Ministry of Education
Curriculum Planning & Development Division

CSEC Agricultural Science

Syllabus Section B: Crop Production

Part 6: Harvesting & Post Production Management

6.4 Explain the importance of preserving crops

- Methods of preserving crops: cooling, freezing and drying
- Develop a processed product from the crops cultivated (separate Lesson)

https://pixabay.com/illustrations/fruit-free-vegetables-healthy-2198378/

Objectives

CSEC Agricultural Science Syllabus
Section C: CROP PRODUCTION
Objective: 6.4

Students should be able to:

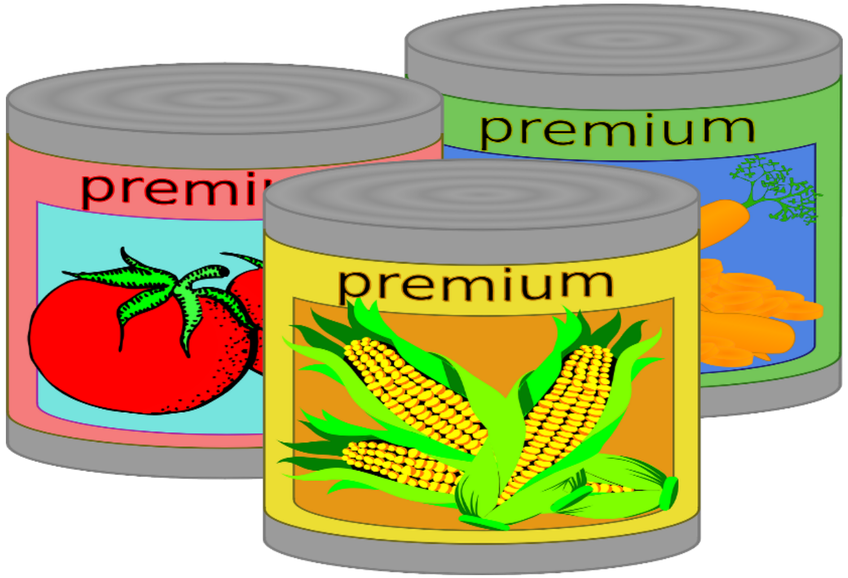
6.4 Explain the importance of preserving crops

- Methods of preserving crops: cooling, freezing and drying

https://pixabay.com/illustrations/vegetables-collage-food-healthy-1529725/

Why should crops be preserved?

- If fresh crop produce (e.g. vegetables, root crops, fruits) are not preserved it can spoil within a few days
- Preserving food prevents it from spoiling and increases its shelf life
- Agro-processing is the science of preserving agricultural produce
- Different methods can be used to preserve food



https://pixabay.com/vectors/canned-food-tin-can-vegetables-149221

https://www.pexels.com/photo/assortment-batch-colors-cooking-625422/

What causes crop produce to spoil?

- Many factors can contribute to the spoilage of crop produce:
  - Microorganisms e.g. bacteria, fungus, yeast, mould which cause decay (rotting)
  - Enzyme activity inside the plant cells e.g.
    - Oxidation of fats causes food to go rancid
    - Hydrolysis of starches to sugars
  - Respiration in the plant cells causes reduction in energy reserves in the plant cells and build up of humidity and temperature around the produce which encourage microbial growth and accelerates spoilage
  - Natural aging of produce causes changes in chemical composition in the cells

https://www.clipart.email/make-a-clipart/?image=3043337

Spoilt produce

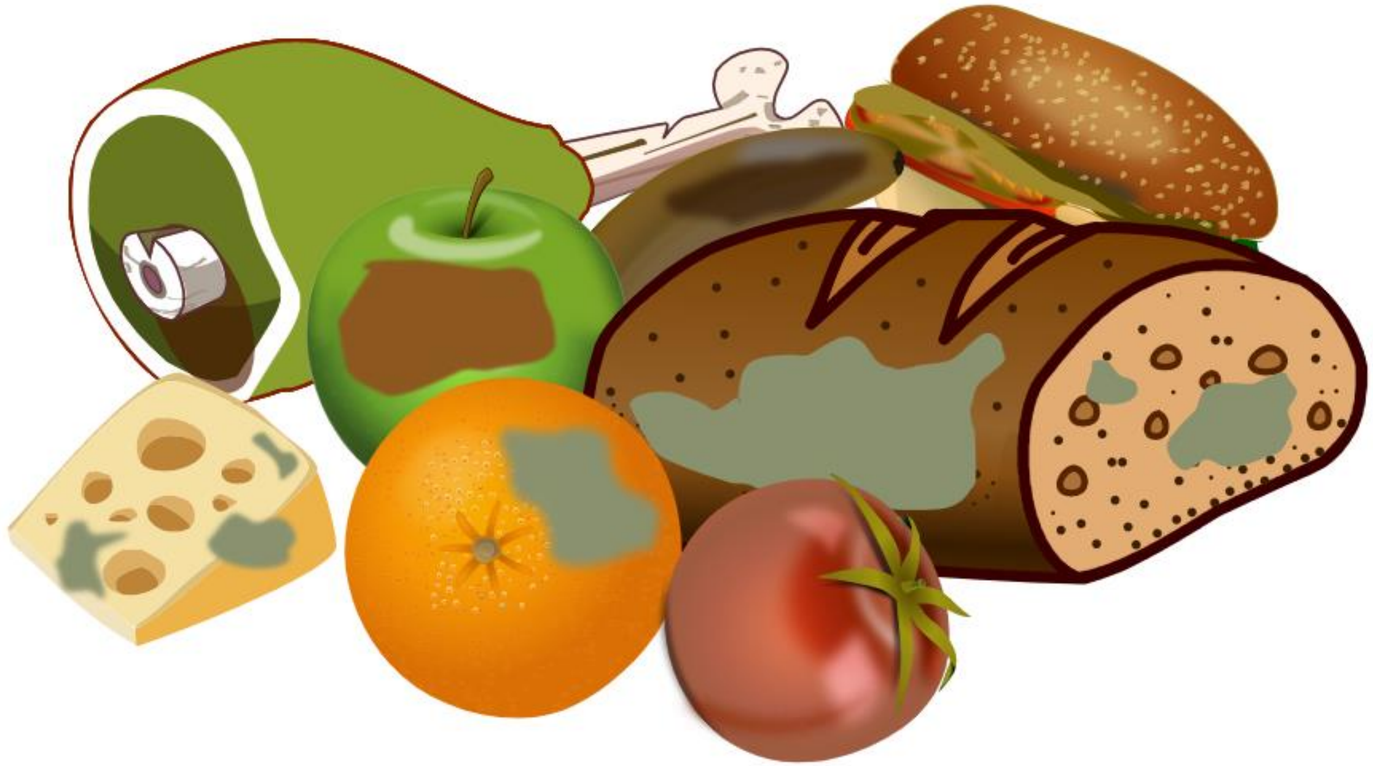
What happens to crops when they spoil?

- Spoiling crops will lose its colour, flavor, smell, texture, taste and nutrients
- If people eat spoilt crops they can become very sick

https://www.pexels.com/photo/bunch-of-rotten-tomatoes-3070381/

How can spoilage be prevented?

- Crop spoilage can be prevented by
  - Slowing down OR killing the microorganisms that cause decay
  - Slowing down enzyme activity within the plant cells that causes oxidation, respiration, etc.
  - Slowing down of natural aging



https://pixabay.com/vectors/rotten-meat-mould-bread-rot-decay-4326830/

Benefits of preserving crops

- Some benefits of preserving crops are:
  - Prevents produce from spoiling
  - Causes foods to last longer (extends the shelf life)
  - Reduces wastage of fresh foods
  - Makes food available outside the growing season
  - Adds value to the food and can be sold at a higher price e.g. consumers are willing to pay more for pepper sauce and pepper flakes
  - Develops more convenient food products that are easy for consumers to use

http://absfreepic.com/free-photos/download/dry-fruits-market-4305x2870_76448.html

Methods of preserving crops

- Some methods of preserving crops are:
  - Cooling / refrigeration
  - Freezing
  - Drying
  - Smoking
  - Salting
  - Pickling
  - Pasteurization
  - Adding sugars
  - Canning & bottling
  - Freeze drying
  - Irradiation
  - Fermentation
  - Vacuum packing
  - Atmospheric modification
  - Fresherized process

Dried peas and beans

Frozen vegetables

Using a refrigerator to cool food

Cooling

- If harvested crops are left out in the field they will spoil
- When crops are cooled their temperature is decreased

- Crops can be cooled by
  - Placing inside a refrigerator/chiller between 1^0C to 4^0C
  - Placing in the shade/cool area
  - Dipping/washing in cool water

- Advantages of cooling/exposing crops to low temperatures
  - Spoilage is prevented because cooling
    - Slows down microorganism activities e.g. the growth of bacteria is slowed down
    - Slows down of natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell
    - Slows down of enzymes
  - Freshly harvested produce will remain fresh for a few days
  - Able to store produce for a longer time
  - Produce retains nutritional value for a longer period
  - Allows for produce to be transported to far areas without risk of spoilage

- Disadvantages of cooling as a preservation method
  - Food will spoil after several days (short shelf life)
  - May require expensive equipment eg chillers, refrigerators, refrigerated trucks

https://pixabay.com/photos/fridge-fridge-door-refrigerator-3475996/

Using a refrigerator to cool food

Freezing

- If harvested crops are left out in the field they will spoil
- Freezing causes the water inside the crop tissue to turn to ice. The crop tissue becomes dehydrated when water is drawn out of the plant cells
- Freezing must be carried out very quickly to prevent the formation of large ice crystals and avoid damage to the plant tissues

- Steps in the freezing process:

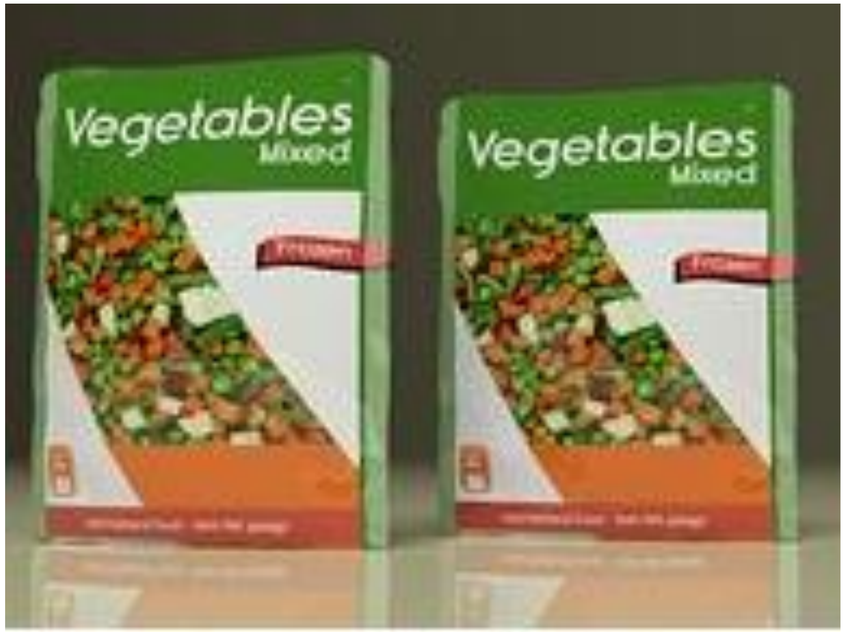
1st •Clean & Grade produce

2nd •Blanch in hot water

3rd •Freeze quickly to -5^{0}C or lower

4th •Package & Label

5th •Store in freezer at -20^{0}C



Freezing

- **Advantages of freezing as a preservation method**
  - Spoilage is prevented because freezing
    - Slows down or stops microorganism activities e.g. the growth of bacteria is stopped
    - Stops natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell
    - Inactivates enzymes
  - Able to store produce for a several months (long shelf life)
  - Produce retains nutritional value for a longer period
  - Allows for produce to be transported to markets in far areas without risk of spoilage

- Disadvantages of freezing as a preservation method
  - Does not destroy all micro-organisms, it is advisable to cook all frozen foods thoroughly after thawing
  - May alter the texture, colour and appearance of some soft crops e.g. tomatoes, lettuce, pakchoi
  - May require expensive equipment and trained personnel

https://www.pinterest.com/pin/460915343114321749/

Refrigerated trucks are fitted with cooling equipment to keep food fresh during transport.

Drying

- If harvested crops are left out in the field they will spoil
- Drying or dehydration removes water from the produce and prevents decay
- Crops can be dried by
  - Placing it in direct sunlight.
    - Produce is spread on trays and turned occasionally to allow for even drying
  - Forcing heated air over the produce e.g. in a commercial dryer or food dehydrator

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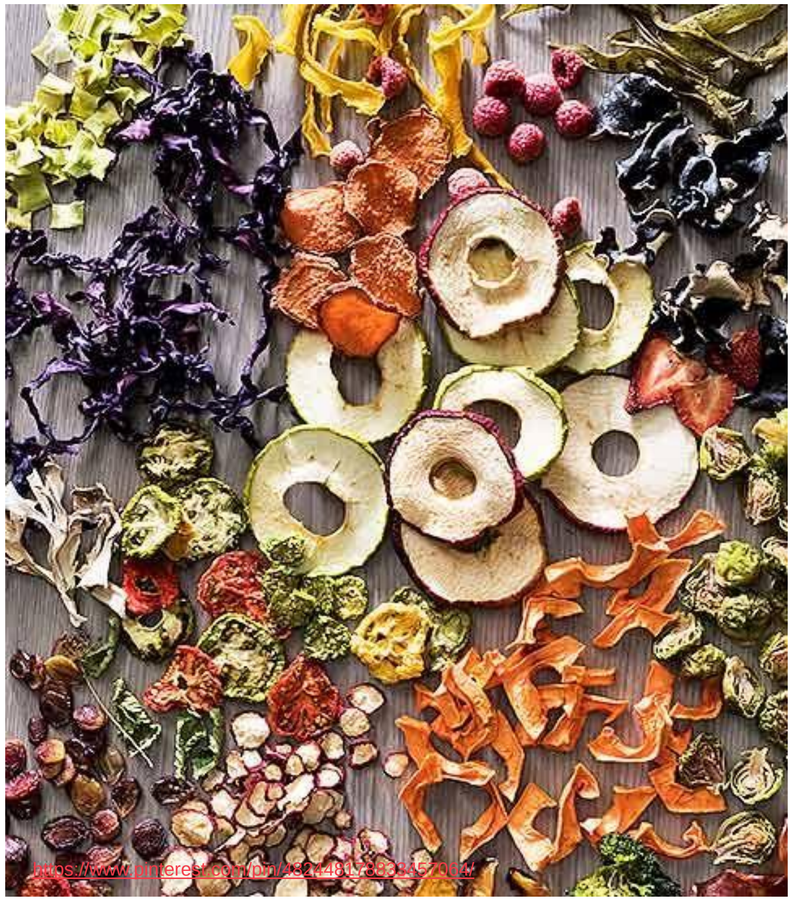
Food dehydrator

Drying

- Advantages of drying as a preservation method
  - Spoilage is prevented because drying
    - Removes sufficient moisture to slow down /delay microorganism activities e.g. the growth of bacteria is slowed down
    - Slows down natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell
  - Able to store produce for a very long time (long shelf life)
  - Produce retains nutritional value for a longer period
  - Allows for produce to be transported to markets in far areas without risk of spoilage

- Disadvantages of drying as a preservation method
  - Unpredictability of available sunlight during the rainy season
  - May require expensive equipment and trained personnel
  - Does not kill microorganisms and microbial activity resumes once the produce is rehydrated



Dried fruits and vegetables

What are some examples of different products that can be made using various food preservation methods?

Preservation Method	Crop Produce	Products
• Cooling / Refrigeration	• Tomatoes	• Fresh chilled, packaged tomatoes
	• Dasheen bush, ochro, pumpkin, carrots, seasoning herbs	• Fresh chilled callaloo packs
	• Sliced mangoes, hot pepper, seasoning herbs, spices	• Fresh chilled mango chow
	• Sliced cabbage, sliced carrots, broccoli florets, cauliflower florets	• Fresh chilled Chow Mein pack
• Freezing	• Cassava	• Frozen cassava logs/chips
	• Coconut	• Frozen grated coconut
	• Seasoning herbs	• Frozen green seasoning
	• Mango	• Frozen curried mango
• Drying	• Rice	• Rice, rice flour
	• Corn	• Corn meal, corn flour
	• Seasoning herbs	• Dried seasoning
	• Hot peppers	• Hot pepper flakes

Assessment

1. Give THREE reasons for preserving crop produce.
2. What causes produce to spoil?
3. How can you tell if produce is spoilt?
4. How can food spoilage be prevented?
5. On a recent visit to the supermarket, you observed that there were many preserved food items on sale.
    a) Identify THREE methods used to preserve food
    b) List TWO advantages of each method
    c) List ONE disadvantage of each method

Answers for Assessment

1. Give THREE reasons for preserving crops
   - Prevents produce from spoiling
   - Causes foods to last longer (extends the shelf life)
   - Reduces wastage of fresh foods
   - Makes food is available outside the growing season
   - Adds value to the food and can be sold at a higher price
   - Develops more convenient food products that are easy for consumers to use

2. What causes food to spoil?
   - Microorganisms (microbes) e.g. bacteria, fungus
   - Enzyme activity inside the cells
   - Metabolic processes e.g. respiration
   - Natural aging

3. How can you tell if produce is spoilt?
   - It smells bad
   - It tastes bad
   - It has a different colour
   - It is too soft / too hard
   - It has rotten spots
   - It has fungus growing on it

Answers for Assessment

4. How can food spoilage be prevented?
   - Slowing down OR killing the microorganisms that cause decay
   - Slowing down enzyme activity within the plant cells that causes oxidation, respiration, etc.
   - Slowing down of natural aging

5. On a recent visit to the supermarket, you observed that there were many preserved food items on sale.
   a) Identify THREE methods used to preserve food
      - Drying
      - Cooling / refrigeration
      - Freezing
   b) List TWO advantages of each method

Drying	Cooling / Refrigeration	Freezing
• Spoilage is prevented because drying removes sufficient moisture to slow down or delays microorganism activities e.g. the growth of bacteria is slowed down / • Slows down natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell	• Spoilage is prevented because cooling it Slows down microorganism activities e.g. the growth of bacteria is slowed down/ Slows down of natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell/ Slows down of enzymes	• Spoilage is prevented because freezing slows down or stops microorganism activities e.g. the growth of bacteria is stopped/ Stops natural metabolic reactions (e.g. respiration, oxidation, hydrolysis) inside the cell / Inactivates enzymes
• Able to store produce for a very long time (long shelf life)	• Freshly harvested produce will remain fresh for a few days	• Able to store produce for a several months (long shelf life

Answers for Assessment

5. c) List some disadvantages of each method

Drying	Cooling / Refrigeration	Freezing
• Unpredictability of available sunlight during the rainy season • May require expensive equipment and trained personnel • Does not kill microorganisms and microbial activity resumes once the produce is rehydrated	• Food will spoil after several days (short shelf life) • May require expensive equipment eg chillers, refrigerators, refrigerated trucks	• Does not destroy all micro-organisms, it is advisable to cook all frozen foods thoroughly after thawing • May alter the texture, colour and appearance of some soft crops e.g. tomatoes, lettuce, pakchoi • May require expensive equipment and trained personnel

References

Perrett-Pearson, M., & Ramharacksingh, R. (2020). *Agricultural Science for CSEC Examinations*. London: Macmillan Education.
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