4-H PROJECT BOOKLET

FOOD INDUSTRY — DARE TO DISCOVER!

Extension Division — Virginia Polytechnic Institute and State University — Revised December 1977 — MFST 100
FOOD INDUSTRY – DARE TO DISCOVER!

A new Project – An Experimental or Self-directed Project for Senior 4-H’ers.

This is a new project, the first food science and technology project in the U. S. As a 4-H’er in this pilot project, please feel free to make constructive criticism. Through your help, the help of volunteers, Extension agents, and others interested in pursuing a new area, we are able to develop projects appropriate to almost everyone's needs and interests.

Read the project book before you decide what to do.

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Are you aware that the food industry is the largest industry in the world? In the U.S., food processing adds over $30 billion to the value of agricultural products; in Virginia, about $1.2 billion. The food industry is concerned with food production, processing, packaging, distribution, product development, and other things. As a 4-H’er, participating in this project, you may choose to learn about many aspects of the industry. The experiences of learning can be many and varied.

Before we get started, let’s take a look at the overall picture of food industry and see how food science and technology fits into it. The food industry covers from agricultural production to consumption. In other words, we start with farm products and go to food for consumption as shown in the diagram:

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Project Objectives:

"Food Industry" – Dare to Discover! is designed and intended to:

(a) Encourage you to use your ingenuity, curiosity, and originality.

(b) Increase your interest in and knowledge of the food industry.

(c) Provide an opportunity for you to plan, carry out, and interpret an independent project in food science and technology according to your special interests, needs, and abilities.

(d) Introduce you to careers and techniques in food science and technology.

(e) Help you develop a greater understanding of problems related to the food industry.

(f) Increase your knowledge of the history of food processing as related to design and present day commercial foods.

Suggested Activities

As a senior 4-H’er, this project will allow you to use your imagination and ingenuity. You may choose from these activities:

- Tour a food processing facility or large food store (individually or as a group).
- Draw a diagram showing how a product is produced (production flow).
- Study an actual food being processed and learn how it is handled to the point that it is ready for customer sales.
- Design and conduct an experiment in food processing.

*Adapted from Exploring Foods and Nutrition, 4-H Bulletin 155K, Michigan State University.
• Design and build a special display.
• Study the many costs involved in processing a food.
• Design a quality control program.
• Learn how to read and understand the food label.
• Discover foods of historical background still produced for today's food market. This is an excellent way to celebrate the American Bicentennial.

All these are merely suggestions. The educational benefits connected with those ideas listed above are many and either or all can be used as a project. You might have ideas of your own which are not listed which can become your special interest project.

I. Tour of a Food Plant or Food Store

Most 4-H'ers live near some type of a food processing plant. For example, a meat processing plant, a poultry plant, a seafood plant, a dairy plant, or a bakery are all excellent possibilities. A trip can be planned with other interested 4-H'ers, volunteer leaders, or Extension agents who are familiar with the type of plants or stores that would be appropriate to tour. Or you may plan a trip alone. In either case, be sure to write or telephone in advance of your visit. Think of the educational benefits derived from simply planning a tour of a food plant. Transportation must be planned, schedules must be developed, permission must be granted from the people concerned, and many other aspects must be considered.

If you cannot tour a food processing plant, consider visiting a large supermarket. Some phase of the food handling within the supermarket may lend itself to an interesting and educational tour. For example, learn how meat is handled, or how fresh fruits and vegetables are handled. Another possibility might be a survey or visit of the delicatessen department within the store. Take a notebook so you can keep good notes for later reports.

II. Diagram of How A Product Moves

What is product flow? It is the way farm products are received and how they are processed and handled up to the point when they reach the hands of the consumer. Hopefully, you will have learned something of product flow in your tour of a processing plant or supermarket (accurate notes are helpful). It would be interesting to prepare a "flow chart" with each of the items you are working with when you become familiar with the overall process.
Food engineers and designers have a lot to do with setting up a food plant, just as engineers have much to do with setting up an automobile assembly plant. Any engineer who works in a plant must know his product and his process. A food engineer must be aware of efficient product flow and the reduction of quality losses. Equipment design is continually looked at in a food processing plant in an effort to reduce the cost of processing or improve the product. If a savings is realized, then this saving may be passed on to the consumer in the form of improved product or lower costs.

If you decide to use this as a part of your project, make an effort to study the various kinds of equipment you have observed and learn of the major improvements in design over the last 20 years. A unique example of machinery might be the "continuous hot dog making machine." Have you ever seen one? If so, describe it because many people have never seen one.

III. Study How a Food is Processed

There are many interesting details in the processing of food which cannot be included in a flow chart. Let's look at what "process" means. It means the steps in going from point A to point B or, as we refer to it in food science and technology, from the raw to the finished product. Good examples with which you might be familiar are:

- milk to cottage cheese
- hog carcass to pork sausage
- cabbage to sauerkraut
- apples to cider

Many of our supermarkets have "deli shops" which produce meat items within the store. As a matter of fact, many of the procedures used in food manufacture are practically the same as those used in the home or on the farm. Therefore, if you know a home process, you already have an idea of what goes on in a commercial process.

This part of your project can be developed from your work on previous sections or can be developed as the major topic of your project. If you should make this activity a major effort then you would be very involved in all the details of processing, such as temperature control, added ingredients, food additives, etc.
IV. Design an Experiment Yourself

An experiment comes out of a hypothesis. The dictionary defines hypothesis as "an unproved theory tentatively accepted to explain certain facts." In other words, as a first step, you decide what you wish to prove and then start making plans. An experiment is a very special way to use originality and creativity.

The food industry depends on much experimentation and research for new and better ways to process certain foods, for new and improved products, for ways to control waste products, among other things. Experimentation can be well planned on a controlled basis or on a more or less trial and error basis. Most often in industry, experiments are carried out on a small scale in a "pilot plant" and then later moved up to a larger scale and finally into full scale plant production. Do you know why this is done?

Here are some examples of experiments that you can perform on a small scale:

- Measure the browning reaction time in fresh apple slices then measure with an antibrowning agent such as ascorbic acid (try fresh lemon juice as a substitute).
- Measure the waterholding capacity of soya flour or textured vegetable protein.
- Measure the amount of sugar that can be dissolved in one cup of water and determine the change in volume and density. Determine the effect of temperature.
- Measure the moisture content of different meats.
- Isolate molds and yeast that develop on breads, fruits, and jellies. Compare mold development on home baked breads vs. commercially baked.
- Measure the temperature of various refrigerated display cases at local supermarkets.

A. Guide To Developing Your Experiment*

1. First develop your idea. Ask yourself if it is a good 4-H related experiment? Does it lend itself to a good experiment.
2. How does this idea relate to the food industry?
   a. A processing or formulation problem
   b. A shelf-life or storage problem
   c. A health or regulatory related item (sanitation)
   d. A consumer acceptance idea
   e. A new product idea
   f. Your own idea

*Adapted from Exploring Foods and Nutrition, 4-H Bulletin 155K, Michigan State University.
3. Are there other ways that this experiment can be approached?

4. Which areas of this problem (experiment) are most interesting to you?

5. What materials, equipment, and sources of help are there?
   At home
   - 4-H bulletins and publications
   - Other Extension bulletins and publications
   - Kitchen equipment
   - Parents and friends' suggestions
   In the community
   - Local industries
   - Library
   - Teachers
   - Businessmen
   - Volunteer 4-H leaders
   - Extension agents
   - School facilities

6. Where and when will you carry out the experiment?
   - Free time
   - During 4-H meetings (regular or special)
   - In school
   Make sure your experiment can be completed within the time you allocate.

7. State specifically your topic and approach. Remember, a carefully planned experiment leads to a more successful and interesting project. Throughout your educational career you will be hearing the "scientific approach" being discussed. This approach is basic to experiments that affect our everyday living. The following steps are basic to the scientific approach:

   (a) Clearly define the problem. What is it that you want to know when you have completed the experiment?

   (b) Collect information. Gather all of the facts you can on the subject. Go back and look at the sources of information in a previous section. Check these out. Take notes and list the references.

   (c) Form a hypothesis or trial answer. What do you think will be the result?

   (d) Test the hypothesis. Try your experiment. Were the results the same as you had anticipated?

   (e) Revise the hypothesis and test again. Results may not have been what you had expected. Do more reading and make the required changes in the experiment. Test again.

   (f) Summarize your conclusions. After you are sure of the results, summarize them. Be sure to indicate what caused the results to happen. Directions for preparing the report will follow.

B. Preparing the Report
Writing up your report will be easy if you have taken good notes on both your reading material and observations. In some cases, your work sheets will not be large enough, however, you may use plain paper.

C. Method*

1. Give a short, but sufficient title to tell what the project is all about.

2. State in the introduction why you selected the subject and what you expect to find at the end of the problem.

3. Prepare a section on materials and methods used. Include procedures or steps, supplies, and controls involved in the experiment.

4. Report findings. Explain the results giving a discussion of the findings.

5. State the summary of your experiment.

6. State the conclusions that you have made. Be specific.

7. Include graphs, pictures, or charts with titles as used in the experiments.

8. List the references that you used such as books, bulletins, people, laboratory, etc.

*Adapted from Exploring Foods and Nutrition, 4-H Bulletin 155K, Michigan State University.
V. Make a Display (or Give a Demonstration)

Most Extension units throughout the state have 4-H Fairs or other events where 4-H'ers may exhibit their work. There are unit contests, district contests, National 4-H Week, 4-H Sunday, and other special events within the unit where there is opportunity to promote 4-H projects. With a food science and technology project involving an experiment, one might exhibit pictures, charts, a color slide presentation along with accompanying cassette script or other products resulting from the experiment. Anything that gives evidence of the experiment or project activity can be exhibited. Examples: A person might isolate molds and yeasts from foods spoiled by these microbes. The cultures would be grown on laboratory medium such as potato dextrose agar and could be maintained for an exhibit. Your science or biology teacher can help you. Color photographs can be taken and enlarged. Don't forget the 4-H photography project could be used in conjunction with such a display and the two projects would complement each other. If you have drawing and drafting ability, you may find the product flow charts will make very good display material. This type material is of much interest to the public because so many people are unaware of what goes on in the food processing industry. Try to incorporate the use of raw materials and finished products into the display because these items will help illustrate what has taken place along the process line.

Here is another example for a display. Let's call it “There’s more to a steer than just steak.” Show examples of all the by-products of meat packing. For example, you might want to show what happens to the hide, hair, bones, feet, glands, etc., in the meat packing industry. This could be shown with charts and samples of the real product produced from packing house by-products.

VI. Costs of Food Processing (Economics)

This phase of your project would consider such economic factors as: a) interest cost on money, b) costs of owning buildings and equipment and having office people, c) costs of labor and utilities. Can you visualize what costs might be called “fixed” and what might be called “variable”? If you choose to write a report on costs of processing, you’ll amaze your reading audience if you can show how a “markup” is arrived at and how some items have a higher markup than others and why. What do we mean by gross margin and net margin? What do we mean by gross profit and net profit? If you choose to analyze a food processing business you will find a lot of interesting things in the business world of dollars and cents.
VII. Designing a Quality Control Program

When you think of quality control you likely ask yourself what quality are we trying to control. Quality can be factors that we see, feel, smell, or taste or it might be factors that we don’t see, such as nutritional status, microbiological factors, or chemical composition. Quality control may be aimed at any or all of these factors. The end results of quality control is better food for the user.

Today, quality control is very scientific because it is mainly based on physical and chemical methods. This sounds complicated, but it isn’t if we look at the jobs of a quality control person. Here are some of his responsibilities:

• Inspection of supplies and material used in food processing.

• Inspection of raw farm products going into a product.

• Inspection of the final product ready for the customer.

• Inspection of sanitation (cleanliness of equipment and facilities).

• Checking to see if products conform to local, state, and federal regulations.

• Checking waste disposal and pollution controls.

Should you decide to write a report on quality control in food processing, you will find that a quality control person has to do many things such as:

• Setting up specifications for a product, as to what goes in and what standards the final product must conform to.

• Developing procedures for testing the ingredients and the finished food.

• Developing procedures for taking samples, such as why, where, when, and how many samples are to be taken.

• Recording and reporting findings.

• Trouble-shooting a problem (trying to find out what is wrong and why).

• Working on special problems, such as finding new ways to process foods.

• Training other people to work in quality control.

In your write up, you won’t actually be writing about all of the duties of a quality control person, but you can see the wide array of skills needed.

VIII. Read a Food Label

What’s in a label? Why worry about what the processor has put on a label? A label tells the users several things:

• It identifies the product.

• It gives directions on how to use the product.

• It tells what ingredients are in the product.

• It may give a USDA grade or quality standard.

• It may give nutritional information.

• It may have a price code which is a group of black and white lines that can be read by a scanner hooked to a computerized cash register.
Today many people are very concerned about the labels on food products. Some people don’t know what the ingredients or food additives really do to food products. As a suggested 4-H activity, you can learn what food additives are and how they function.

Food additives are substances added to perform specific functions. For example, they may preserve the quality of the food, improve the nutritional value, or add flavor. Salt is one of the oldest additives known. Spices are additives which have been used for centuries. Both were used by early man as preservatives for meat and fish. Nutrient additives such as vitamins are widely used. Certain minerals or food acids may be used as additives to increase food safety or stability.

The following are some reasons why foods contain certain additives:

- Add nutritional value.
- Enhance the flavor of certain foods.
- Help maintain appearance, palatability, and wholesomeness.
- Give or maintain desired consistency.
- Control the acidity or alkalinity.
- Give desired and characteristic color.
- Serve as maturing and bleaching agents.

There are at least 10 other functions that additives may have.

To understand labels, you need to know the classes and names of common additives. Reference material is available through your 4-H leaders and Extension office.

Questions to answer in your report on food labels:

- What agency or agencies enforce labeling laws?
- How is the consumer protected through science and legislation?
- Can you identify the food additives in 10 food labels? Can you explain what they are, where they came from and why each is used? You may include extra sheets listing these.
- How do food additives contribute to our food supply?
- Did you remember to make a list of all reference materials?

IX. Foods of American Bicentennial Importance

Man began processing foods when he still lived in caves. As he became more civilized, he began to specialize in certain trades and skills. History has recorded a gradual commercialization of food production and processing. By the time our forefathers began arriving in this country, Europe was already beginning its Industrial Revolution. That is to say, industry was developing, and with it the food industry was growing. The many settlers and immigrants from Europe and other parts of the world brought to this country many methods of preserving and preparing foods. Today, we still use many of the old methods and certainly you should have an appreciation for many of the old traditional foods, passed on from generation to generation. Many of these foods, deeply rooted in history, are available to us in our food markets today.

Here is a chance for you to look to our country’s Bicentennial celebration and do a project on a food or foods that are still processed today on a commercial basis. An example is the country cured ham which is extremely historical, going back to the Jamestown settlement in 1607. Take a look at some others.
Final Remarks

The food science and technology project is new. This pilot project is designed to expand the learning opportunities and experiences of 4-H'ers through exploring the food industry. Granted, only small parts of the total program are needed for one to develop into an interesting 4-H project. Experiments and reports can be very unsophisticated and yet meaningful, or they can be quite elaborate depending on your interests and needs. It is hoped by the author that this project, centered around food science and technology, will be well received. The opportunities are here now.
Plant Tour:

Name of Company

Location

Approximate Number of Employees

Products Produced:

Main Line of Products

Different Products

Product of Special Interest to Me

Special Process or Technique of Interest to Me

What part of the tour will you want to expand into a project effort? 

"Food Industry"--Dare to Discover!
Show a Flow Diagram Below.
Identify the kinds of equipment used in the diagram

"Food Industry"--Dare to Discover!
<table>
<thead>
<tr>
<th>Name of Process</th>
<th>Ingredients Used</th>
<th>Steps to Produce the Product</th>
<th>Controls in the Process (temperature, moisture, humidity)</th>
<th>Description of the Process</th>
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"Food Industry"—Dare to Discover!
Title

Introduction

Materials and Methods

Findings (Results)

Summary and Conclusions

"Food Industry"--Dare to Discover!
Subject

Location of Display or Demonstration

Date of Exhibit

Rating

Description of your Project Activity

"Food Industry"--Dare to Discover!
Report (open to your own ideas)

"Food Industry"--Dare to Discover!
Report (open to your own ideas)

"Food Industry"--Dare to Discover!
Work Sheet

NAME: __________________________

AGE: __________________________

COUNTY: _______________________

CLUB: _________________________

FOOD LABEL

Report (open to your own ideas) ___________________________________________________________________________
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"Food Industry"--Dare to Discover!

17
HISTORICAL FOODS

Name of Food(s) ________________________________________________

The Old Process

Today's Method of Processing

"Food Industry"--Dare to Discover!