

UNIT II - FOOD PROCESSING

Lesson 10: Processing of Grain Crops

Objective

The student will be able to explain the processing of grain crops.

I. Study Questions

- A. What are the steps in processing grain crops?
- B. What techniques can be used to preserve grain products?
- C. Why is grain inspected?
- D. What factors are considered in grading grain?
- E. How are the different grades of grain used?
- F. What is the structure of the food grain industry?

II. References

- A. Martin, Phillip R. *Food Science and Technology* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1994. Unit II.
- B. Activity Sheet
AS 10.1 Processing Wheat

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TEACHING PROCEDURES

A. Review

Review the leading food grains. Relate to the class that only a small percentage of these grains are consumed as "whole grain." Most grains are milled before they reach the supper table. This lesson examines the processing of grains.

B. Motivation

1. Blindfold two students, and have them taste several breakfast cereals to try to identify the cereal name. Record their responses. You may want to taste whole grain corn, wheat, and oats, in addition. How successful were the students in identifying what they were eating? Relate how extrusion improves the texture of these grains.
2. Give an overview of the history of grain marketing. The following information is a synopsis from "Historical Facts about Grain Marketing" from the Cooperative Extension Service.

Pure food and market inspectors existed in Athens in 400 B.C.

In 1625, which was five years after the Mayflower landed, a shipload of corn was exchanged for 700 pounds of furs.

Wheat was used as legal tender for taxes, whereas Indian Corn was legal tender for debts in 1631. In 1640 wheat was established in New England and shipments were made between colonies. The U.S. imported grain from 1835-1837 because of early frosts and poor production. Then the Ohio and Erie canals were opened. A barrel of flour brought \$3 in 1826 and \$6 in 1835. Corn went from 12 to 20 cents per bushel in that same time period.

In 1848 the Chicago Board of Trade was established. In 1857 a Grain Inspection Department was established in Chicago. The Chicago Board of Trade set up the first grain standards using numerals for wheat, corn, oats, and barley. In 1869, the Kansas City Board of trade was reorganized.

C. Assignment

D. Supervised study

E. Discussion

1. Discuss the steps in processing grain crops. Have students complete AS 10.1. The instructor may wish to have several types of grains for students to process.

What are the steps in processing grain crops?

- a. Harvest
 - b. Transport
 1. rail
 2. barge
 3. truck
 - c. Milling - cereal grains
 1. Dry milling - remove foreign seeds and soil; condition to proper moisture; separate germ, bran (hull), endosperm; grind, roll and sieve
 2. Wet milling - water slurry used to separate germ, bran, and endosperm
 - d. Malting - germinate barley seeds to activate enzymes
 - e. Roasting - oil seeds
Grains are steamed and crushed to expose oil
 - f. Enrichment and fortification
 - g. Extrusion
2. Discuss what techniques can be used to preserve grain products.

What techniques can be used to preserve grain products?

- a. Drying below 14 percent - grains, meals, flours, pasta
 - b. Regulating osmotic pressure - syrups with high sugar content
 - c. Irradiation - destroys any insects, molds, bacteria
3. Discuss why grain is inspected. The quality of the whole can be no better than the sum of its parts.

Why is grain inspected?

- a. To determine its quality/wholesomeness
- b. To establish a price

4. Discuss what factors are considered when grading grain. Recall that grain is graded to determine its quality and therefore its destination. Also, a fair price must be established based on its quality.

What factors are considered in grading grain?

- a. Test weight
 - b. Moisture
 - c. Damaged/split grains
 - d. Heat damaged grains
 - e. Foreign material
 - f. Diseased/treated kernels
5. Discuss how the different grades of grain are used. The lower the grade number, the higher the quality. Naturally, the highest quality will be used for human food while the lower quality is used for animal feed.

How are the different grades of grain used?

- a. Grades U.S. #1 and #2 are suitable for human food processing.
 - b. Grades U.S. #3, #4, #5 and sample grade are processed for animal feed. They may be upgraded with U.S. #1 grain to meet U.S. #2 standards, depending on reason for initial grade.
6. Discuss the structure of the food grain industry.

What is the structure of the food grain industry?

- a. Very diverse; ranges from multi-million dollar conglomerates to local processing businesses
- b. Kansas City Board of Trade - wheat sales
- c. Chicago Board of Trade - multi-grain sales
- d. Contract growers - raise specific varieties for specific mills

F. Other activities

1. Using the flour processed in AS 10.1, make bread, biscuits, or other products. Discuss why and how the end products differ.
2. Visit a local grain elevator and examine the grain grading equipment and run a sample.
3. Invite a local grain grader to speak to class about his/her job.

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4. Display samples of different grades of grain. See if students can tell which grade is which.

G. Conclusion

A vast majority of grains are processed before consumption. A part of this processing is the preservation process accomplished by drying, irradiating, or regulating osmotic pressure. Grain is graded to establish a fair price and to determine its future use. Several factors of grain quality determine its grade.

H. Competency

Explain the processing of grain crops

Related Missouri Core Competencies and Key Skills: None

I. Answers to Evaluation

1. a
2. c
3. d
4. To replace vitamins and minerals lost during milling.
5. Four of the following: moisture, test weight, damaged/split kernels, heat damage grain, foreign material, diseased/treated kernels
6. Teacher's discretion

J. Answers to Activity Sheet

AS 10.1

Instructor's discretion

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Name _____

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Date _____

EVALUATION

Circle the letter that corresponds to the best answer.

1. On which grain is the malting process used?
 - a. Barley
 - b. Corn
 - c. Soybean
 - d. Wheat

2. What are two of the methods used to preserve grain products?
 - a. Moisture below 20%, high salt content
 - b. Moisture below 20%, high sugar content
 - c. Moisture below 14%, high sugar content
 - d. Moisture below 14%, low sugar content

3. Which U.S. grades of grain are the primary source for food grain products?
 - a. Grades 5 and sample
 - b. Grades 4 and 5
 - c. Grades 3 and 4
 - d. Grades 1 and 2

Complete the following short answer questions.

4. Why are certain grains enriched?

5. List 4 of the factors used to evaluate grain in grading.

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6. Compare the Kansas City Board of Trade and the Chicago Board of Trade based on what crop(s) they trade.

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AS 10.1

Lesson 10:Products from Grain Crops

Name_____

Processing Wheat

Objective: Process wheat into flour.

Activity Length: 1 period

Materials and Equipment:

1 pound wheat grain (You may substitute oat, rye, and barley.)

Steel- or stone-wheel grinder

Bowl to receive flour

Scales

Procedure:

1. Read manufacturer's instructions for operating the grinder.
2. Weigh the bowl and record the weight or set the scale to the weight of the bowl.
3. Weigh out one pound of grain. Record in Table 10.1.
4. Tightly secure the grinder to a bench or table.
5. Place grain where it can be easily reached and bowl where it will receive the flour from the grinder.
6. Place grain in receiving hopper according to manufacturer's directions.
7. Turn crank slowly, with a steady pressure.
8. Continue grinding until all grain is ground.
9. Weigh flour. Record in Table 10.1.

Table 10.1

Type of Grain Used	Weight of Grain	Weight of Flour

Key Questions:

1. Does the flour look like flour purchased from the store? Why or why not?
2. Did the pound of grain equal one pound of flour? Why or why not?