Chapter 10:

Storage

Learning Objectives

After completing this chapter, you will be able to:

- Outline appropriate conditions required for the safe storage, both long and short term, for different food types
- Define and practice recommended stock rotation procedures (first in, first out)
- Describe the conditions required for safe storage of non-food items
- Develop a food safety plan for storage including standard operating procedures and record templates

Chapter 10: Storage

Totes Are Great But Storage Needs Work

Pam and Liane carry the pickling cucumbers, peas and beans in bulk totes to the market and sell these products by the pound. Their potatoes and carrots are bagged and sold in two sizes: 2 pound and 5 pound plastic bags. Squash, tomatoes and peppers are marketed by the piece, strawberries by the basket.

Pam and Liane checked the CFIA website for suppliers of food grade plastic totes to use for their bulk produce. They talked to a number of tote suppliers while visiting the Prairie West Trade Show at the Alberta Horticultural Congress. Food grade packaging, including totes and cardboard boxes, must be used when food comes in direct contact with the packaging.

However, their careful preparation in one area did not prevent a disaster in another. After returning from their Thursday market, Pam and Liane's crew unloaded the truck and placed the boxes of unsold vegetables back into the upright cooler. On Saturday when loading the vegetables for market, they notice a strong bleach smell when they open the cooler door. They find that one box on the top shelf that they thought contained vegetables actually held cleaning supplies. The bleach bottle had tipped over and leaked onto the vegetables below. They dispose of all the boxed vegetables in the cooler and scramble to harvest more for market. Pam realizes that the cleaning box should be labelled and properly stored. She also realizes she needs to review procedures with her staff to prevent contamination from occurring again.

R_x For Cold

Mike and Elizabeth need on-farm freezer storage because of the increased demand for their products at the urban market. After consulting with their public health inspector, they learned that meat products intended for sale cannot be stored in their large home freezer. They could store them in a separate chest freezer located in an area that is approved by the health inspector.

Mike and Elizabeth consider building a walk-in freezer that will accommodate future expansion to the business. Before deciding, they discuss this with their public health inspector. They discover the plans for this storage area will need to be approved by the regional health authority before they can begin construction or estimate costs for specific requirements. For instance, the freezer must have an accurate built-in thermometer or other temperature recording device so they can monitor the temperature of their frozen meat products.

Hazards

Food products stored at farm direct market outlets including Alberta Approved Farmers' Markets are subject to all three types of hazards. Food can become contaminated by:

- Chemical hazards such as residues or spillage of cleaning supplies used to clean equipment, demonstration and sale tables and storage areas
- Biological hazards from pathogens present in water, dirt, spills, unclean storage containers, pests or other contaminants due to unsanitary handling. Microbial growth can occur because of time/temperature abuse or poor storage conditions
- Physical hazards such as broken glass (e.g., light bulbs), metal shards, screws, etc. because of poor storage conditions

Safe Storage Practices

Farm direct marketers need to consider three primary food safety storage issues:

- Maintaining proper temperatures during storage
- Protecting food from contamination through the use of appropriate packaging
- Following recommended procedures for storing non-food items

All farm direct marketers, including farmers' market vendors and those supplying products directly to restaurants, **must** follow safe storage practices at their production site and at the market.

Temperature control is critical to keep your foods safe and extend their shelf life. Problems with food spoilage and foodborne illness can result if satisfactory conditions of cleanliness, temperature, humidity and stock rotation aren't provided during storage. Any of your employees with poor personal hygiene or improper food handling practices can also contaminate food during storage.

"One food safety change we made is to implement daily checks on our walk-in freezer to make sure temperature and humidity are controlled at all times." Greg Sawchuck, Muriel Creek Cattle Company

It is important to clean incoming stock before storing. Store all your food, utensils and single service items a minimum of 15 cm (6 in.) off the floor. This also applies to your equipment except, for those pieces designed to sit directly on the floor. Covering these items will protect them from contamination. Under good storage conditions, you can maintain the temperature control and air flow needed to reduce the risk of damage and contamination.

Primary food safety storage concerns are:

- ***Maintaining proper temperatures***
- ***Using appropriate packaging***
- ***Avoiding cross contamination***
- ***Inventory management***

Correct storage helps prevent spoilage, contamination and wastage. It is essential in the safe and hygienic operation of any food business, including selling food at Alberta Approved Farmers' Markets.

Single service – according to the Alberta Food Retail and Foodservices Code **single service** means a utensil designed to be used only once and then discarded.

Avoid storing food and food handling products with hazardous materials or under pipes carrying liquid waste. Keeping your food well away from non-food items significantly reduces the risk of contamination.

Clean, cold temperature storage facility with product off the floor, packaged and separated by type is essential.

Figure 10.1 **Proper Storage Facility**

Food Types and Storage Conditions

You **must** store food safely at all times and promptly clean up any spills. Depending on the type of food, you can store it in one of three ways:

Store canned goods such as jams and pickles and some baked goods in cool, dry, well ventilated areas.

Provide refrigerated storage of 0- 4ºC for short-term storage for perishable and potentially hazardous foods. Eggs are the one exception and can be stored at 7ºC or less.

Storage temperatures of –18ºC or colder are required for frozen food. Frozen storage does not destroy microorganisms; it simply suspends growth.

1. Use cool, dry, well ventilated storage for shelf stable, non-perishable non-hazardous items such as jams, jellies and pickles.

2. Refrigerate (4ºC or less) for short-term storage of fresh, perishable items and potentially hazardous foods. The only exception is eggs which may be stored at 7ºC or less.

3. Freeze (-18ºC or colder) for long-term storage (6 to12 months) of perishable and potentially hazardous foods. Freezing simply extends the shelf life and quality of potentially hazardous foods. Frozen storage doesn't destroy microorganisms; it simply suspends growth. Once thawed, the pathogens will continue to grow and food can readily spoil. Long-term freezer storage is a quality and not a food safety concern.

For more information on the recommended storage life of specific foods refer to Appendix G: Food Storage Chart. For more information on defrosting food safely see Chapter 14: Food Handling.

Your food storage areas should be clean, well ventilated, pest proof, tidy and separate from non-food products. Different food types require specific storage conditions to keep them safe as shown in Table 10.1.

Table 10.1 **Storage Conditions for Various Food Types**

Food Type	Examples	Storage Conditions	Comments
Perishable and Potentially Hazardous	Fresh meat, fish, poultry, milk and dairy products, eggs, hazardous baking such as meat, cream, lemon meringue and pumpkin pies, cheese cakes, perogies, raw seed sprouts, garlic and oil mixtures, prepared entrees with meat, vegetables or cooked cereals, cider and vegetable juices, home canned and low acid foods such as antipasto and salsas, cooked vegetables and cereals, etc.	Fresh: between 0ºC and 4ºC Eggs at 7ºC or less (only exception)	Sell that market day Foods with eggs as an ingredient must be stored at 4ºC or less Prevent cross contaminating other foods
		Frozen: at –18ºC or colder	Meats, fish, poultry and dairy product may be frozen for extended storage
Perishable and Non-hazardous	Fresh produce, breads, muffins, fruit pies, etc.	Clean, cool, well ventilated area Produce: between 0º and 4ºC and appropriate humidity levels Frozen baked goods: at –18ºC or colder	Keep produce clean and inspect frequently as spoilage organisms spread very quickly Cover or protect from contamination by pests and other contaminants
Non-perishable and Non-hazardous	Jams, jellies, pickles, high acid bottled and canned goods, dried, sweet and salt-preserved foods	Store canned goods in a clean, cool, dry location	Non-perishable foods have a shelf life greater than 90 days at room temperature

Temperature Control

Safe refrigerator temperatures are between 0 – 4ºC. Freezer temperature is –18ºC or less.

Refrigerated storage slows the growth of bacteria that may be present in your perishable or potentially hazardous foods. You can maintain cold temperature storage by using mechanical refrigeration units or insulated coolers. Portable coolers **must** be used for short-term storage only. You should pre-cool all cold storage units to the recommended temperatures before storing your products.

Insulated Portable Coolers

If you're using portable coolers, make sure that you have enough packaged ice or frozen gel packs to maintain proper temperatures, especially for potentially hazardous foods. Make your packaged ice from potable water and bag it to prevent melt water from contaminating food during storage. Drain off the melt water as needed.

It is your responsibility to ensure that food is maintained at the required storage temperatures. Frozen foods stored in portable coolers at the market **must** be solidly frozen before being loaded into the coolers. An insulated portable cooler will prevent foods from thawing during the day but is not capable of freezing or cooling foods.

Use precooled insulated coolers for short-term storage only. These coolers cannot freeze or cool foods – they only help to maintain cool temperatures.

Remember, the temperature of potentially hazardous foods packed in a portable cooler with ice will rise during the market day, exposing the food to danger zone temperatures. If you are using a portable cooler that plugs into the electrical outlet in your vehicle, make sure it can maintain temperatures of 4ºC or less.

Perishable – any food product or ingredient that is susceptible to deterioration or loss of quality when subjected to temperature abuse. They have a shelf life of less than 90 days at room temperature.

Potentially hazardous food – any food that is capable of supporting rapid and progressive growth of pathogenic microorganisms or the production of toxins; has a pH greater than 4.6 and a water activity (A_W) of 0.85 or more.

Non-hazardous food – food such as dry goods, cereals, most baked goods and unconstituted dehydrated foods. These foods do not normally support the growth of disease causing bacteria and do not usually need to be refrigerated (e.g., cookies, breads, cakes, potato chips, popcorn and nuts).

pH – scale by which the acidity and/or alkalinity of food is measured. The lower the pH number, the more acid is the product. pH values range from 0 to 14. The value for pure distilled water is 7, which is considered neutral. Potentially hazardous foods have a pH greater than 4.6 which favors growth of food poisoning organisms.

Water activity – the amount of free water in the food that is available to pathogens; denoted by the symbol A_w. Pure water has a water activity of 1.0.

Figure 10.2 **Portable Cooler for Temporary Storage**

Portable coolers can be used for temporary storage as long as temperatures are being maintained. Monitor the temperatures throughout the day to ensure that food is kept out of the danger zone.

Mechanical Cold Storage Units

Refrigeration units **must** operate between 0º and 4ºC. Freezers **must** be maintained at -18ºC or colder. Cold air should circulate easily around the food products in the unit. You should use a calibrated thermometer to check the unit and product temperatures at the beginning of the market day.

Monitor the temperatures of refrigeration and freezer units using calibrated thermometers. Record the temperatures in a temperature log book.

Each refrigerator and freezer **must** have an accurate thermometer that is calibrated as required. If the thermometer is not built in, place a refrigerator/freezer thermometer in the warmest areas of the unit which are usually near the door.

For information on using and calibrating a hand held thermometer, see Chapter 12: Equipment.

Remember that refrigerators and coolers are designed to hold cold foods, not cool large quantities of hot food. Overloading a refrigerator with hot food increases the temperature of the unit which encourages condensation thereby increasing the risk of contamination. You should avoid putting a large quantity of hot food into a refrigeration unit. Instead, first separate your hot food into small, shallow stainless steel containers, immerse the containers in an ice slurry and stir until cool. Or, you can place these small containers into a freezer for about 30 minutes. Once cool, refrigerate immediately.

Ice slurry – mixture containing equal parts of crushed ice and water.

Preventing Contamination

To keep food from becoming contaminated during storage, you need to:

- Prevent cross contamination
- Package food correctly
- Rotate stock and practice inventory control

Cross Contamination

Cross-contamination occurs when disease causing microorganisms are transferred from one food or surface (utensils, hands, gloves, cloth towels or equipment) to another. This can happen very easily in storage.

You can control cross contamination by separating raw foods from ready-to-eat products within the refrigeration unit. Some examples of when cross contamination can occur are:

Harmful bacteria can be transferred from food to people, people onto food, and from one food to another. This spread of bacteria or cross contamination is a prime cause of foodborne illness. It's critical that food be handled and packaged correctly to prevent cross contamination during storage.

- Raw food touching or dripping onto cooked or ready-to-eat foods
- Utensils that touch raw food are not cleaned and sanitized before handling ready-to-eat foods

Store your ingredients or raw materials separately from finished product to avoid cross contamination. Store unwashed or raw foods below clean, cooked or ready-to-eat foods.

Raw animal based foods such as meat, fish, poultry or their juices **must** not contaminate produce or ready-to-eat food. Store raw meat, poultry and fish separately from prepared and ready-to-eat food. If you can't store your raw products separately, limit the risk of contamination from drips and spills by storing them on the bottom shelves of the refrigerator or cooler.

Ready-to-eat foods – foods that do not require any further preparation before consumption.

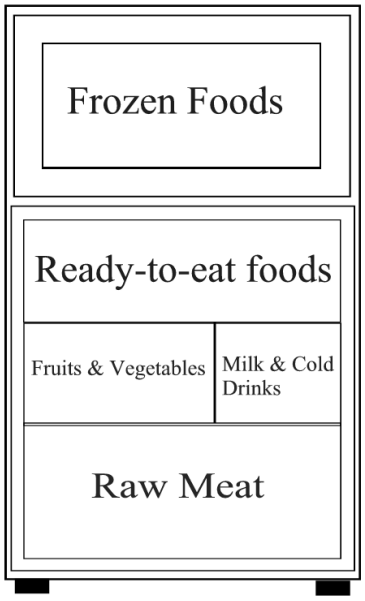

Figure 10.3 **Proper Refrigerator Storage**

You should never store fresh produce below fresh or frozen meat that is thawing. Store raw meat, poultry and fish in the refrigerator in the following top to bottom order: whole fish, whole cuts of beef and pork, ground meats and fish, whole and ground poultry. This way the meats requiring the highest cooking temperatures are stored on the lowest shelves.

Store food in designated storage areas. To prevent possible contamination, keep your food away from warewashing areas, restrooms and furnace rooms. Never store your food near chemicals or cleaning supplies and keep it out from under stairways and pipes.

Store raw meat, poultry and fish separately from prepared and ready-to-eat food. If they can't be stored separately, store them below prepared foods and fresh produce.

Warewashing – the cleaning and sanitizing of equipment and utensils.

Packaging and Storage Containers

It is your responsibility as a farm direct marketer to package all food in a way that prevents contamination and damage during storage.

Follow the maximum stack height recommendation for your packaging materials. Overstacking may result in the weight of the stacked products damaging the bottom container. This increases the risk of contamination of the food in the bottom container.

Packaging materials and storage containers that are in direct contact with food **must** be constructed of food grade materials. This means that materials must be non-toxic and easy to maintain, clean and sanitize. Some examples of food grade materials include stainless steel, styrofoam and food grade plastic wrap or containers. Do not reuse packaging that is intended for single use such as styrofoam containers or plastic wrap. Never use reusable containers such as portable coolers or stainless steel mixing bowls to mix or store non-food items such as veterinary medicines, chemicals, etc.

Only food grade quality packaging can be used for your food products. A food grade container is one that will not transfer noxious or toxic substances into food and has been approved by the CFIA.

Food Grade

"Food grade" applies to packaging materials in direct contact with foods. The Food and Drug Regulations state that no person shall sell any food in a package that may be injurious to the health of a consumer. Injury may result through the transmission of a contaminant from the packaging to the food.

All your storage containers and storage units should be durable, clean, in good condition and able to withstand regular sanitizing.

Inspect all your products, packaging and storage units frequently for:

- Dirty, damaged or leaking containers and packaging
- Mould and decay
- Insect or vermin infestation and other signs of contamination

For information on acceptable packaging materials, see the document *Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products* which is on the Canadian Food Inspection Agency (CFIA) website at www.inspection.gc.ca/english/ppc/reference/cone.shtml

Evaluate Your Packaging

List all the types of packaging and containers you use. Check the CFIA website to see if they are food grade quality.

_____

_____

_____

_____

_____

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_____

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Stock Rotation and Inventory Control

The risk of contamination increases the longer food is stored, even when it's stored under proper conditions. Stock rotation prevents deterioration that could present a food safety hazard.

The First In, First Out (FIFO) rule is a standard practice for safe food storage. It states that food received, harvested or processed first should be sold first. Label your packaged, prepared and processed foods with a date of manufacture or production to help you manage your inventory.

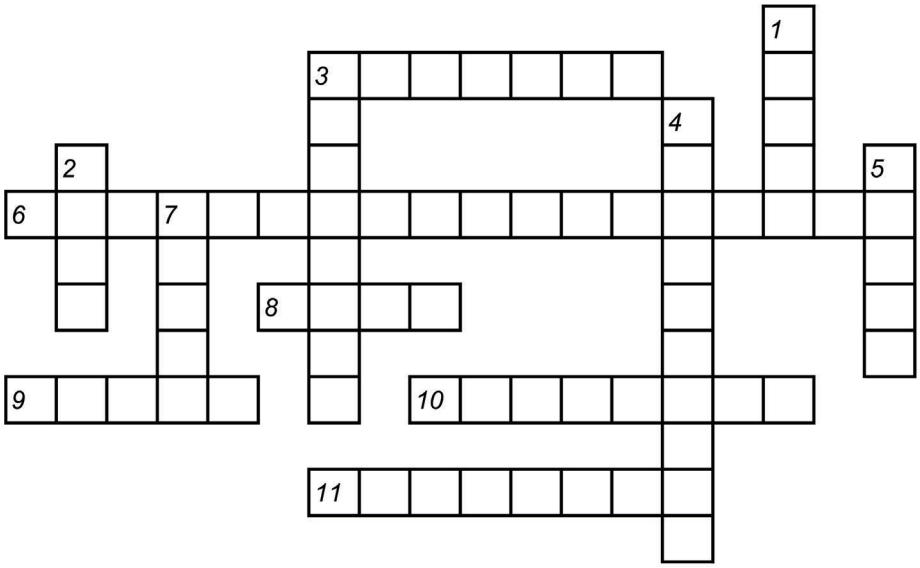
First In, First Out. If in doubt, throw it out!

Always store and display your new stock behind or underneath older stock. This leaves the older stock accessible so it will be sold first. Ensuring that your older food products are sold and used first is essential to avoiding spoilage. This applies to all types of food. Selling older products first also maintains the quality of the food product.

Date and label all food products and store newer ones behind older items on the shelf or below older items in the freezer. Sell older products first.

Storage Crossword Puzzle

Complete the crossword puzzle below to help you review the principles in this chapter. You will find the answers at the end of this chapter.



ACROSS

3 To help prevent contamination, food in storage must be _____.

6 Is an essential part of safe food storage.

8 Acronym that stands for first in first out.

9 When storing food safely you must prevent cross _____.

10 It is important for storage areas to be _____.

11 In order to store food safely you must_____ potentially hazardous foods from cooked and ready-to-eat foods.

DOWN

1 Food must be stored off the _____ at least 15 cm (6 in.).

2 _____ is considered a potentially hazardous food and must be stored refrigerated or frozen.

3 Store all _____ supplies separately and away from food and food packaging materials.

4 Storage areas should be well _____ to help minimize condensation and cross contamination.

5 Storage areas must be kept_____.

7 Ensure that various types of _____ cannot gain entry into your storage areas.

Storing Non-Food Items

Store all your chemicals, cleaning supplies, garbage containers, toxic materials and non-food or personal items separately and away from food, packaging materials and food contact surfaces. Never store chemicals or cleaning supplies on a shelf above food, near food related supplies or any area where you prepare, display or sell food.

Store food products in separate areas away from non-food items. Storage areas should be designated with signage.

Keep all your chemicals and cleaning supplies, including detergents, soaps and sanitizers in their original containers. Make sure they are clearly and accurately labelled. Store in cabinets used solely for this purpose. They should be well away from food preparation and food storage areas.

Legislation requires that you lock all your chemical storage areas and deny access to anyone without proper training and authorization. Proper training reduces the risk of accidental contamination. Easy access to cleaning, sanitizing and pest control chemicals presents an opportunity for product tampering.

Post appropriate signs on all chemical storage units.

Figure 10.4 **Danger Sign**

Keeping Records

Records are critical for you to monitor your storage conditions and show due diligence. Your record keeping system should include:

- Temperature logs where you record temperatures of foods checked in storage and throughout the market day. Temperature logs also should indicate what corrective actions were taken, if necessary and when
- Freezer/refrigeration unit temperatures
- Cleaning and sanitizing records for storage units and reusable containers
- Inventory records include ingredients, food use supplies and finished products, etc.
- Staff training

Examples of inventory records and temperature logs can be found in Appendix F: Record Templates.

Staff Training

Train all your staff so that they understand the importance of the various storage conditions for each type of food product you produce. They should know how to:

- Properly store food to prevent contamination
- Maintain proper temperature control and temperature logs
- Maintain inventory control
- Store non-food items
- Take action in the event that appropriate storage conditions are not maintained and contamination occurs

Food Safety Plan – Storage

The goal of a storage plan is to ensure that all your food products and packaging materials are stored and handled in a sanitary manner that will prevent contact with contaminants.

Your written plan should document:

- How to receive product into storage, including returned product
- Proper storage conditions and handling practices for all food types
- How and when to monitor temperatures during storage and where to record this information
- How product should be rotated in storage
- Proper handling and storage of non-food items including packaging materials
- What packaging materials must be used for all food products
- What must be done in the event that food becomes contaminated (deviation and corrective actions)
- Staff training

Take the time to continue developing your food safety plan. Create a section in your binder for Storage. Use the information above to build the storage component of your food safety plan.

Summary

Your food products may become contaminated or may not reach the market in a suitable condition unless effective control measures are taken during storage. Measures **must** be taken to:

- Provide an environment that effectively controls the growth of microorganisms by controlling storage temperatures
- Protect food from potential contamination by using the correct packaging and storage containers
- Monitor temperatures of food and storage units
- Store food and food handling materials in designated areas away from non-food items and chemicals
- Prevent contamination of stored packaging materials
- Control inventory through First In, First Out (FIFO) stock rotation

As a farm direct marketer, farmers' market vendor or regional cuisine supplier, it is your responsibility to ensure that food reaches the market safely and your staff has been instructed on how to properly store food at the market and in inventory.

Market Manager Responsibilities

Managers of Alberta Approved Farmers' Markets need to monitor storage conditions at the market to ensure that food is handled safely.

Food needs to be held at the proper temperatures. Check to see that refrigerator and freezer units are operating at the proper temperatures.

Food products need to be stored off the ground in clean containers. Non-food items including personal belongings need to be stored away from food products.

Food grade packaging materials and storage containers must be used. Single use containers such as stryrofoam trays or paperboard containers must not be reused.

If you see a problem, inform the vendor and suggest corrective actions.

Food Safety Checklists

Review the Weekly Food Safety Checklist for Market Managers in Appendix M. Add any storage points that are missing for your market. Remember you and your vendors should be using the checklists every market day.

What's Next

Why is it important to have a clean, well maintained market vehicle? What do farm supplies and pets have in common? To learn the answers to these questions and find out why it's so important for your food safety plan to include a transportation component, read Chapter 11: Transportation.

Resources

If you need more information or have food safety questions about this chapter contact:

Safe Food Systems
Agri-Food Systems Branch, Food Safety Division
Alberta Agriculture, Food & Rural Development
Phone: (780) 427-4054 Dial 310-0000 first for toll free access.

Chapter Review

1. What temperature range should refrigeration units be kept at? _____

2. A farmers' market manager needs to check that food is packaged in what type of packaging material? _____

3. What food products should never be stored on the top shelves of a refrigerator? _____ and _____

4. What is a standard practice for inventory control? _____

5. What type of food product must be stored at 4^0C or less? _____

6. What two storage records must be kept by a farm direct marketer? _____ and _____

Answers to Chapter Review

1) 0^0 - 4^0 C

2) food grade packaging

3) raw meat and poultry records

4) FIFO-First In, First Out

5) potentially hazardous foods

6) temperature logs and inventory

Answers to Crossword Puzzle