact or Fiction?</i> statements aloud to the participants. Ask them to indicate “fact” or “fiction” by raising their hands. 4. Now, read each statement again and ask the group to discuss whether each is fact or fiction. As you do this, explain to the group why it is fact or fiction. Where appropriate, tie in other important safety points, such as good personal hygiene practices. <p>Note: Participants can answer the questions privately on a sheet of paper. If using this method, use one sheet of paper and one pen/pencil for each participant, if available. If using paper, ask participants to write the numbers 1 through 6 and write Fact or Fiction by the number as each statement is read.</p>	

FACT or FICTION?

Questions for Exercise Key 3

1. Dangerous microorganisms carried in animal faeces can contaminate fruits and vegetables and survive for months.

[**FACT.** Dangerous microorganisms can still be living on the fruits and vegetables when they are eaten several days or weeks after harvest and cause foodborne diseases.]

2. It's a good idea to keep farm animals uphill from where the crops are, to keep them separated.

[**FICTION.** Faeces from animals can be washed downhill into the field and can contaminate the crops.]

3. Livestock or poultry in the growing areas can contaminate fruits and vegetables.

[**FACT.** Crops should not come in contact with faeces. Faeces contain dangerous microorganisms that can cause diseases when contaminated fruits and vegetables are eaten.]

4. Since birds are not on the ground all the time, there is little chance that they will contaminate fruits and vegetables you are growing.

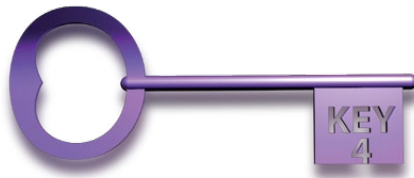
[**FICTION.** Birds flying overhead can drop faeces on crops. This has caused foodborne diseases.]

5. It is okay to have a dog in the field or in your home growing area.

[**FICTION.** Any animal faeces can contaminate fruits and vegetables.]

6. Trash should be removed from around the growing areas to prevent it from attracting domestic and wild animals.

[**FACT.** All efforts should be made to avoid drawing animals into or near the growing fields.]



Key 4: Use treated manure and treated faecal waste

Key learnings	Why?
<ul style="list-style-type: none"> • Use manure that is well-aged or properly treated • Apply treated manure to growing fields prior to planting • Mix treated manure with safe water for use on growing fields • Maximize the time between the application of treated manure and harvest 	<ul style="list-style-type: none"> • Human and animal faecal waste must be treated to kill dangerous microorganisms. • Properly aged and treated manure is an effective and safe fertilizer. • Untreated and improperly treated manure contains dangerous microorganisms that can contaminate water, soil and crops. • Increasing the time after treated manure application minimizes potential contamination of the fruits and vegetables.

How to treat manure

- Ageing is one way to treat manure. The manure is simply stacked into a pile and left for a long period of time, at least one year. The dangerous microorganisms die due to natural heating.
- Another common treatment involves turning the manure pile. The manure is placed in a pile or enclosed bin and exposed to the air to accelerate decay. Hand turning is the most common way to add air to manure. It is most important to ensure that the manure on the outside is turned to the inside where it will be subjected to higher temperatures. A cover should be placed on the bin holding the composted manure to ensure that it reaches high temperatures uniformly. The time, temperature and moisture needs vary, but the treatment time can be as short as several weeks.
- Liquid manure (slurry or tea) is made by soaking manure in water for several weeks so that the nutrients from the manure enter the water. It is important to treat the manure prior to soaking to ensure that dangerous microorganisms do not enter the safe water.

Considerations for the trainer

- Since the length of time required for dangerous microorganisms to die depends on manure composition, temperature and moisture, the ageing of manure varies greatly from region to region.
- In many countries, standards for manure treatment and application are based on plant nutrient and environmental requirements, not health concerns.
- WHO recommends a withholding time of at least one month between the application of treated excreta as fertilizer and crop harvest⁵.

Additional information

Direct discharge of untreated or improperly treated manure and faeces into surface waters (e.g. rivers, ponds, streams, etc.) harms human and animal health, and causes serious environmental damage.

Use of human faeces as fertilizer is a greater risk than animal faeces because of the possible presence of human viruses or parasites.

Reinforce these teachings with the training exercise for Key 4.

⁵ WHO Guidelines for the safe use of wastewater, excreta and greywater. Volume 4: Excreta and greywater use in agriculture available on-line at http://www.who.int/water_sanitation_health/wastewater/gsuweg4/en/index.html



Key 4: Training exercise

Use treated manure and treated faecal waste

Overview

There are many misunderstandings regarding the use of manure when growing fruits and vegetables. Helping participants understand the dos and don'ts of using manure is important to the safety of the fruits and vegetable they grow.

A good way to get them thinking about why it is important to use aged or otherwise treated manure as a fertilizer is to do another simple Fact or Fiction? exercise. This helps the participants think through the “whys” and “why nots.” It can also help correct any misunderstandings.

The problem	Objectives
<p>Animal or human manure is a source of dangerous microorganisms. Manure used as fertilizer should be properly treated or well-aged before application to prevent contamination of fruits and vegetables.</p>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> • Explain why they should not use untreated manure as fertilizer • Explain when in the growing process treated manure should be added to the soil • What composting is and how to do it safely
<p>Supplies needed (optional): paper and pens/pencils</p> <p>Training plan:</p> <ol style="list-style-type: none"> 1. Review Key 4: Use treated manure and treated faecal waste 2. Explain to the participants that they are going to once again separate fact from fiction. Read the statements for Exercise 4, and ask audience to raise their hands and “vote” if it is a fact or if it is fiction. 3. After you’ve gone through all 7 statements, wrap up by reviewing and discussing each one. Read each statement aloud again, and reinforce the learning by discussing why a statement is fact or fiction. <p>Note: Participants can answer the questions privately on a sheet of paper. If using this method, use one sheet of paper and one pen/pencil for each participant, if available. If using paper, ask participants to write the numbers 1 through 7 and write Fact or Fiction by the number as each statement is read.</p>	

FACT or FICTION?

Questions for Exercise Key 4

1. Animal manure is a source of dangerous microorganisms that can contaminate fruits and vegetables.

[**FACT.** Manure contains dangerous microorganisms found in animal faeces.]

2. Any fruit or vegetable that grows in the soil (such as root vegetables) is protected against dangerous microorganisms in animal manure because it is under the ground.

[**FICTION.** Untreated manure contains dangerous microorganisms that can spread to soil and crops. In fact, root vegetable crops are the most susceptible to becoming contaminated.]

3. To minimize contamination, manure should be treated and decayed before applying it to the fields.

[**FACT.** Heat kills dangerous microorganisms; the length of time needed can vary by manure composition, temperature and moisture.]

4. It is best to apply manure to the soil when you are planting.

[**FICTION.** Aged or otherwise treated manure should be applied to fields prior to planting and after harvest.]

5. Ageing or otherwise treating manure can reduce the dangerous microorganisms found in faeces.

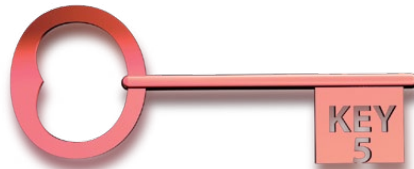
[**FACT.** With treatment, dangerous microorganisms die.]

6. Manure piles should be as close to the growing fields as possible.

[**FICTION.** Manure piles should be kept as far from the field as possible. It should be downhill from any crops to protect against “run off,” and should be barricaded or covered to prevent outside contamination by birds and other wildlife.]

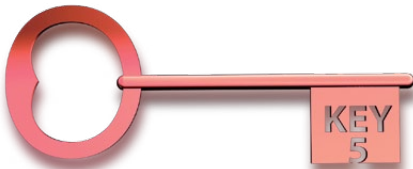
7. Manure should not be placed directly on plants.

[**FACT.** Keeping manure from coming directly in contact with plants further reduces the risk of contamination by any remaining dangerous microorganisms in the treated manure.]



Key 5: Keep harvest equipment, containers and storage facilities clean and dry

Key learnings	Why?
<ul style="list-style-type: none"> Remove visible dirt and debris from the fruits and vegetables in the growing field Keep packing containers off the ground during and after harvest Wash harvest equipment and storage containers with clean, safe water and dry before harvesting crops Cool fruits and vegetables quickly Limit access of animals, children and other non-workers to the harvest equipment and storage areas 	<ul style="list-style-type: none"> A lack of cleanliness in the packing area increases the risk of contamination to the fruits and vegetables. Wet or damp surfaces promote the growth of dangerous microorganisms. Cool temperatures slow the growth of dangerous microorganisms and preserve the quality of the fruits and vegetables. People in the harvest area who come in contact with the fruits and vegetables, equipment or containers can be a source of contamination.
<p>How to keep equipment and facilities clean and dry</p> <ul style="list-style-type: none"> Store packing containers off the ground in a clean, dry cover location, to prevent contamination by pests, dirt and water. Remove visible dirt and debris from the fruits and vegetables in the growing field to help prevent the transfer of dirt and debris to the containers and storage facilities. Clean the area used for washing, sorting and packing fruits and vegetables at the end of each day to reduce the risk of contamination. Cool fruits and vegetables by putting them in the shade or in a cool, refrigerated structure to slow the growth of dangerous microorganisms and preserve the quality of the fruits and vegetables. <p>Considerations for the trainer</p> <ul style="list-style-type: none"> Fruits and vegetables can become contaminated with dangerous microorganism during harvest by contact with contaminated hands, soil, and harvest equipment, packing containers or storage facilities. <p style="text-align: right;">Reinforce these teachings with the training exercise for Key 5.</p>	



Key 5: Training exercise

Keep harvest equipment, containers and storage facilities clean and dry

Overview

There are several instances, practices, and places where fruits and vegetables can become contaminated as they make their way from the field to the market place. Note: if your audience consists mainly of people who grow fruits and vegetables in their own gardens, you will need to adjust the list in training plan item #2 below.

The problem	Objectives
<p>Fruits and vegetables can come in contact with dangerous microorganisms from equipment and containers during harvest. These dangerous microorganisms can survive for long periods of time on the surface of fruits and vegetables and cause illness when the fruits and vegetables are eaten.</p>	<p>Participants will be able to:</p> <ul style="list-style-type: none"> • Explain why they should keep harvesting and packing equipment and facilities clean • Discuss potential risks to fruits and vegetables that can occur during harvesting and packing • Explain practices that can help keep fruits and vegetables safe/uncontaminated during the harvesting and packing processes
<p>Supplies, if available: Flip chart and felt-tip markers Sheet of paper and pen or pencil for each participant</p> <p>Training plan:</p> <ol style="list-style-type: none"> 1. Review Key 5: Keep harvest equipment, containers and storage facilities clean and dry 2. Start this activity by listing the practices and places where fruits and vegetables can become contaminated between the field and the market on a large pad or flip chart. Keep this sheet covered so participants can't see it. Alternatively, have this page of the manual available to refer to as you conduct this exercise. <ol style="list-style-type: none"> a. Dangerous microorganisms in soil b. Children accessing equipment in the harvesting or packing area c. Harvesting area and equipment not clean d. Packing containers not clean e. Farm animals kept near the harvesting area f. Packing area open where birds or small rodents can contaminate surfaces g. Packing and storage facilities not clean 3. Pass out a sheet of paper and pen or pencil to each participant. 4. Ask participants to think about when, why and how fruits and vegetables might become contaminated. Remind them that this can happen in a number of ways, starting in the field and up until the fruits and vegetables leave for the market. Ask them to write as many down as they can think of; allow them 5 minutes to do so. <p>Note: If supplies are not available, or you are working with a group with limited literacy skills, ask the participants to think of opportunities for contamination.</p>	

5. Next, have everyone stand up. Ask: who can think of 3 or more possible points of contamination? They remain standing; others sit down.
6. Next, have the participants who know 4 or more remain standing as those who know 3 take their seats. Continue in this manner until only 1 or 2 are still standing; ask them to share their answers.
7. Reveal your master list, and place an “H” next to each one they have identified. As you do, give the reason why that particular point is important.

Note: If not using a flip chart, read the list aloud to see if the group was able to identify all contamination points.

8. If the group identifies potential practices or places that are not on the list, add them to your flip chart list (or review them aloud). These are likely to be situations specific to the region, climate, or cultural traditions (such as bringing infants to work). Be sure to include and discuss other important points that are specific to your audience, climate/environment, type of crops (for example, trees versus vines), or farm settings.

Glossary of terms

Contamination: the introduction of any biological or chemical agent, foreign matter or other substance not already present in food nor intentionally added to food that may compromise food safety or suitability

Diapering: removing a wet or soiled diaper from a child and replacing it with a clean diaper

Diarrhoea: disorder of the intestine marked by abnormally frequent and fluid evacuation of the bowels

Excretion: the natural process of eliminating bodily wastes in the form of faeces or urine

Faeces: waste matter or excrement eliminated from humans and animals

Food safety: all measures to ensure that food will not cause harm to the consumer when it is produced, prepared and/or consumed as intended

Foodborne disease: any disease or illness caused by eating contaminated food or drink

Groundwater: a natural water source created by rain that soaks into the ground and flows down until it collects in the spaces between soil particles or cracks in underground rocks

Irrigation: method of watering crops in dry areas through ditches, channels or streams

Latrine: a standalone receptacle, such as a pit in the earth, designed for urination and defaecation

Manure: a mixture of faeces and vegetable waste

Microbial: involving or caused by a microorganism, especially a bacterium causing disease

Microorganisms: microscopic organisms such as bacteria, moulds, viruses and parasites, which may be found in the environment, food and in or on animals

Parasite: an organism that lives on or in an animal host, including humans

Potable: water deemed suitable for drinking

Protective clothing: clothing or garments to prevent contact of substances with the skin

Refrigeration: the process of cooling or freezing (e.g., food) to delay spoilage

Risk: the severity and likelihood of harm resulting from exposure to a hazard

Safe water: water that is free from dangerous microorganisms and toxic chemicals at levels that could cause illness and/or disease

Surface water: water collecting on or above the ground as in a pond, stream, river, lake or ocean

Toilet: a system equipped with plumbing and a removal mechanism in which one urinates or defaecates

Toileting: urinating or defaecating in an area or sanitary facility followed by wiping and hand washing

Toxic: harmful, dangerous or poisonous



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