



Manager's Corner

Storing Produce for Optimal Quality

PROJECT COORDINATOR
Chef Patrick Garmong

EXECUTIVE DIRECTOR
Aleshia Hall-Campbell, PhD, MPH



NUTRITION



OPERATIONS



ADMINISTRATION



COMMUNICATIONS/
MARKETING

Institute of Child Nutrition

The University of Mississippi

The Institute of Child Nutrition was authorized by Congress in 1989 and established in 1990 at the University of Mississippi in Oxford and is operated in collaboration with The University of Southern Mississippi in Hattiesburg. The Institute operates under a grant agreement with the United States Department of Agriculture, Food and Nutrition Service.

PURPOSE

Improve the operation of child nutrition programs through research, education and training, and information dissemination.

VISION

Lead the nation in providing research, education, and resources to promote excellence in child nutrition programs.

MISSION

Provide relevant research-based information and services that advance the continuous improvement of child nutrition programs.

This project has been funded at least in part with Federal funds from the U.S. Department of Agriculture, Food and Nutrition Service through an agreement with the Institute of Child Nutrition at the University of Mississippi. The contents of this publication do not necessarily reflect the views or policies of the U.S. Department of Agriculture, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. government.

The University of Mississippi is an EEO/AA/Title VI/Title IX/Section 504/ADA/ADEA Employer.

In accordance with Federal law and U.S. Department of Agriculture policy, this institution is prohibited from discriminating on the basis of race, color, national origin, sex, age, or disability.

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights; Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

© 2019, Institute of Child Nutrition, The University of Mississippi, School of Applied Sciences

Except as provided below, you may freely use the text and information contained in this document for non-profit or educational use with no cost to the participant for the training providing the following credit is included. These materials may not be incorporated into other websites or textbooks and may not be sold.

Suggested Reference Citation:

Institute of Child Nutrition. (2019). *Manager's corner: Storing produce for optimal quality*.
University, MS: Author.

The photographs and images in this document may be owned by third parties and used by the University of Mississippi under a licensing agreement. The University cannot, therefore, grant permission to use these images.

For more information, please contact helpdesk@theicn.org.

November 22, 2019

Table of Contents

Professional Standards	1
Introduction	1
Lesson Overview.....	2
Questions for Staff.....	3
Activity: Storing Fresh Produce	4
References.....	8

Professional Standards

RECEIVING AND STORAGE – 2500

Employee will be able to ensure proper inventory management including correct delivery and storage of inventory, and that which has been placed on hold or recalled.

2520 – Receiving and Storage

Apply safe and effective inventory receiving and storage procedures.

Introduction

Manager's Corner: Storing Produce for Optimal Quality is designed to empower managers to use in training their staff. Each lesson is roughly 15 minutes. This lesson plan contains:

- Learning objective
- Statement explaining the importance of the topic
- List of materials
- Instructions on how to present the information
- Questions to ask staff
- An activity to strengthen or refresh the knowledge of the staff

Lesson Overview

Instructions for lesson:

- Review the lesson objective and background information.
- Review why it is important.
- Ask staff the questions.
- Facilitate the activity outlined.
- Provide time for staff to ask questions.

Objective: Identify best practices for storing produce (fruits and vegetables) to ensure optimal quality.

Background information: The way a school nutrition program stores and cools its produce can influence its flavor, texture, tenderness, and how quickly it decays. There are two areas of consideration when storing produce. The first is identifying the optimal storage temperature for produce items. The second is understanding which items can and cannot be stored near each other due to the effects of the naturally occurring gas, ethylene, which some foods produce.

Certain produce items maintain better quality at warmer temperatures. These items may include:

- Citrus Fruits
- Cucumbers
- Melons
- Peppers
- Pineapple
- Summer Squash

Some items do not need refrigeration. Items that should be stored in a cool dry storage room with temperatures between 60–70 °F include:

- Bananas
- Dry Onions
- Potatoes
- Sweet Potatoes
- Winter Squashes

Certain foods produce ethylene gas. Ethylene gas is produced naturally in many fruits and some vegetables that causes ripening—and then over ripening. While refrigeration and humidity slow the effects of ripening, they don't stop the production of ethylene gas. Fruits are usually producers of ethylene gasses, and vegetables are generally sensitive to ethylene which causes them to become overripe and deteriorate more quickly. Ideally, fruits and vegetables should be stored as far apart from each other as possible to lessen the over ripening effects of ethylene gas.

Why it is important: Ensuring proper storage of produce items allows for longer shelf life of products. Proper storage reduces food waste and helps to ensure produce items maintain a higher quality of freshness.

Questions for Staff

- **Some fruits and vegetables naturally give off a gas called ethylene. Ethylene can affect the quality of produce by causing it to ripen—then become overripe. What is a quick way to determine if a food is an ethylene producer or if the food is ethylene sensitive?**

Answer:

- Ethylene-producing foods are most often fruits while ethylene-sensitive foods are mostly vegetables.

- **Why is it important to ensure produce items are properly stored according to temperature and ethylene sensitivities?**

Possible Answers:

- Ensures products have a better eye and textural appeal for customers
- Promotes longer shelf life, products will not deteriorate as quickly
- Reduces food waste

Please note: The answers provided are only examples and are not an inclusive list of possible responses.

Activity: Storing Fresh Produce

Activity materials included in this document:

- **Storing Fresh Produce** (worksheet and handout)
- **Storing Fresh Produce Answer Key**

Materials provided by school nutrition operation:

- Copies of handouts
- Pens/pencils

Activity Instructions:

- Print the handouts and worksheets.
- Individually or in teams, complete the **Storing Fresh Produce worksheet**.
- Write the names of foods listed, in the key, in the proper storage area.

Storing Fresh Produce

There are two areas of consideration when storing produce. The first is identifying the optimal storage temperature for produce items. The second is understanding which items can and cannot be stored near each other due to the effects of the naturally occurring gas, ethylene, which some foods produce.

Walk-in refrigerators are required to maintain a temperature of 41 °F or less, but temperatures inside the walk-in may range from 32 °F to 41 °F depending on proximity to the door. The coldest part of the walk-in refrigerator tends to be the back wall, the furthest location from the door. Certain produce items maintain better quality at warmer temperatures. These items may include:

- Citrus Fruits
- Cucumbers
- Melons
- Peppers
- Pineapple
- Summer Squash

Some items do not need refrigeration. Items that should be stored in a cool dry storage room with temperatures between 60–70 °F include:

- Bananas
- Dry Onions
- Potatoes
- Sweet Potatoes
- Winter Squashes

Certain foods produce ethylene gas. Ethylene gas is the ripening agent that many fruits and vegetables produce naturally. Ethylene causes them to ripen—and then become overripe. While refrigeration and humidity slow the effects of ripening, they don't stop the production of ethylene gas. Fruits are the primary producers of ethylene gasses. While ethylene gasses help fruits to ripen, the gas can also cause some other fruits and many vegetables to become overripe and deteriorate more quickly. Ideally, fruits and vegetables should be stored as far apart from each other as possible to lessen the ripening effects of ethylene gas.

Food items that are high ethylene gas producers include:

- | | |
|-------------|----------------|
| • Apples | • Pears |
| • Apricots | • Stone Fruits |
| • Kiwifruit | • Tomatoes |
| • Melon | |

Foods that are sensitive to ethylene gas include:

- | | |
|---------------|--------------------------|
| • Broccoli | • Cucumbers |
| • Cabbage | • Leafy Greens |
| • Carrots | • Peppers |
| • Cauliflower | • Squash – all varieties |

Storing Fresh Produce

Instructions:

Use the words listed in the word bank below and place the food items in the appropriate storage location for optimal quality.

- | | | | |
|--------------------|---------------------|--------------|------------------|
| • Apples | • Corn | • Lettuce | • Pineapple |
| • Asparagus | • Cucumbers | • Limes | • Plums |
| • Avocados | • Dry Onions | • Mangoes | • Potatoes |
| • Banana | • Fresh-Cut Produce | • Mushrooms | • Radishes |
| • Berries | • Grapefruit | • Nectarines | • Spinach |
| • Broccoli | • Green Beans | • Okra | • Summer Squash |
| • Brussels Sprouts | • Greens | • Oranges | • Sweet Potatoes |
| • Cabbage | • Herbs | • Peaches | • Tangerines |
| • Cantaloupe | • Honeydew | • Pears | • Tomatoes |
| • Carrots | • Lemons | • Peppers | • Watermelon |
| • Cauliflower | | | |

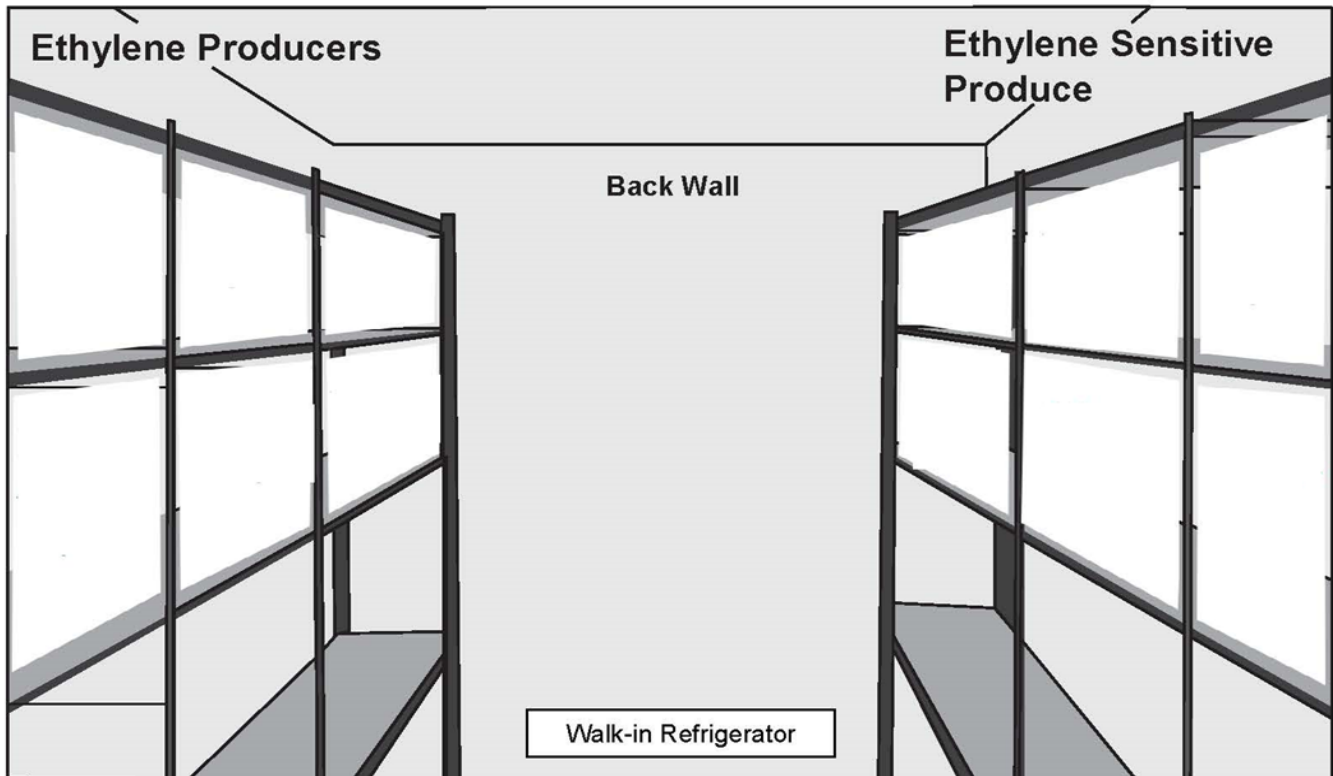
List the items that should **not** be refrigerated.
Items best stored between 60 °F and 70 °F.

1.

2.

3.

4.



Storing Fresh Produce Answer Key

Refrigerators should maintain a temperature of 41 °F or less, but temperatures inside a refrigerator can range from colder (32 °F) to warmer (41 °F), depending on the location. Colder temperatures are found in the back and warmer temperatures in the front, near the door. Some kinds of produce should be stored at warmer temperatures near the door for best quality. The location of fruits and vegetables is important because fruits, in general, produce ethylene gas, which fosters natural ripening, but it also can cause most vegetables and a few non-ethylene producing fruits to deteriorate more quickly and develop undesirable characteristics. Ideally, ethylene-producing fruits should be stored in the refrigerator as far from ethylene-sensitive fruits and vegetables as possible.

These items should not be refrigerated. Store ideally between 60 °F and 70 °F

Bananas

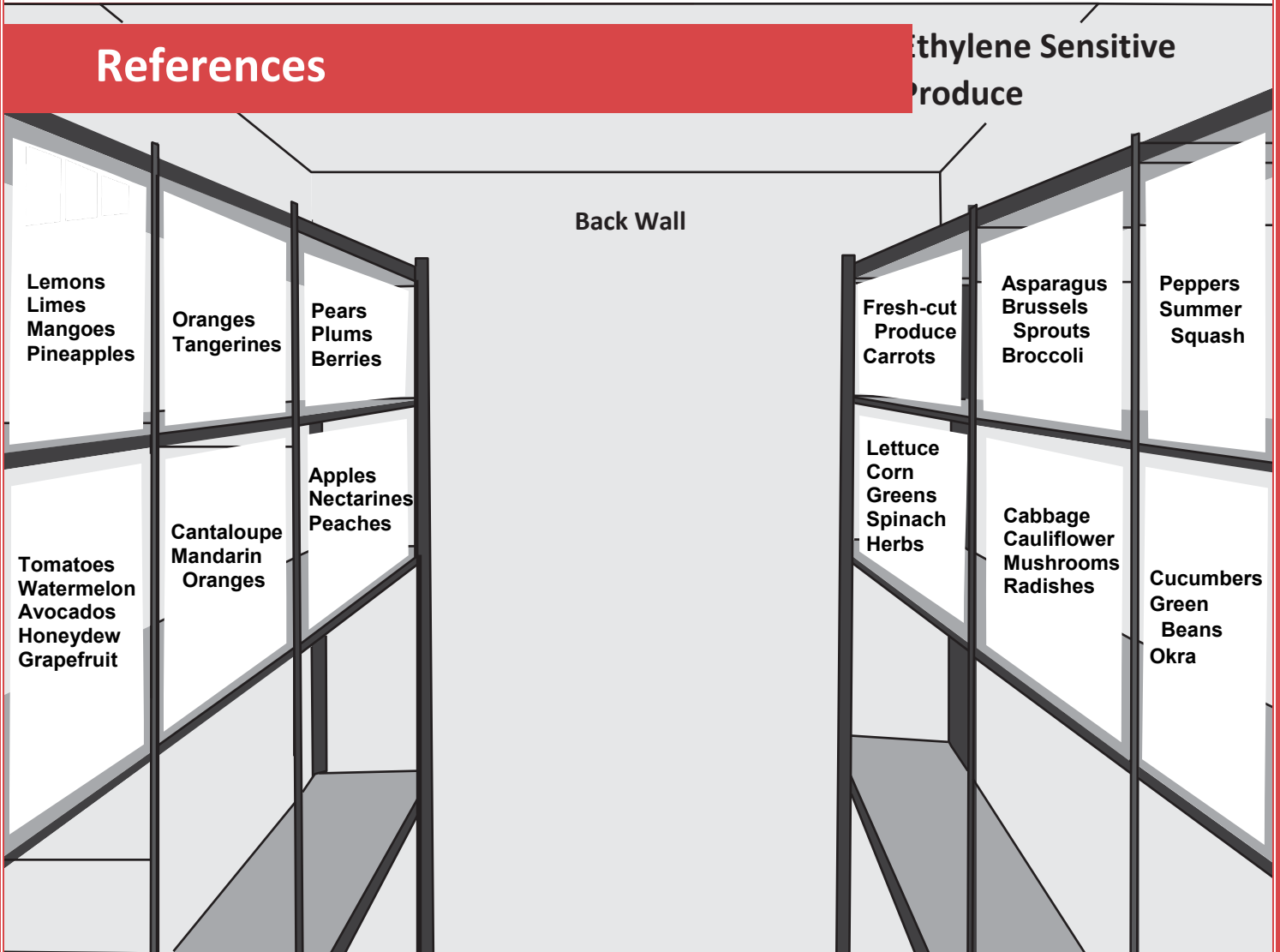
Sweet Potatoes

Potatoes

Dry Onions

Walk-in Refrigerator

References



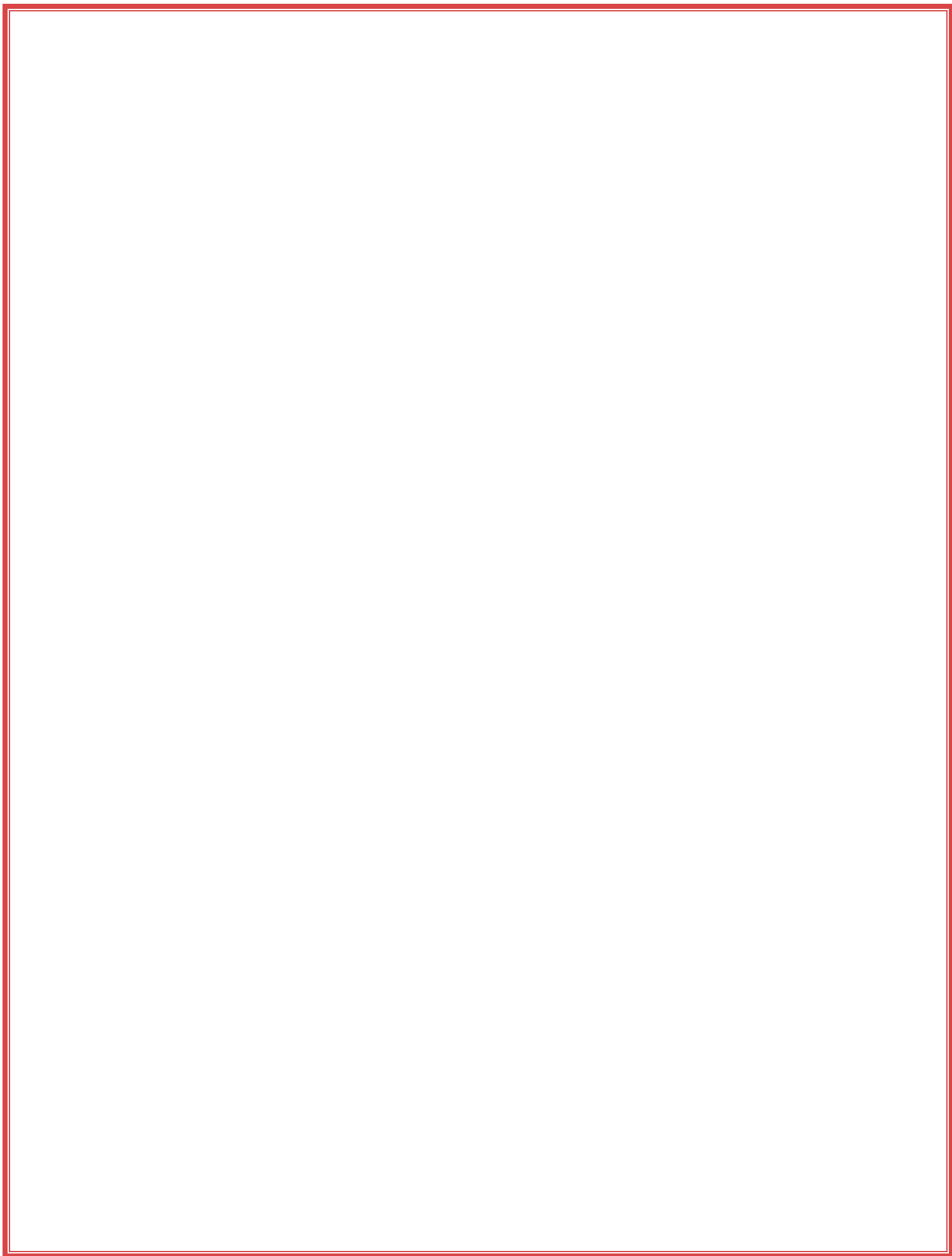
Purdue University. (2011). Factors influencing produce quality. Retrieved from https://hort.purdue.edu/prod_quality/quality/factors.html

The Regents of the University of California, Agriculture and Natural Resources. (2012). *Storing fresh fruits and vegetables for better taste*. Retrieved from <http://postharvest.ucdavis.edu/files/230110.pdf>

United States Department of Agriculture. (2013). *School food and produce safety*. Retrieved from https://fns-prod.azureedge.net/sites/default/files/foodsafety_storage.pdf

United States Department of Agriculture. (2019). *Professional standards*. Retrieved from <https://www.fns.usda.gov/school-meals/professional-standards>

United States Environmental Protection Agency. (2016). *Smart storage: Know which fruits and vegetables stay fresh longer inside or outside the fridge*. Retrieved from https://www.epa.gov/sites/production/files/2016-02/documents/smart_storage_ftgtw_2_1_2016_pubnumberadded_508_v2.pdf





The University of Mississippi
School of Applied Sciences

800-321-3054
www.theicn.org