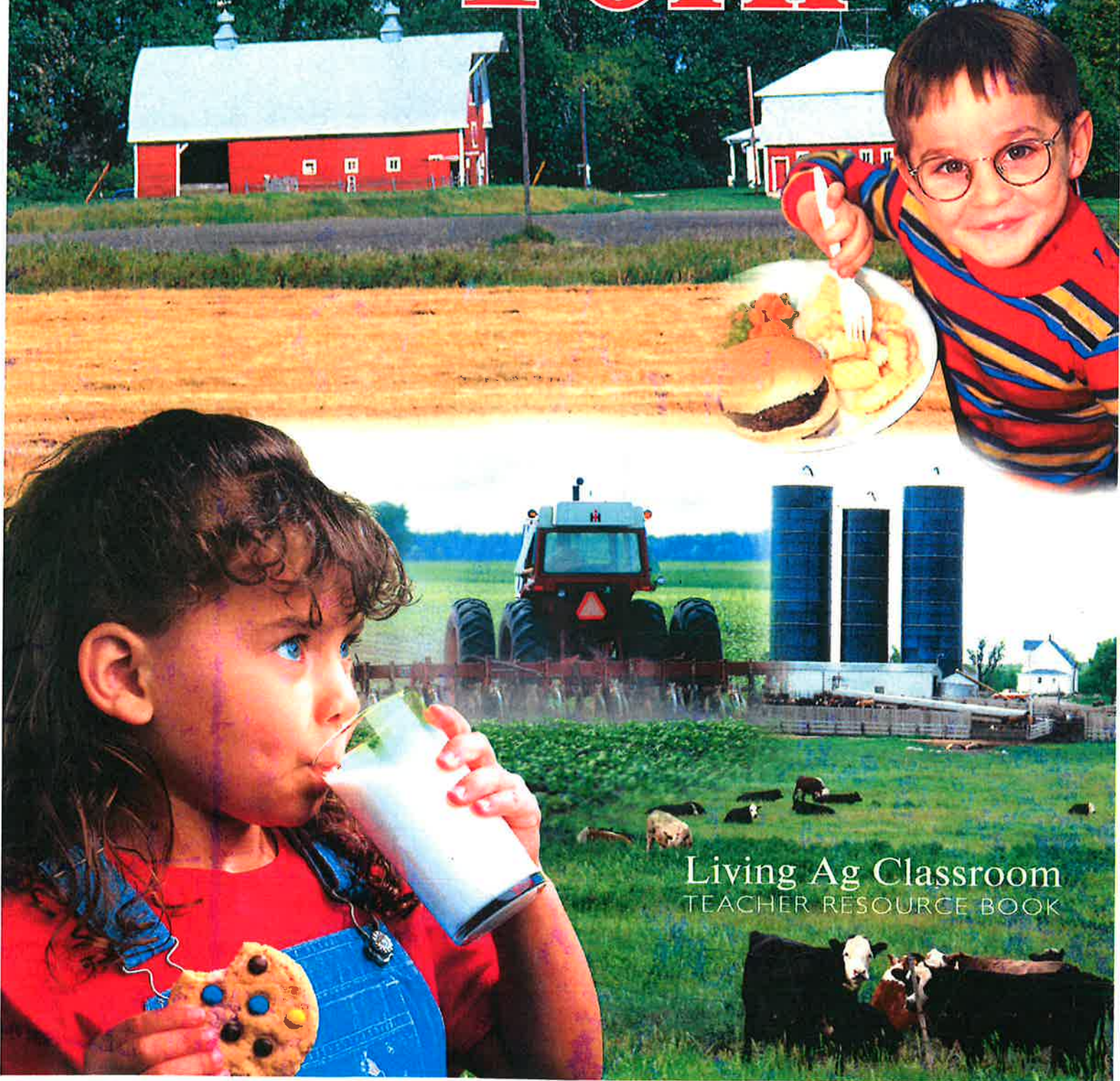


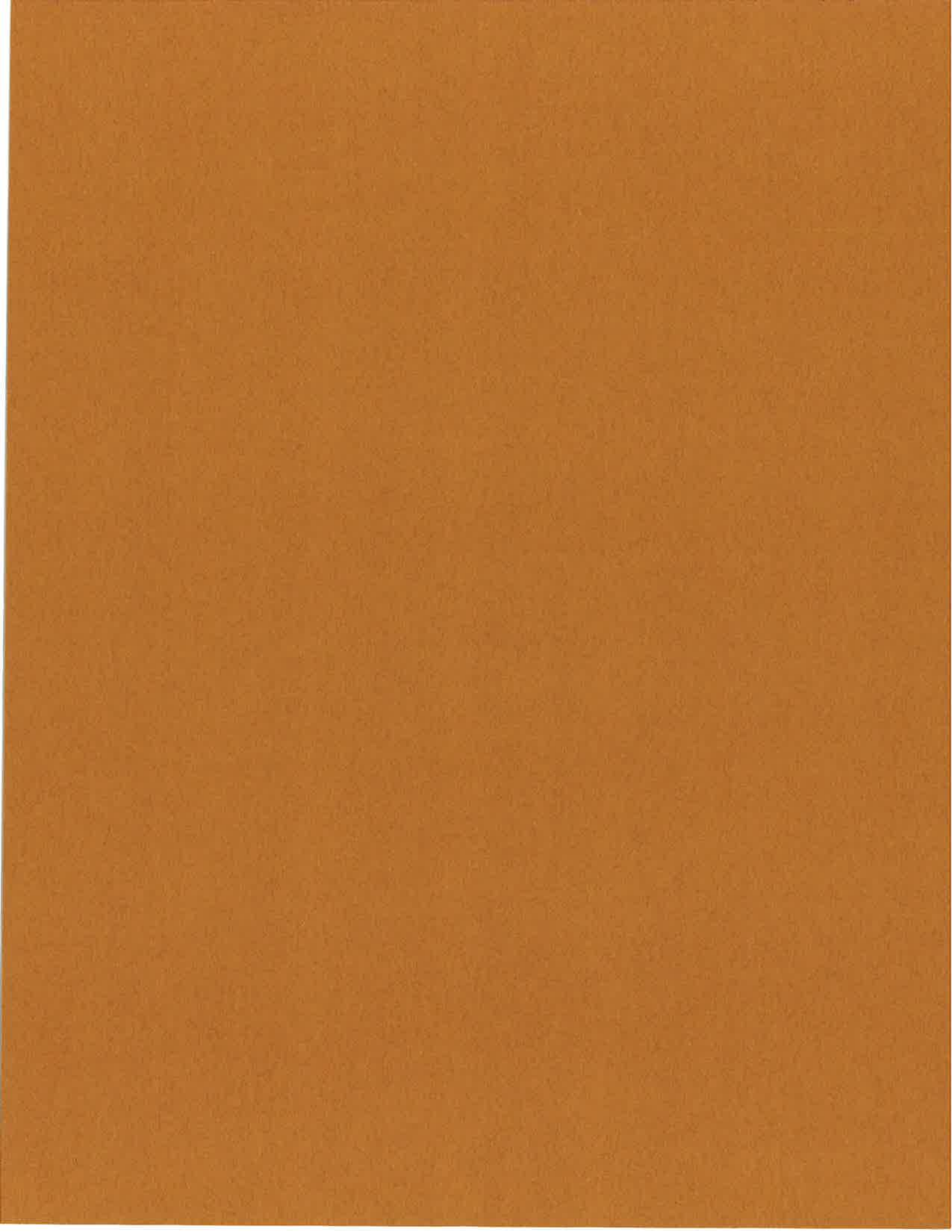
From Farm to Fork



Living Ag Classroom
TEACHER RESOURCE BOOK

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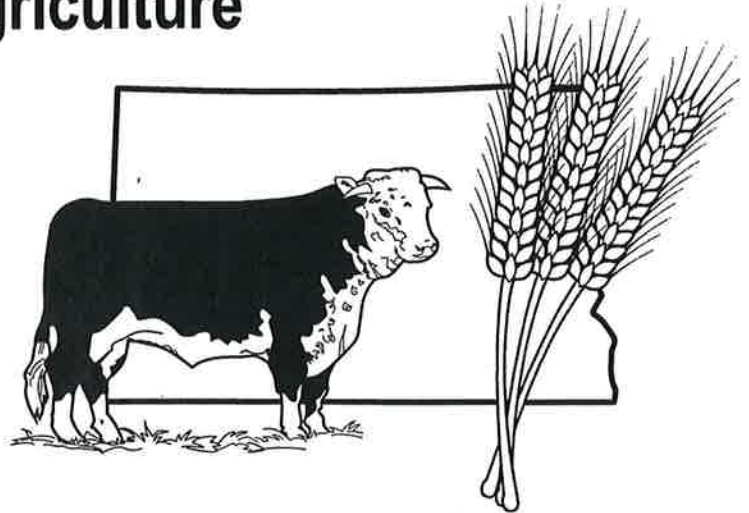
FROM FARM TO FORK

North Dakota's Agriculture

Agriculture is North Dakota's #1 Industry

- North Dakota agriculture is a \$3.8 billion industry.
- Production agriculture is the largest sector of North Dakota's economy, making up 25% of the economic base.
- Nearly 24% of North Dakota's workers are farmers or ranchers, or employed in agriculture-related jobs.
- North Dakota has about 30,300 farms and ranches. The average North Dakota farm is 1,300 acres.
- More than 39 million acres — nearly 90% of North Dakota's land area — is in farms and ranches.
- North Dakota farms provide food and habitat for 75% of the state's wildlife.
- North Dakota consumers spend only 11% of their gross income on food.
- Farmers and ranchers receive only 20¢ out of every \$1 you spend on food at home and away from home.

From North Dakota Department of Agriculture.



North Dakota Tops the List

North Dakota ranks first in the United States in production of many crops. For 2001, they include:

Flaxseed	95%
Canola	90%
Durum wheat	65%
Navy beans	57%
Pinto beans	47%
Spring wheat	46%
Dry edible peas	46%
Sunflower	44%
Barley	32%
All dry edible beans	32%
Oats	13%

From North Dakota Agricultural Statistics Service.

Check out

www.nass.usda.gov/nd

How Important is Agriculture?

Agribusiness begins with the farmer, but many other people are involved in putting food on your table. Let's look at how many jobs revolve around producing a simple loaf of bread, as an example.

- Farmers grow the wheat with help from people who supply equipment, products to protect the crop from disease and insects, fertilizer, seed and information needed to produce a crop or livestock.
- After harvest, the farmer takes the wheat to the grain elevator which stores grain from many farmers.
- The grain is sold and employees at the elevator load the wheat onto a train or truck.
- The grain is taken to a flour mill where millers grind the wheat into flour.
- A trucker takes the flour to a baker.
- A baker adds other ingredients and makes bread.
- Another trucker takes the loaf of bread to a store.
- Grocery store employees stock the bread on the shelf and check you out when you buy groceries.
- You buy the bread, take it home and eat it!

Other Suggested Activities

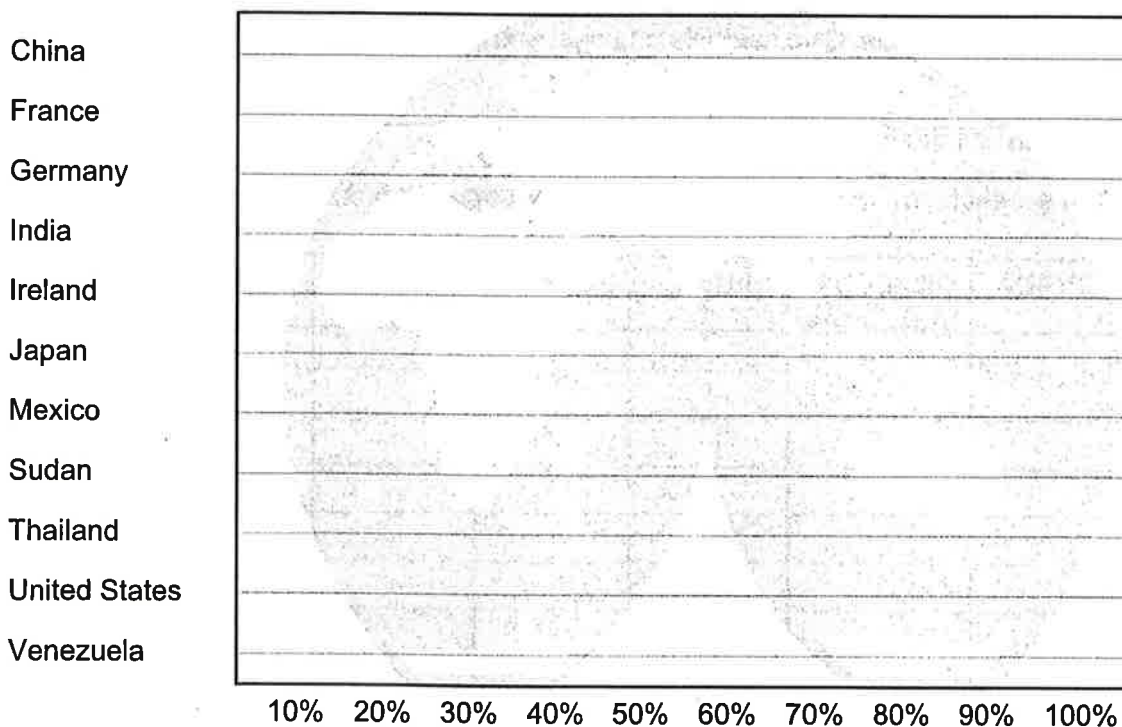
- Find the countries listed on the next page on a map, globe or atlas.
- Discuss their agricultural products and industries.
- How does the U.S. differ geographically, technologically, economically?
- If an average North Dakota family has \$2,000 income per month, how much do they spend on food each month? How much is left for other expenses?
- If an average Mexican family earns \$500 each month, how much do they spend on food each month? How much is left for other needs?
- What have you learned about these countries in your classes or heard in the news lately? Why might what they have to spend on food vary? Give three reasons.

Affordable Food in America

Americans spend less of our income on food than people in any other nation in the world. That means we can afford to eat nutritious, well-balanced diets that include a variety of safe, wholesome foods. And we have money left over for clothing, housing, household needs, schooling and recreation.

Percentage of Income Spent on Food

Using the figures below, complete the graph by indicating the percentage on the line of the corresponding country.



China	48%	France	16%	Germany	25%	India	55%
Ireland	37%	Japan	21%	Mexico	33%	Sudan	63%
Thailand	26%	U.S.	8%	Venezuela	37%		

Food for Us All

Producing enough food to feed our nation and those around the world is a big job, a responsibility accepted by the

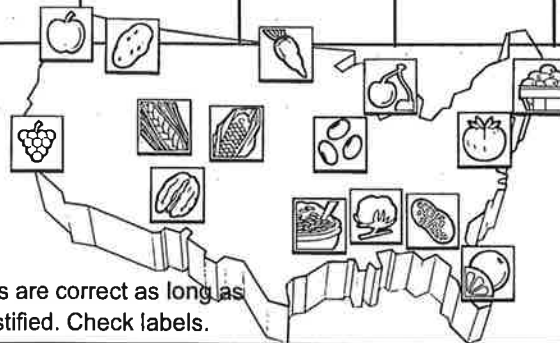
American farmer. Although farmers make up only 2% of our population, they produce food for all of us to eat!

Food from Near and Far

- Where are the commodities below produced? Why?
- Outline the steps a raw commodity takes as it is transformed into foods and ends up on your table.
- Price the products. Give students a budget and ask them to determine how they will spend their food dollars.
- Which one product could you do without? Why?

What products are made from these different commodities?

CORN	OILSEEDS (canola, sunflower, flaxseed, safflower)	BEEF	WHEAT	BEANS	DAIRY	COTTON



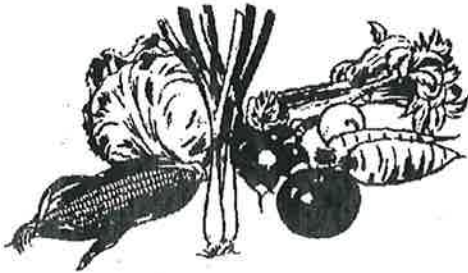
Note to Teacher: Answers are correct as long as they can be verified or justified. Check labels.

Food Groups

The lowest level of the pyramid is the bread, cereal, rice and pasta group; between six and 11 servings a day are recommended. Try to eat whole grain cereals and breads.



Vegetables can be eaten raw, cooked and even juiced; eat three to five servings a day. Eating hard raw vegetables will help keep your teeth clean.



Two to four servings of fruit a day are recommended. Citrus fruit, strawberries and cantaloupe are very high in vitamin C and can satisfy a sweet tooth. Packaged fruit drinks usually contain very little fruit juice, if any.



Milk, yogurt and cheese are high in calcium that we need for our teeth and bones.



Skim milk has more nutrients and fewer calories than regular pop. Add fresh fruit or nuts to yogurt for even more nutrition.

In the meat, poultry, fish, dry beans, eggs and nuts group, two and a half to three ounces of low-fat meat, poultry with



skin removed, and baked or broiled fish are good choices. Two tablespoons of peanut butter equals one serving. Nuts and seeds are high in protein and high in fat, but low in cholesterol.

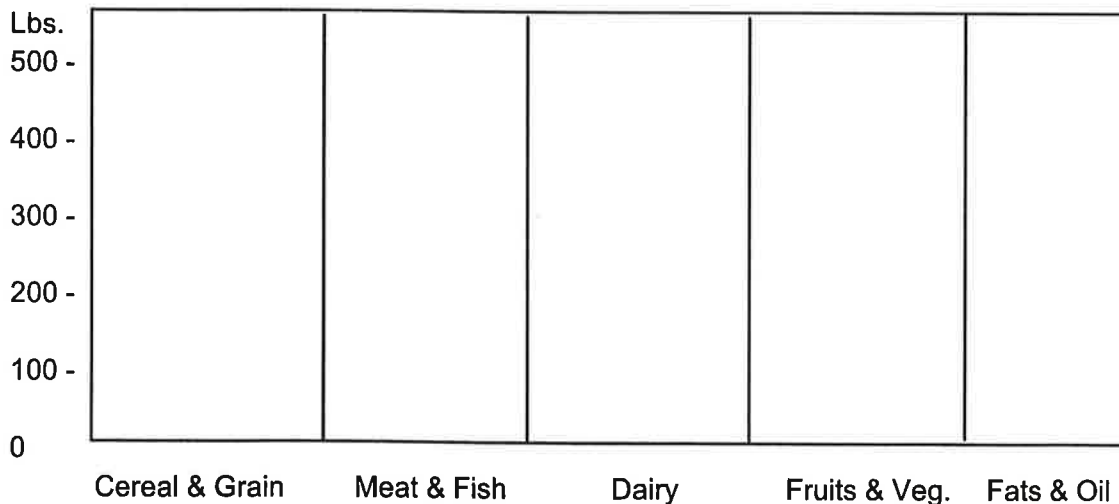
Let's Go Shopping

Each year the average American eats:

- 187 pounds of grain products such as rice, bread, pasta, crackers and breakfast cereal made from barley, oats, rice, rye, wheat and corn.
- 227.6 pounds of beef, pork, poultry, fish, eggs and nuts.
- 215.3 pounds of milk, 29.1 pounds of cheese and 16.4 pounds of ice cream.
- 492.6 pounds of fruits and vegetables — 133.5 pounds of potatoes alone.
- 65.6 pounds of fats and oils, such as butter and margarine, shortening, lard and salad and cooking oils.

Create a Bar Graph

Using the shopping figures, make a graph that illustrates how much of each food group the average American eats each year.



Choose the Food Group

Gorp

- 1/2 cup peanuts
- 1/2 cup raisins
- 1/2 cup sunflower nuts
- 1/2 cup pretzel sticks

Mix together in a bowl or plastic bag.

Lead Bread

- 1 1/4 cups whole wheat flour
- 3 tsp. baking powder
- 1 1/2 cups cold bran cereal
- 1 1/4 cups skim milk
- 1 egg
- 1/3 cup vegetable oil

Stir together and pour batter into well oiled muffin pans and bake at 400 degrees for 25 minutes.

Veggie Sandwich

- 2 slices whole-grain bread
- Cucumber slices
- Parsley
- Mayonnaise

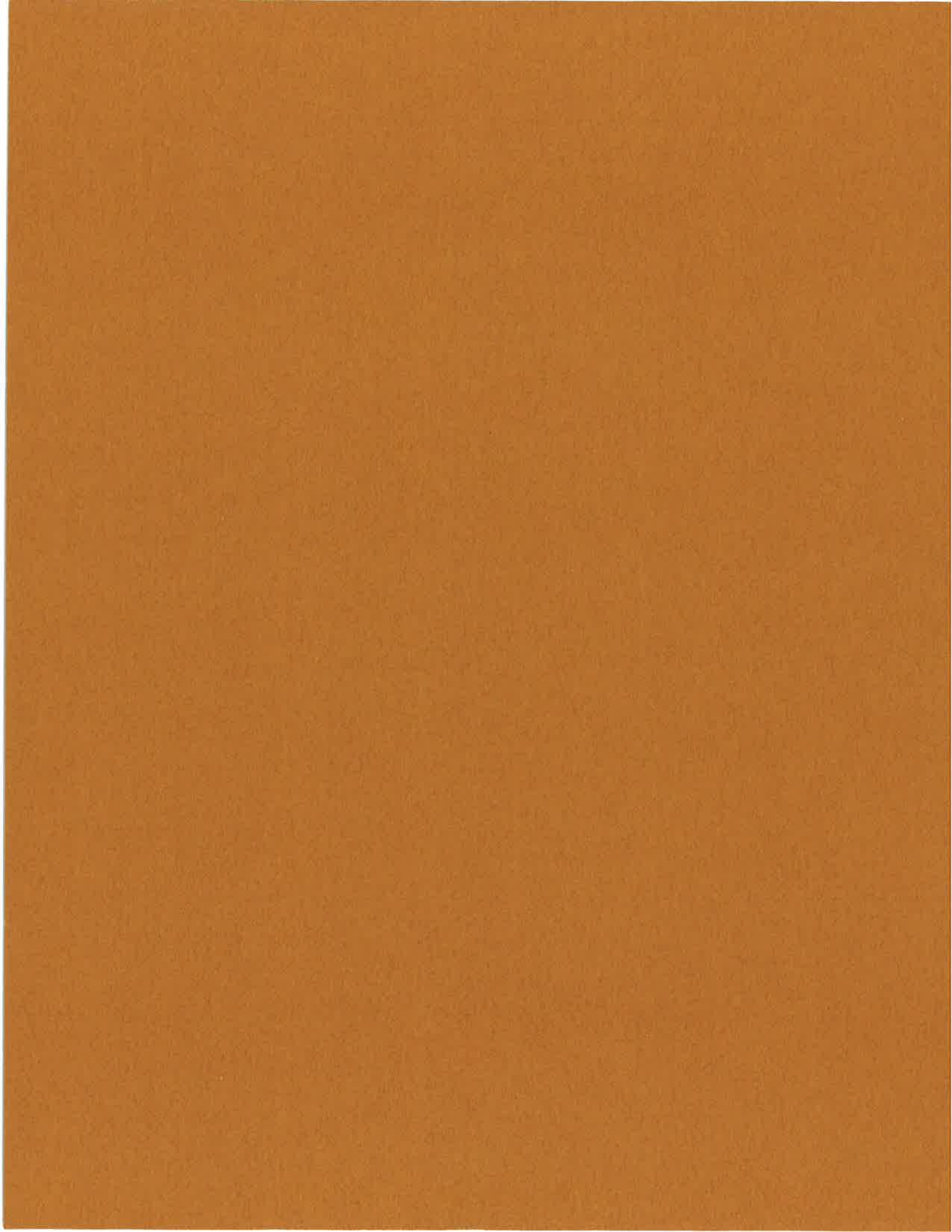
Spiced Milk

- 1 cup milk
- 1 Tbsp. honey
- Sprinkle of nutmeg, cinnamon and ginger

Purple Passion

- 3/4 cup pineapple juice
 - 1/4 cup grape juice
 - 1 cup yogurt
 - 1 banana
- Mix in blender and pour over ice.

Pick one recipe and list the food groups found in it.



CROP PRODUCTION

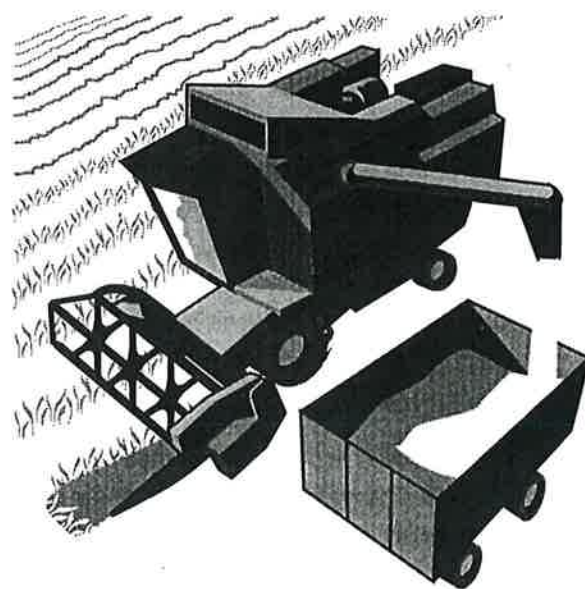
Crop Production Facts

North Dakota

- Usually ranks first in hard red spring and durum wheat, barley, flaxseed, sunflower, oats and dry edible bean production; second in navy beans and all wheat; third in sugar beets; and fourth in potatoes.
- Farmers plant about 21 million acres, or half of the state's total area, to various crops each year. It's no wonder crop production is so important to the livelihood of North Dakota and its citizens.

Minnesota

- Usually ranks first in sugarbeet production; second in wild rice and green peas; third in sweet corn, soybeans, hard red spring wheat, oats and sunflowers; and fourth in barley and corn.
- Farmers plant various crops on about 21 million acres.



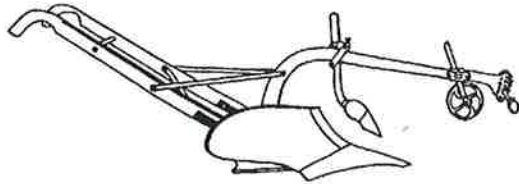
The Northern Plains of the United States are a grocery store to the world. Many of the products we enjoy daily started in the fertile fields of this area. Farmers in this region are able to produce grain and other crops because their soil is productive and the climate is right.

However, crop production can often be a challenge. Drought, floods, hail, bugs and weeds are just some of the problems farmers may face with each year's crop. There have been times when poor conditions have blocked every effort to produce a crop. Yet when things go just right, the Northern Plains have an immense capacity for producing food and other essential supplies.

History of Progress

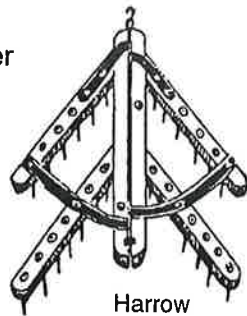
From the 1870s until the early 1900s, thousands of immigrants homesteaded in America's Northern Plains to fulfill dreams of freedom and farming. These pioneers worked hard to make a living off the soil and to turn this area into one of the most productive crop-producing regions in the world.

Then, the land was broken with a **plow** and **harrow**. The plow had a blade that cut into the earth and turned it over.



Moldboard plow

Usually draft horses pulled the plow while the farmer walked behind the equipment to guide it. This was a very slow way of working the land, and a farmer was often only able to break a few acres in a year. The harrow broke up and leveled the plowed soil.

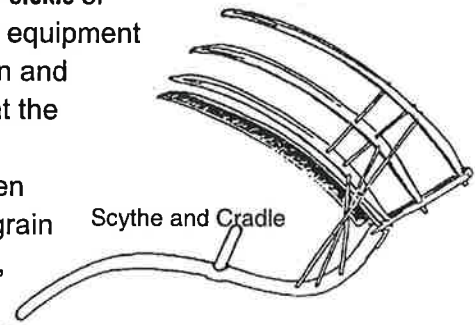


Harrow

The farmer would then **broadcast** the seed, scattering it by hand from a bag slung over his or her shoulder.

Between planting and harvesting, the crop could be harmed or destroyed by many natural events such as drought, insects, flood, frost and disease. These factors still affect our crops today.

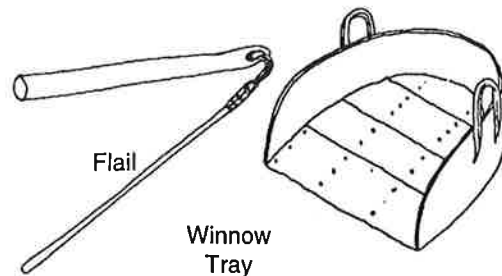
Once the crop reaches maturity, or ripens, it has to be harvested. This was done with a **sickle** or **scythe**. This equipment cut the grain and bundled it at the same time. Farmers then bound the grain into shocks, ready to be threshed.



Scythe and Cradle

Threshing is the process of separating the kernels of grain from the hull and straw. From early civilization, this was most often done by hand with a **flail**. The flail was used to beat the shocks, knocking the grain loose.

To separate the grain from the **chaff**, or outer shell, the farmer used a process called **winning**. The grain and chaff



Flail

Winnow Tray

were placed on a wooden tray which was shaken lightly in the wind. Because grain is heavier, it would fall back onto the tray and the chaff would blow away.

Gradually machines began to replace some of the labors. By the late 1700s, a successful threshing machine had been built, and by 1874, a binder was made.

Farming is a Science

Technology has progressed rapidly throughout history. Within 150 years, the power for farming went from human to animal to mechanical, and agricultural thinking went from basic to scientific. Today, complex equipment and techniques help the work of a grain farm and allow farmers to cultivate more land than ever before. With modern machines and practices, farmers do basically the same steps the pioneers did, but mechanization and new-found knowledge allow farmers to work more efficiently.

Soil preparation

Today, the soil is no longer tilled, or prepared for planting, with a hand-drawn plow, but rather with a field cultivator or chisel plow pulled by a tractor. These machines help aerate the soil, or expose it to the air, and rid it of weeds. The

machines also help prepare a fertile seedbed and bury plant and animal matter that eventually rots and replaces lost soil nutrients.

Excessive tillage can be harmful to the soil, causing it to lose organic matter. Therefore, new implements and tillage methods are constantly being designed and used by farmers to prevent those problems. One such method is minimum- or no-till. This method helps conserve, or save, the soil by minimizing wind and water erosion.

Planting

After the soil is prepared, farmers plant, or sow, their crops. There are many different types of seeding equipment used, but they all open a furrow in the soil, drop the seeds in at an even depth, cover the seeds and pack the soil. Because of the region's cold winters, most crops are planted in the spring after the frost has left the ground.

Fertilizer may also be placed in the soil with the seeds or spread before or after planting. Fertilizer gives plants added food and is used where the soil is missing some of its natural nutrients.

Many farmers also use methods of crop protection to guard against damage from weeds, insects, fungi and diseases. Farmers are very careful with their crops to provide the world with a tasty, safe and abundant food supply.

Harvesting

Harvesting begins when the crops are mature enough for their special uses. Silage crops for feeding cattle are harvested when they are still green. Grain, oilseed and row crops are harvested when they are ripe.

Cereal grains like wheat and barley are harvested with a giant machine called a **combine**. The combine cuts, separates and cleans grain all at the same time. Before the combine was invented, farmers had to use two separate machines for harvest — a reaper, or binder, to cut the grain and a threshing machine to separate the kernels from the hulls and the straw. The combine is so named because it “combines” the jobs of both machines.

Combines have made grain harvesting much faster and easier. It used to take three days to cut and thresh an acre of grain, an area just smaller than a football field. Today, with a large combine, farmers can harvest an acre in less than six minutes.

During harvest, kernels are removed from the plant and stored in the combine. When full, the kernels are dumped into a truck and hauled to a storage bin on the farm or to a grain elevator.

Marketing and Transporting

When the grain is harvested, the farmer stores it on the farm or takes it to the elevator. At the elevator, the grain is sampled and graded. The price a farmer gets for the truckload usually depends on the grain’s quality, or grade. The better the grade, the more money the farmer receives.

The grain is emptied into a pit and then raised or “elevated” into a tall bin. The farmer may store the grain until the price is better. Farmers and elevator operators often use computers to check prices to decide if they want to sell grain now or store it longer, and to predict if the price will rise or fall.

The grain may then be shipped by truck, railroad or cargo ship to processors or even other countries.

Today’s marketing and transporting are much different than when farmers would trade, or barter, their grain for their family’s necessities.

Factors in Crop Production

Weather

Weather is the most important factor affecting crop production. Weather not only impacts the growing of crops, but it is important in planning haying and spraying operations, designing heat and ventilation for barns and in laying out farm yards to control snow drifting.

Light, heat, moisture and air (carbon dioxide, nitrogen, oxygen and hydrogen) are essential for plant growth. Different amounts are needed for different plants and for different stages of their growth. Weather controls all this.

Light

Green plants take energy from the sun and turn it into food. This process is called **photosynthesis**.

Sunlight warms the soil and helps the seeds **germinate**, or start to grow. It helps the plant produce food and later helps dry that food for harvest.

Heat and Temperature

Both air temperature and soil temperature influence plant growth. Each plant has a certain set of temperature conditions it needs to grow. A sudden cold spell may harm or destroy a crop.

Moisture

Plants need the right amount of moisture (rainfall and snowfall) to grow. With too little moisture, the seeds may not germinate. With too much, the crop may be flooded and the soil nutrients lost.

1. plow; 2. drought; insects; flood; frost; disease; 3. winnowing; 4. mechanical; 5. aerate; 6. conserve; 7. combine; 8. football; 9. barter; 10. sickle; 11. crops; 12. sow; 13. photosynthesis

Answers: Word Match

Word Match

- | | |
|--|--|
| 1. The _____ cuts into the soil and turns it over. | mechanical |
| 2. Crops can be harmed by natural events such as _____. | sow |
| 3. _____ is the process of separating the kernels of grain from the hull and straw. | combine |
| 4. Within less than 150 years, the power for farming went from human to animal to _____. | acre |
| 5. A field cultivator or chisel plow can help _____ the soil. | aerate |
| 6. Minimum or no-till methods are ways to _____ soil. | barter |
| 7. Grains are now harvested with a _____. | winning |
| 8. An acre is a piece of land about the size of a _____ field. | plow |
| 9. In the late 1800s and early 1900s marketing was done by _____. | crops |
| 10. A _____ was used to cut the grain. | photosynthesis |
| 11. Soil is prepared for planting of _____. | drought, insects, flood, frost, disease |
| 12. After the soil is prepared, farmers plant or _____ their crops. | conserve |
| 13. _____ is the process when green plants take energy from the sun and turn it into food. | sickle |
| | football |

Match the Farm Machine with What It Does

Draw a line that connects the piece of farm machinery with the machine's name and the job it does on the farm.

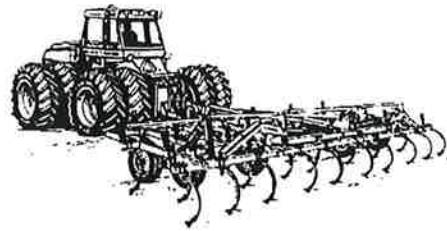
Combine

Harvests crops from the field.



Tractor

Pulls equipment,
does other farm chores.



Cultivator

Tills the soil to prepare land for seeding.



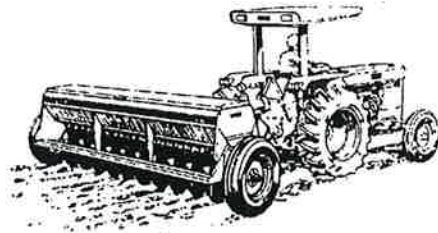
Baler

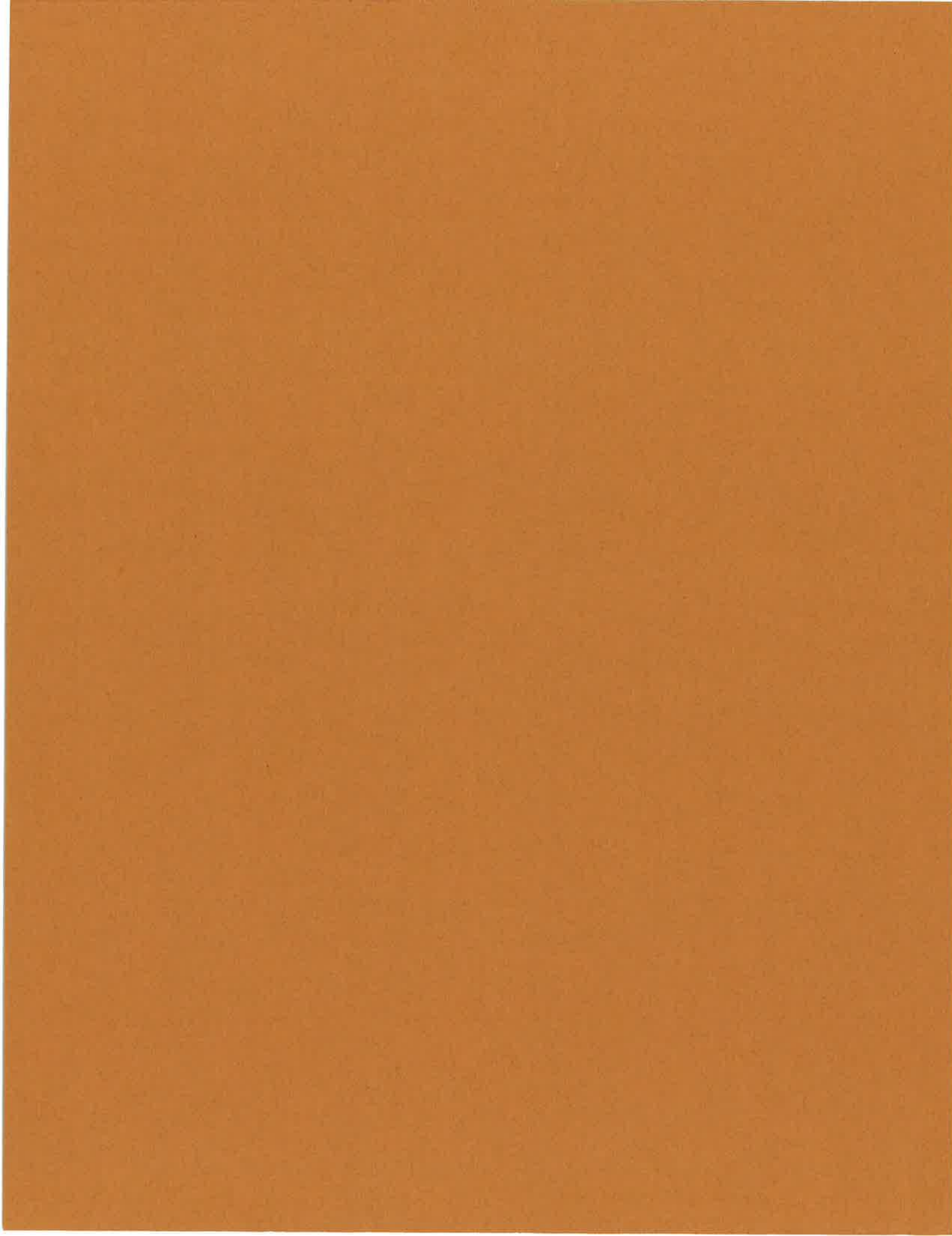
Packages forage for feeding
to livestock in the winter.



Seeder

Places seed in the ground
so the crop can get started.





WHEAT

The staff of life

Wheat has been important since prehistoric times. The development of early civilizations closely followed its cultivation. During biblical times, bread was introduced in religious ceremonies, and armies sought to conquer wheat producing lands. Entire civilizations rose and fell because of wheat. Throughout history, wheat has been a staple in the human diet — it is the staff of life.

From fields of wheat to baskets of bread, plates of pasta and bowls of cereal, the story of wheat provides an exciting look at how an agricultural commodity is processed from a raw product to foods we eat.



check out
www.ndwheat.com

Wheat Facts

North Dakota

- # Wheat is the number one crop in the state. Farmers devote about 10 million acres, almost one-fourth of the state's land area, to its production.
- # North Dakota farmers produce almost 300 million bushels of wheat per year. The state typically ranks second in total wheat production, although some years it captures the lead from Kansas.
- # When production figures were first recorded in 1880, farmers grew 2.3 million bushels.
- # Wheat prices vary. At \$4 per bushel, an average North Dakota wheat crop is worth \$1.2 billion. But the total economic impact is at least \$4 billion. The money generated by wheat helps create jobs and makes the state prosperous.

Minnesota

- # Wheat is the third leading crop in the state, behind only corn and soybeans. Farmers devote about 2 million acres to wheat production.
- # Frequently ranks among the top 10 states in total wheat production. Farmers produce about 80 million bushels of wheat each year, enough to almost twice fill the Metrodome in Minneapolis.
- # At \$4 per bushel, an average Minnesota crop is worth close to \$320 million in direct economic impact and about \$1 billion, counting indirect benefits.

Wheat Classes

Today the United States offers the world six distinct classes of wheat, grouped according to hardness, color and time of planting. They are hard red spring, hard red winter, hard white, soft red winter, soft white and durum.

Millers and bakers need to know what class of wheat they're using, since each makes a different type of flour and is used in different types of foods.

Hard wheats, like hard red spring, are used to make breads and rolls. The soft wheats are used in such foods as cakes, pastries and crackers. Durum, the hardest wheat of all, is used in pasta — macaroni, spaghetti, lasagna and more. Hard red spring wheat, the wheat highest in protein, also can be blended with soft wheats to make all-purpose flour.

Wheat Facts

North Dakota

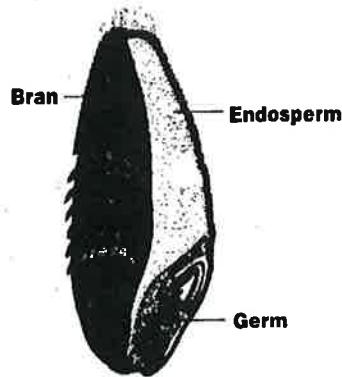
Raises almost half of all the hard red spring wheat grown in America and 70% of the durum, making it first in the nation in the production of these two classes. Most of the wheat grown in the state is hard red spring wheat, with just one-fourth of it durum.

Minnesota

Ranks third in the nation in production of hard red spring wheat. Raises very little durum.

The Kernel

The wheat kernel, or seed, is the part of the wheat we eat. There are about 50 kernels in a head of wheat and 15,000 to 17,000 kernels in just one pound.



The large, white part of the kernel is called the **endosperm**. It's the part that's ground to make white flour.

The hard, outer coating is the **bran**. This portion is made of many layers. Bran can be used alone in cereals or livestock and poultry feeds.

Finally, the tiniest part of the kernel is the **germ**. It's the part that grows into a new wheat plant if the kernel is planted. The germ is sometimes added to baked goods and casseroles.

If all three parts of the kernel — endosperm, bran and germ — are ground, or **milled**, together, you get whole wheat flour.

Growth to Harvest

Warm, moist days make wheat plants grow quickly after planting. Wheat plants can grow to be as tall as 7 feet, but they are usually about 2 to 4 feet high. A wheat plant has four basic parts: head, stem, leaves and roots. The **head** contains the kernels, the **stem** supports the head, the **leaves** conduct photosynthesis and the **roots** hold the plant in the soil.

Toward the middle of July, green wheat plants turn a rich, golden color and become ripe. While Mother Nature usually cooperates with them, farmers race to harvest the crop because a ripe wheat field can easily be damaged and yields reduced by wind, rain, hail and even fire. Wheat can't be harvested if it's rainy. The moisture level in the wheat has to be just right.

Because of all the different climates, wheat doesn't ripen at the same time everywhere in the United States. Harvest begins in May in hot, southern states like Texas and Oklahoma and then moves north as the summer goes along. In the Northern Plains, harvest usually begins in early August and lasts until mid-September.

The Mill

After harvesting the wheat, farmers sell their grain at an elevator. From there, wheat is sent by truck or train to a mill where it's ground to make flour for human foods. The type of flour produced depends upon what type of wheat it was made from.

Wheat Facts

North Dakota

In the late 1890s, there were 63 flour mills in North Dakota. Today, the state has just a few mills: the North Dakota Mill in Grand Forks, which grinds spring and durum wheats; Harvest States Milling in Fairmount, a spring wheat mill; the durum mill at Dakota Growers Pasta Company, Carrington; Noodles by Leonardo, Cando; Minot Milling; and Minnesota Grain Inc. at Rhame. The North Dakota Mill is the only mill in America owned by the government.

Minnesota

Minnesota ranks third in overall flour production. The state is home to nine mills that grind spring wheat and one that processes durum.

1. Export; 2. Mill; 3. July; 4. Bushel; 5. Hard Red Spring; 6. Durum; 7. Gluten; 8. Semolina; 9. Rise; 10. Carbohydrates

Unscrambling Exercise Answers:

1. 17,850 Bushels; 2. \$57,120; 3. \$44,625; 4. \$12,495; 5. 749,700 Loaves; 6. \$1,124,550

Wheat Math Answers:

Bread

Bagels, croissants, French breads, pizza crusts, kaiser rolls and other breads are made with hard red spring wheat. Hard red spring wheat's high protein content and **gluten**, or magical protein, make it perfect for some of the world's finest baked foods. Other grains have gluten too, but not as much as hard red spring wheat.

Besides flour, yeast is the most important thing in many breads. Yeast is what makes bread **rise**, or increase in size. When yeast is mixed with warm water and flour to make bread dough, the yeast gets "active" and makes thousands of tiny air bubbles. These bubbles need to be trapped in the dough so it will rise and become light. That's where the gluten comes in.

Gluten is very stretchy, much like bubble gum. The gluten traps the air bubbles from the yeast and keeps them in the dough. All the tiny holes in a slice of bread were formed by gluten stretching around air bubbles.

Since other grains don't have as much gluten as hard red spring wheat, bread made from other grains is heavier. Therefore, hard red spring wheat flour is usually combined with other flours to make rye, pumpernickel, barley and other multi-grain breads.

Pasta

Durum wheat is used to make pasta. "Pasta" is from the Italian word for paste — meaning a combination of flour and water. It's used to describe the 350 shapes and sizes of pasta products made from durum wheat.

Before durum can be used in foods, it must be milled into **semolina**, the coarsely ground endosperm of a durum wheat kernel.

At a processing plant, semolina and water are mixed to make pasta dough. The dough is kneaded and then forced through **dies**, or metal disks with holes, to create many pasta shapes. The size and shape of the holes in the dies determine the shape of the pasta; that's how pasta can be in flat ribbons, bows, sea shells, twists, corkscrews, cartwheels, grooved tubes, rings, stars and many, many more.

After being forced through the dies, the wet pasta noodles are dried in special machines, packaged and sent off to the grocery store where families buy the food to make their favorite dishes.



Nutrition

Wheat foods help fulfill the U.S. Department of Agriculture's daily dietary guidelines which are illustrated by the **Food Guide Pyramid**. The pyramid is a guide to daily food choices and an easy way to remember how to eat better and feel better all day long.

At the base of the pyramid are the foods we should eat most often — bread, pasta, cereal and rice. Six to 11 servings are recommended daily, depending on your age and activity level.

Wheat products provide **complex carbohydrates** that give our bodies energy and help our brains function.

Fiber is another strong point of wheat. It helps our digestive systems keep moving on schedule.

Sometimes adults go on diets to lose weight and stop eating wheat products because they think those foods are fattening. However, wheat is very low in fat and can actually help them lose weight. One slice of bread has just 65 to 70 calories.

Wheat also has **B-vitamins** and **iron** that aid in digestion, good appetites and healthy nerves.

Athletes eat a lot of wheat products for these reasons. They know wheat foods will give them energy without many calories.

Bushels

Wheat is often bought and sold by the bushel, a unit of measurement for dry goods. A bushel of wheat weighs about 60 pounds when the farmer harvests the crop. From that one bushel, flour mills grind about 42 pounds of flour. Then it goes to the baker who can make 42 1-1/2 pound loaves of bread or 42 pounds of pasta.

One bushel of wheat yields 42 loaves of bread. The average 1-1/2 pound loaf, the size we usually find in the grocery store, has 24 slices.

Multiply 24 slices x 42 loaves = 1,008 slices of bread. That's enough to make 504 sandwiches! If you ate a sandwich for breakfast, lunch and dinner, it would take about 168 days to eat all the bread from one bushel of wheat!



Worldwide Sales

The wheat grown in the Northern Plains and the rest of the United States travels to other countries so people there can eat wheat products, too.

Not all children grow up eating bread like Americans. Instead, some eat mostly rice products. Wheat farmers in the United States sometimes send people to foreign countries to teach citizens there how to make and use bread, cereal and other wheat products in their daily diets. When they realize wheat foods are good for them and taste good, their countries sometimes buy wheat from American farmers.

Wheat farmers must **export** their wheat, or sell it to other countries because they raise more than Americans can eat. Each year the United States sells more than half the wheat it raises to about 70 different nations around the world — everywhere from Japan to Venezuela.



Profit Share

While wheat flour is the main ingredient in bread, the price of wheat has little to do with the price of bread. Today, a 1-1/2 pound loaf of wheat bread costs about \$1.50 at the supermarket. Of that \$1.50, the farmer gets between 5 and 15 cents. The rest of the money goes to others, including elevator operators, millers, bakers, pasta manufacturers, truckers and grocers.

Who Gets The Dough?

Wheat Math

1. A farmer planted 595 acres of hard red spring wheat and it yielded 30 bushels per acre. How many bushels of wheat did the farmer harvest from the field?

2. The farmer delivered that wheat to a grain elevator. He was paid \$3.20 per bushel for his wheat. How much was the farmer paid for the total amount of wheat sold ?

3. The farmer's expenses to seed and harvest the wheat totaled \$75 per acre. This included seed, fertilizer, fuel, herbicide and equipment costs. What was the total cost of producing the wheat?

4. How much profit will the farmer have made when total expenses are deducted from the total payment received?

5. If 42 1-1/2 pound loaves of bread are made with just one bushel of hard red spring wheat, how many loaves could the farmer's crop make?

6. A 1-1/2 pound loaf of bread costs about \$1.50 at the store. How much money would you need to buy all the bread the farmer's crop could produce?

Unscrambling Exercise

All bold words are used in previous text.

1. **torpxe** _____
Sell products to another country.
2. **lmil** _____
Where wheat is ground to make flour for human foods.
3. **jylu** _____
The month wheat plants begin to turn gold in northern states.
4. **lbuehs** _____
A unit of measurement for dry goods.
5. **drah dre sgrnip** _____
The wheat class highest in protein and used to make yeast breads.
6. **mdruu** _____
The wheat class used to make pasta.
7. **nelutg** _____
A magical protein that traps air bubbles from yeast.
8. **asnoliem** _____
The coarsely-ground durum endosperm used to make pasta.
9. **srei** _____
How bread dough increases in size.
10. **rsceatrabdoyh** _____
A nutrient in wheat foods that gives our bodies energy.

Wheat Math

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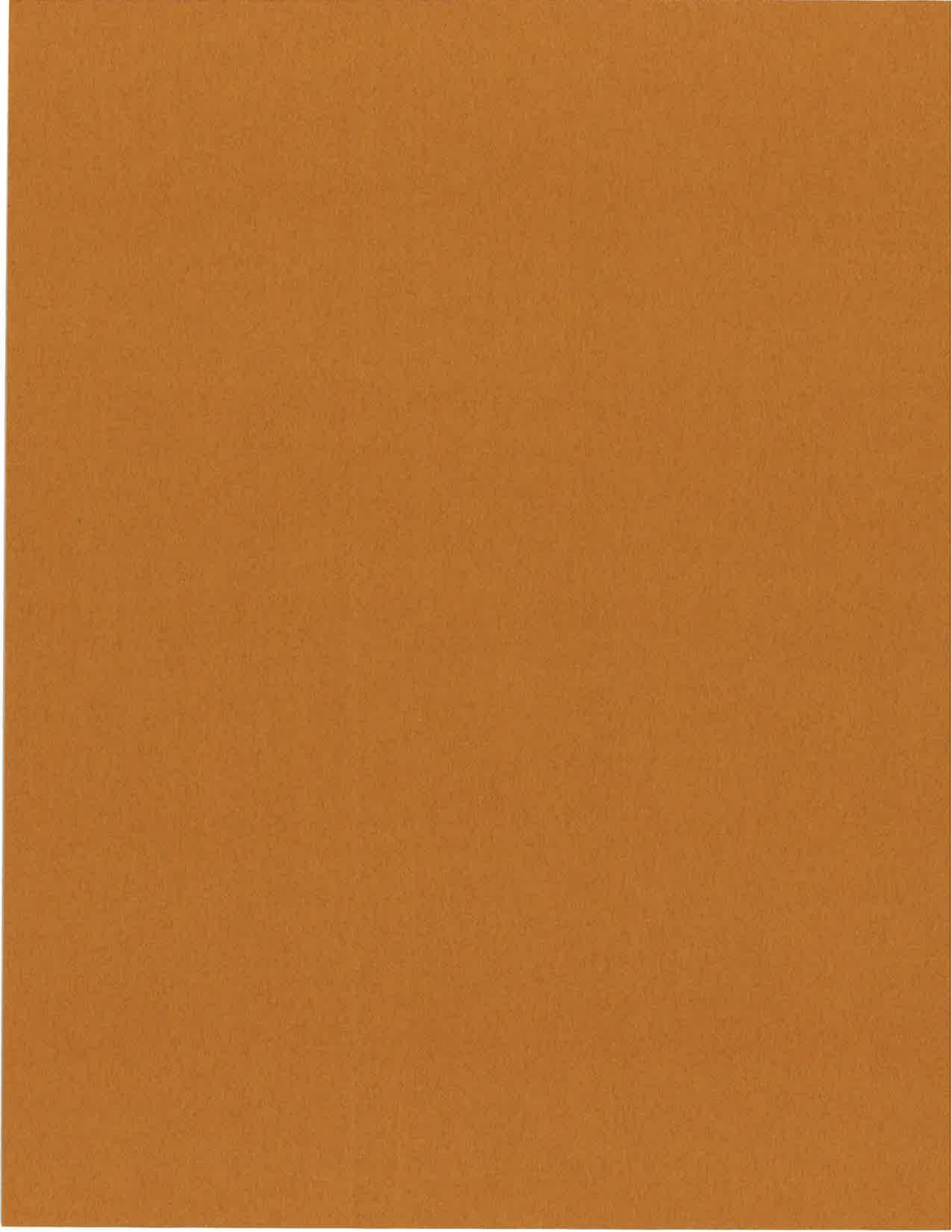
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BARLEY

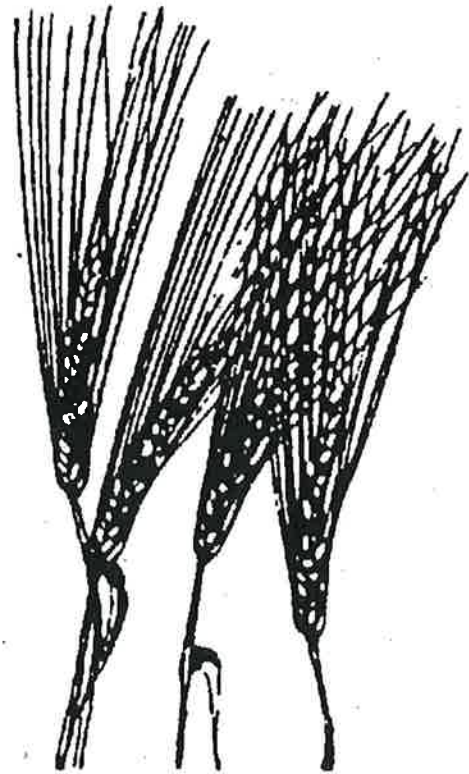
Standing the Test of Time

History

In Babylonia, barley was so important it supported the value of their money. Archaeologists have discovered evidence of barley as far back as 16,000 B.C. Ancient history indicates that China, Turkey, Scandinavia, Switzerland and what we now call the Middle East raised a crop similar to barley. Barley nourished Julius Ceasar's Roman armies as they conquered Europe. Biblical passages talk about barley ripening as a sign of spring. In those days, barley was a wild variety that came up early in the year and ripened quickly. Columbus brought it to the new world and pioneers carried it to the prairies and west coast. Today's commercial barley crop is planted in May and harvested in July or August.

Production

Barley is the fourth largest crop produced in the world after wheat, rice, and corn. The United States is fourth in world production after the European Union, Canada and Australia. Barley is grown throughout the world in all kinds of climates and soils. It continues to grow even when rainfall is lacking and the weather is bad.



North Dakota is the nation's largest barley-producing state, growing about 1.6 million acres of barley, or roughly one third of the total U.S. crop. About 60% is used for human food, seed and beverages. Approximately 40% is used for livestock feed.

Between 10 and 16% of the barley produced in the U.S. is exported, primarily for animal feed. Much of the barley is sold through the Minneapolis Grain Exchange, while a portion goes through the Port of Duluth for export through the St. Lawrence Seaway. Some is purchased by breweries at planting time from farmers who promise to deliver the grain after harvest. This is called "contracting".

Pearl barley is made by removing the hull, outer layers and embryo so only the endosperm remains. Scotch, pot or hulled barley is the entire kernel except for the tough hull. The embryo, or germ, contains the best quality protein as well as minerals and vitamins. The germ is the live portion of the kernel and is what starts a new plant's growth when the kernel is planted in the ground. The outer layers, testa and pericarp also contain good quality protein, vitamins, and minerals. The endosperm is nutritious but does not contain as many vitamins and minerals as the embryo and two outer layers. The husk or hull is very tough and must be removed before eating.

Barley is a hardy crop that is not widely used in the U.S. as food. Scientists have recently begun to develop barley varieties with unique fibers, starches, proteins and oils that can be used by the food industry. **Waxy Hulless** barley looks like any other barley as it grows, but it threshes clean from the hulls, similar to wheat. While there are other hulless barleys available, Waxy Hulless barley is unique because it has greater potential for ethanol or syrup production, food processing and livestock feed.

Uses

The major use of barley is for animal feeds, then for making beverages and finally for human consumption. Because barley is a healthy food option, human consumption may increase. Food barley is used in many ways from soup to dessert. Barley can be ground into flour and used in cookies, biscuits, muffins and breads. In fact, the earliest breads were made entirely from barley. They did not look like the bread we know today because they were flat and heavy.

For Cooking

To use in baked goods, barley can be cooked in water until tender and added to any recipe for extra nutrition and texture. Today, quick barley and regular barley are available for home cooking. A homemaker in 1000 BC first had to hull the barley with stone grinding and then continue grinding to get flour. Today we can pour pearl or scotch barley into a blender and quickly end up with barley flour. Barley contains gluten (essential for yeast breads) but not as much as wheat, therefore, a loaf of bread should not contain more than 25% barley flour or it will be flat and heavy. Barley, especially “hulled” barley, is a good source of dietary fiber — the substance that passes through the body undigested.

Malt Barley

The second largest use of barley in the United States is as malt. Special varieties of barley are grown to meet the specific requirements of the malting industry. If the barley meets the special quality levels, it is transported to a malting facility to begin the transformation. Malting involves a 4-to-6-day process where barley kernels are allowed to germinate in a controlled environment. The kernels must germinate, or begin to grow, to initiate an internal chemical process that converts starch into sugar. After conversion, the kernels are slowly dried to stop the growth and retain the sugar content within the kernels. Once dried, the barley is now malt and can be used in a variety of food products, from breakfast cereal to candy to beverages such as beer.

Barley Sprouts

Since winters can be long and dreary, start your own barley crop inside. You need the following items:

1 plastic planter 6" x 2' x 2'

1/2 cup of barley

paper towels

pie plate or baking dish

plastic wrap

Borrow a large, deep, wood or plastic planter (6" wide, 2' long, and 1 to 2' deep should be large enough) and fill it with dirt. Dig a row 1/2 inch deep down the middle.

Get 1/2 cup of barley from a farmer or the closest grain elevator and place the barley kernels 1/2 inch apart in rows. Cover with dirt and pat lightly. Water and continue to water whenever the soil dries out, and within 10 days to 2 weeks you should have your own barley crop.

The rest of the 1/2 cup of barley can be used for sprouting. Place a paper towel in the bottom of a baking dish or pie plate. Put the barley kernels on the towel and cover them with 3 to 4 layers of paper towels. Pour enough water on

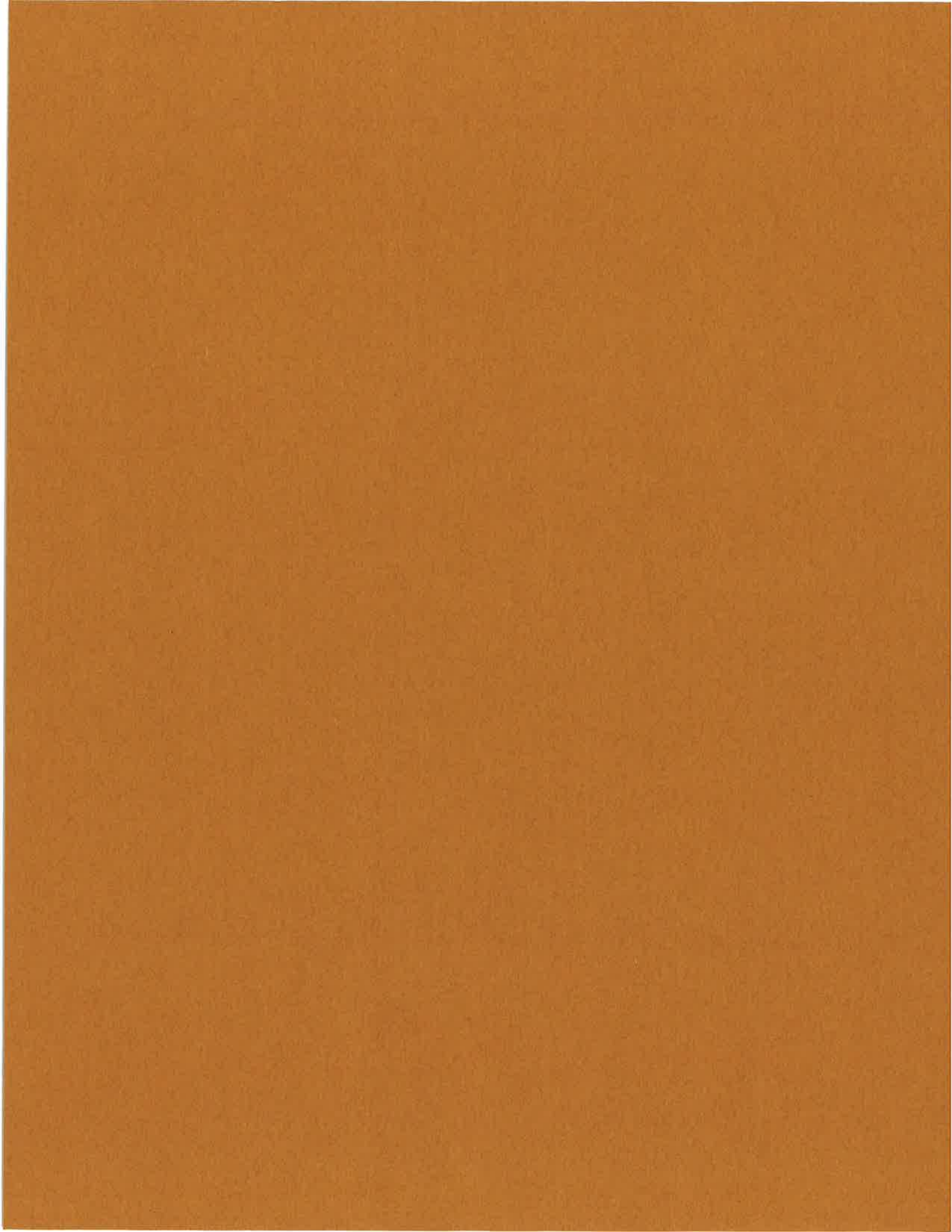
them to thoroughly dampen the towels (do not over-water, or they will get moldy). Set the pan in a warm, sunny place and add water whenever the towels dry out. You may need to do this every morning.

Watch the kernels closely. When you see sprouts growing out of the embryo, remove the towels and place plastic wrap over the pan. The sprouts will continue to grow to an inch or two long if they have enough moisture.

As long as there is condensation (drops of water) on the plastic wrap, the kernels are sufficiently wet. Do NOT OVER-WATER.

These sprouts can be broken off and eaten in salads or toasted in the oven and added to breads. The remaining kernels are the "malt".





OATS

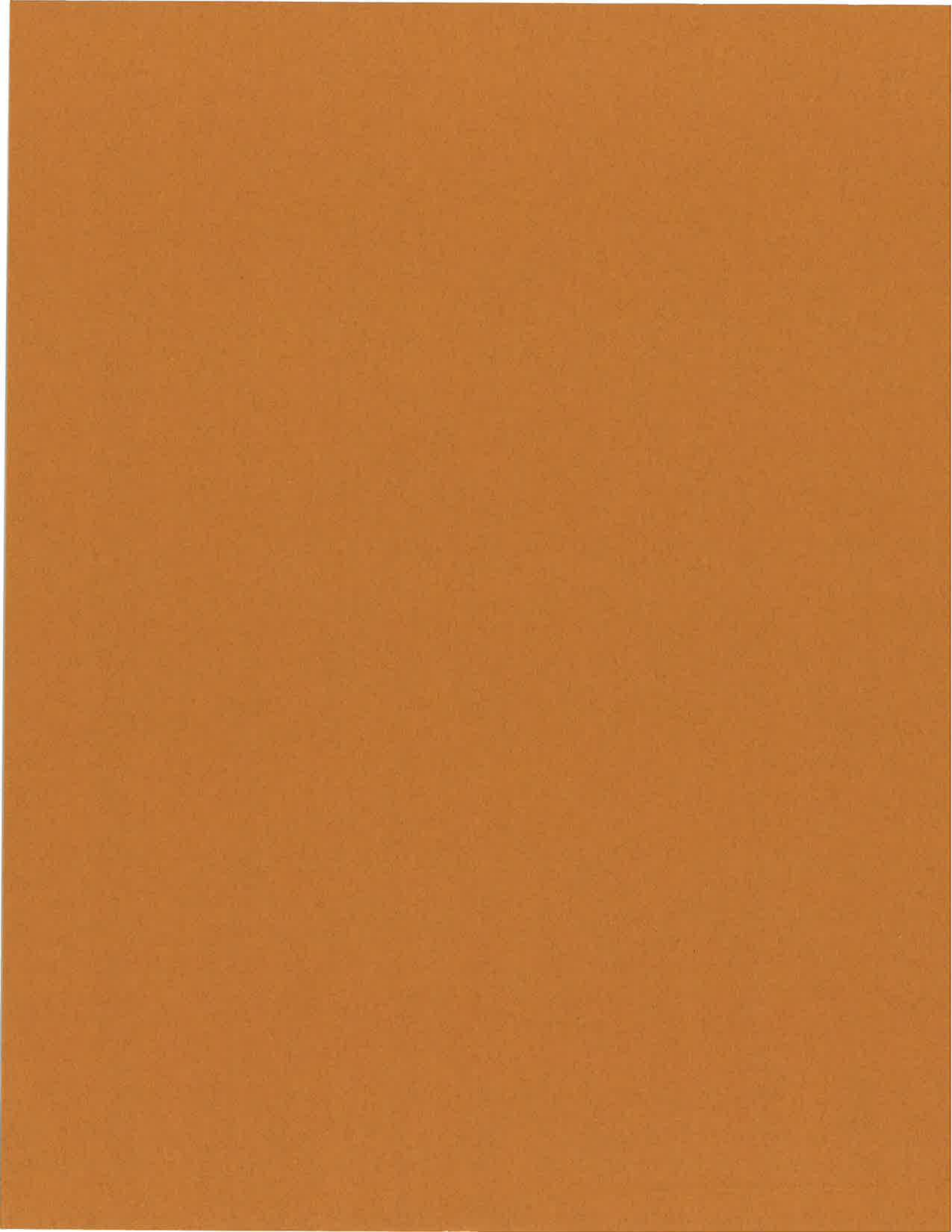
Oats share many features with wheat, including similar appearance, growing conditions and farming practices.

Oats is an ancient crop. It originally grew in the Middle East and can be traced to around 2000 B.C. Oats is a multipurpose crop that is used as animal feed and for human consumption. About two-thirds of oats produced in this country is for animal feed, with the remainder used as food for people.

An oats kernel consists of the hull and the groat. The hull is the outer portion or cover. The hull is removed during processing. Inside the hull is the inner kernel called the groat, which is the part eaten as a cereal grain. Bran is the groat's outer portion that surrounds the endosperm, the largest and starchy part of the groat. The germ grows into a new plant when an oats kernel is planted.

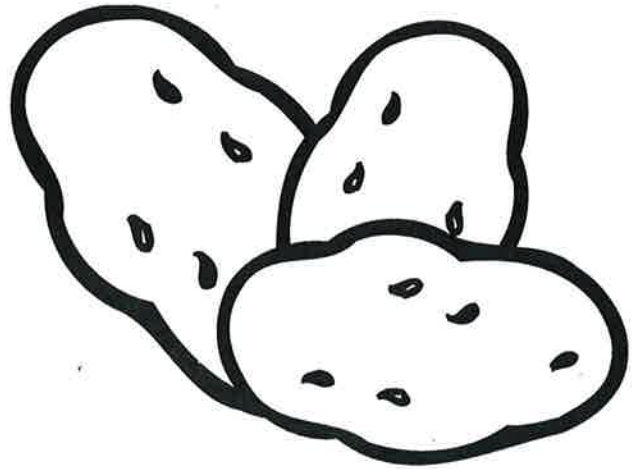


As far as human consumption, oats is used in a variety of ways. Both hot and cold breakfast cereals are made from oats. Other uses include cookies, breads, granola, cereal bars and baby food.



POTATOES

America's Favorite Vegetable



The word "potato" is believed to have originated from the Indian name "batatas." Most people agree that the potato originated in South America, probably in the Andes mountains of Peru.

The potato is one of about 2,000 species in the *Solanaceae* family. This family includes plants such as tomato, eggplant, pepper, horse nettle, bittersweet, nightshade, ground cherry, tobacco and petunia.

The first record of potato planting in North Dakota was by trader Alexander Henry in 1801. The seed for this first planting was apparently brought down the Red River from Canada. Henry spent considerable time in northeast North Dakota and at one time established a fort near Park River, N.D. Records show Henry planted potatoes on his farm in 1803 and 1804. He planted 21 bushels with a yield of 1,000 bushels. Henry also claimed to furnish potato seed to the Indians at Dead River, Manitoba.

In 1814, the Selkirk settlement was established in the northeast corner of North Dakota, where Pembina is now. The settlers planted potatoes the first year and, with the good crop, lessened their risk of starving during the winter.

Growth

A potato seed piece is planted in the ground about 4 inches below the soil surface. Each seed piece must have an eye, which looks like a dimple on the potato. Plants should be spaced about 9 to 12 inches apart in the row. The best time for planting potatoes in North Dakota is mid-May.

Potato plants need an even, moderate moisture supply. If the water supply is not even, the harvested potatoes will not have a uniform size and shape.

Potatoes must be carefully watched for insects and diseases because those factors can destroy an entire crop if not properly treated. Weeds must also be removed from the potato field to allow the potato to grow properly.

As the potato plant grows, a cluster of flowers forms on a single stalk. The color of the flower, which may be white, yellow, red, purple or blue, depends on the

variety of potato. Flowering is not directly related to potato production, but tuber formation begins at that time. The plant continues to grow and form underground stems which produce tubers, or potatoes. About 90 days after planting, the potatoes are ready to be dug, or harvested.

Varieties

There are hundreds of different varieties of potatoes grown in the United States. Of these many varieties, 15 were developed at North Dakota State University.

There are also several different types of potatoes, such as round red, round white, long white, russet, yellow flesh, and blue or purple. Different types of potatoes have different uses. For example, round white potatoes are used for making potato chips, russet potatoes are used for making french fries and round red potatoes are used for fresh consumption. Of course, some types are used for more than one thing, but these uses are the most common.

9. A; 10. C.

1. C; 2. A; 3. A; 4. C; 5. A; 6. C; 7. B; 8. B;

Answers

Production

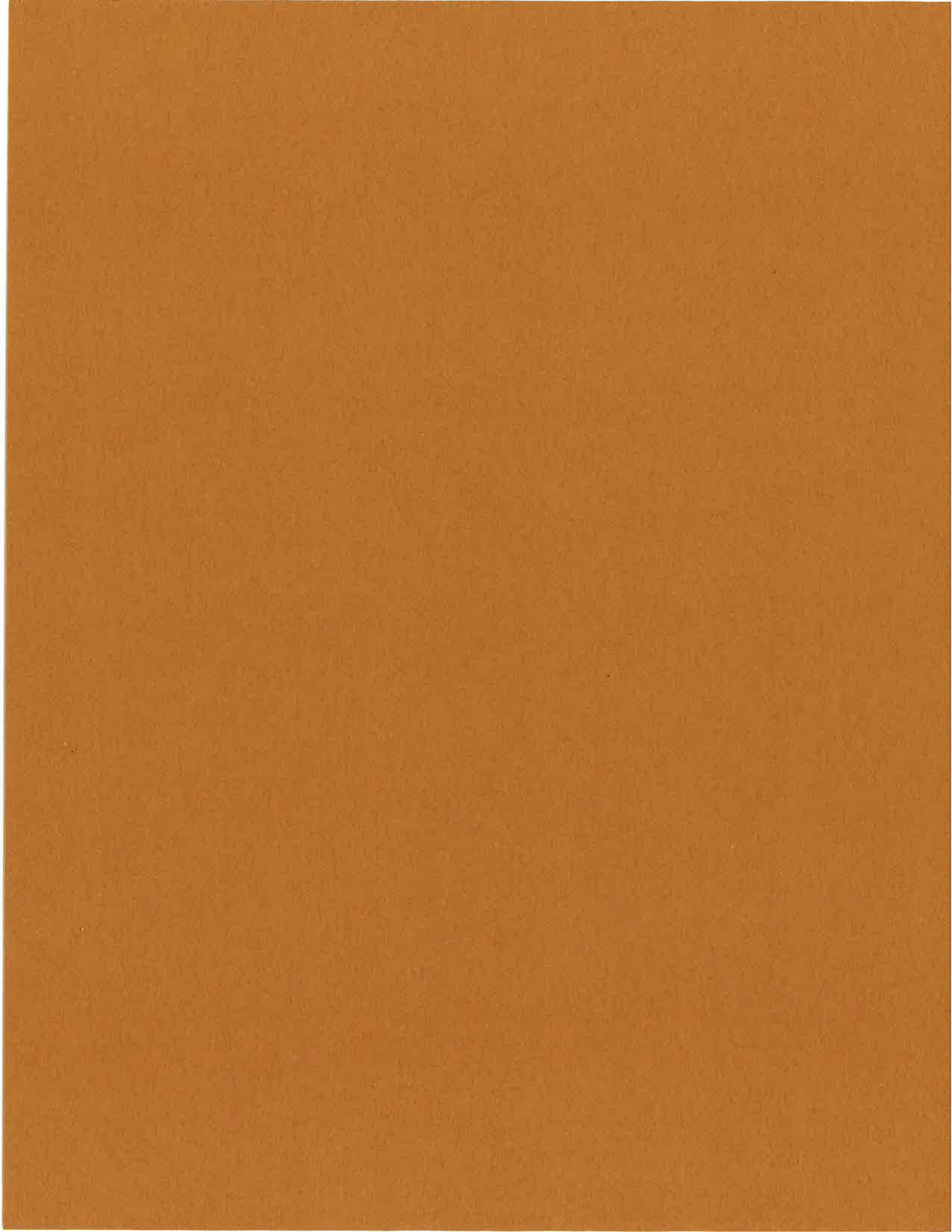
The Red River Valley of North Dakota and Minnesota is the second largest potato-producing area in the U.S. About 160,000 acres of potatoes are planted in the Red River Valley each year. The average yield per acre (about the size of a football field) is 200 100-pound bags, or about 20,000 pounds of potatoes. This means the Red River Valley produces about 3,200,000,000 pounds of potatoes each year. It is the only region that produces potatoes in volume for the chip, fresh, seed and process major potato markets. Potatoes are also grown in central North Dakota and Minnesota under irrigation. There are french fry factories in Jamestown and Grand Forks, N.D., and Park Rapids, Minn.

Nutrition

The potato is a convenient, nutritional food. A medium potato (about 5.5 ounces) has only 100 calories, is a good source of fiber (3 grams) and potassium (720 milligrams), is an excellent source of vitamin C (45% of Recommended Daily Allowance), is low in sodium (5 mg), has no cholesterol, and is fat free. Some nutritionists say a person could live on a diet of only potatoes and milk and still be strong and healthy. Some people think the potato is a fattening food. In fact it is low in calories and has no fat, but the toppings some people put on their potato have a very high fat content.

Potato trivia

- How many potato chips are in a one-ounce bag of chips?
 - 3 to 6
 - 9 to 10
 - 15 to 20
- How many ounces of raw potatoes does it take to make a one-ounce serving of potato chips?
 - 3-1/2 ounces
 - 1 ounce
 - 1/2 ounce
- How did potatoes help gangster John Dillinger break out of jail?
 - He carved a potato into a gun and pretended it was a weapon.
 - He threw raw potatoes at the guards and knocked them out.
 - He ate too many mashed potatoes and got sick, so a doctor had to be called.
- Potatoes come in many colors. Which of the following colors is not a recognized potato color?
 - Red
 - Purple
 - Orange
- Which of the following statements about potatoes is true?
 - They have eyes with eyebrows
 - A medium potato has only 250 calories
 - Russet potatoes are bright red.
- Why is it best to boil potatoes with the skins left on?
 - So the water can't seep into the potatoes
 - To protect the surface of the pan
 - To help them keep all of their vitamins and minerals.
- What is the best way to store potatoes?
 - In a sunny window
 - In a cool, dark place
 - In the refrigerator
- Spud is another name for potato. Where did this slang term come from?
 - From the British word for potato "spudato"
 - From the word spade, the shovel used to dig potatoes
 - From the Spud Evans Potato Company in New Orleans.
- Who is responsible for introducing french fries to America?
 - Thomas Jefferson
 - Pierre LeBlanc
 - The first Betty Crocker cookbook
- Where were potato chips invented?
 - At the 1922 World's Fair
 - In the trenches of WWI
 - At a resort hotel when Cornelius Vanderbilt complained the fried potatoes were too thick.



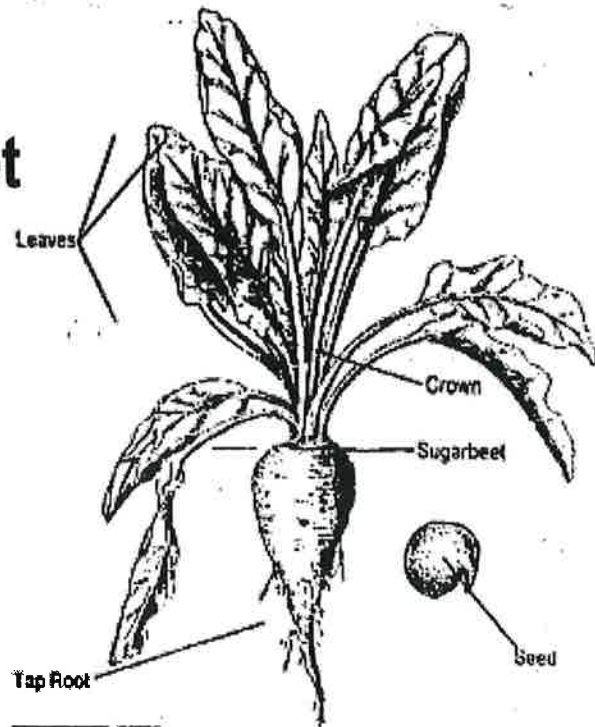
SUGARBEETS

Making things sweet

Sugarbeets are planted in the early spring. The plants are grown primarily in nine counties of North Dakota, almost entirely in the Red River Valley. The combination of cool nights and warm days in this region provides ideal conditions for beets to produce a high amount of sugar. The growing season is April to October.

Planting is done as early in the spring and as quickly as possible to help give the sugarbeets the maximum number of growing days. Generally the seeds are planted as soon as the ground temperature reaches 50° F, usually in mid to late April.

Producers plant about five sugarbeet seeds per foot. Only half of these seeds will develop into plants. The plants will grow too thick to produce a quality crop so producers chop out extra beets so there is only one beet every 6 to 10 inches. This is called "thinning" the beets. Some producers use mechanical thinners, an attachment for a tractor that thins up to 12 rows of beets at one time. Other producers hire seasonal workers to thin the beets and chop the weeds during the growing season.



The sugarbeet plant

The sugarbeet is a root crop that grows underground. The tap root extends down 6 to 8 feet. When fully grown a sugarbeet weighs 2 to 5 pounds and produces 10 to 20% of its weight in sugar. An average yield is 15% or about 3 teaspoons of sugar per beet.

The Sugarbeet Seed

The sugarbeet seed is rough, bumpy and tiny — about half the size of a grain of rice. Most sugarbeet seed is produced in the Willamette Valley of Oregon. You may know this as the destination point of the historic Oregon Trail.

The sugarbeet is a biennial plant, which means it takes two years to produce sugarbeet seeds. The first year, the plant produces the root; the second year it produces seed. There are about 22,000 seeds per pound.

Photosynthesis

The sugarbeet plant produces sugar in its leaves by a process called photosynthesis. During photosynthesis, the plant combines water with carbon dioxide from the air and energy from the sun to produce sugar. The sugar is then stored inside the fleshy root called the beet. By harvest, the root contains about 16 teaspoons of raw (unprocessed) sugar.

Harvesting

During fall harvest, producers use a machine called a roto beater, or defoliator, to cut off the tops of the beets which are left in the field. A sugarbeet lifter/loader then lifts the beets out of the soil onto a truck and the beets are delivered to a receiving station or a sugarbeet processing plant. Harvested sugarbeets are very heavy — an average stack of beets weighs about 40,000 tons representing about 6,000 tons of sugar. If the weather is good, harvest is completed by the third or fourth week of October. The average sugarbeet harvest in North Dakota brings in more than 4 million tons. The Minnesota harvest weighs about 8 million tons.

The Factory Process

First the beets are cleaned in a beetwasher. Then a machine called a slicer is used to cut the beets into long strips that look like shoestring potatoes or noodles. The beet noodles are sent through a machine called a diffuser or extractor. Hot water is mixed with the beets to dissolve and remove the sugar from the beet noodles.

The water and sugar juice are saved and this solution is called "raw juice". The beet noodles, now free of most of their sugar, are dried into beet pulp for livestock feed. The raw juice is treated with lime and carbon dioxide gas to clean the mixture again. It is sent through a big, round filter to clean it and remove other non-sugars. The raw juice goes into a series of big tanks called evaporators where some of the water is boiled off. At this point the mixture contains more sugar than water. It is a thick syrup and is again filtered to make sure it is very clean.

Crystallizing into Sugar

The mixture passes through a big tank called a white pan, which allows the thick juice to boil at a low temperature. As the water boils away the sugar solution becomes a thick mass, which is dropped into a centrifugal machine. The machine spins very fast to separate the sugar crystals. These crystals drop onto a conveyor belt for further drying and cooling. The finished sugar moves into bulk sugar bins for storage, or to the warehouse for packaging.

Granulated sugar, sold in small bags in stores or shipped in bulk, is by far the most common form of processed sugarbeets. However North Dakota and Minnesota sugar factories also process sugarbeets into brown sugar, powdered sugar and even sugar cubes.

Answers: The Sweet Goes On
1-F, 2-C, 3-E, 4-A, 5-B, 6-D

Did you know?

- * Sugarbeets came to America from Europe in the 1870s with the first sugarbeets being planted in California. Over the past 125 years the industry has grown considerably, especially in the northern states of Minnesota, North Dakota and Idaho. These states are ideal for sugarbeet production because of the sunny days and the cool nights. The first Red River Valley sugar processing plant was built in East Grand Forks in 1926.
- * North Dakota ranks #2 in sugarbeet production in the United States (Minnesota ranks #1) in planted acreage and total sugar production. North Dakota produces 11% of the nation's sugarbeets, while Minnesota produces 20% of the nation's sugarbeets and has twice the acreage of North Dakota.
- * More than 230,000 acres are usually planted in sugarbeets in North Dakota. Of these acres, nearly 20,000 were planted in the northwestern counties of Williams and McKenzie, with the remainder planted in the Red River Valley of North Dakota.
- * Sugarbeets harvested in the Red River Valley are processed at factories in Drayton, Hillsboro and Wahpeton. Sugarbeets in the northwestern counties are processed in Sydney, Mt. In Minnesota, sugarbeets are processed at in Crookston, East Grand Forks, Moorhead and Renville.
- * The United States imports more sugar than we export.
- * North Dakota and Minnesota sugarbeet growers are quickly adapting new technology that will reduce fertilizer and pesticide use. New products include grid soil sampling, variable rate fertilizer applications and herbicide injection systems.
- * The major by-products of sugarbeets are molasses and beet pulp. The beet pulp is exported to countries such as Japan to be used as livestock feed.
- * All of the sugarbeets grown in the Red River Valley of North Dakota and Minnesota comprise more than 40% of the nation's sugarbeet crop and are processed by farmer-owned cooperatives.

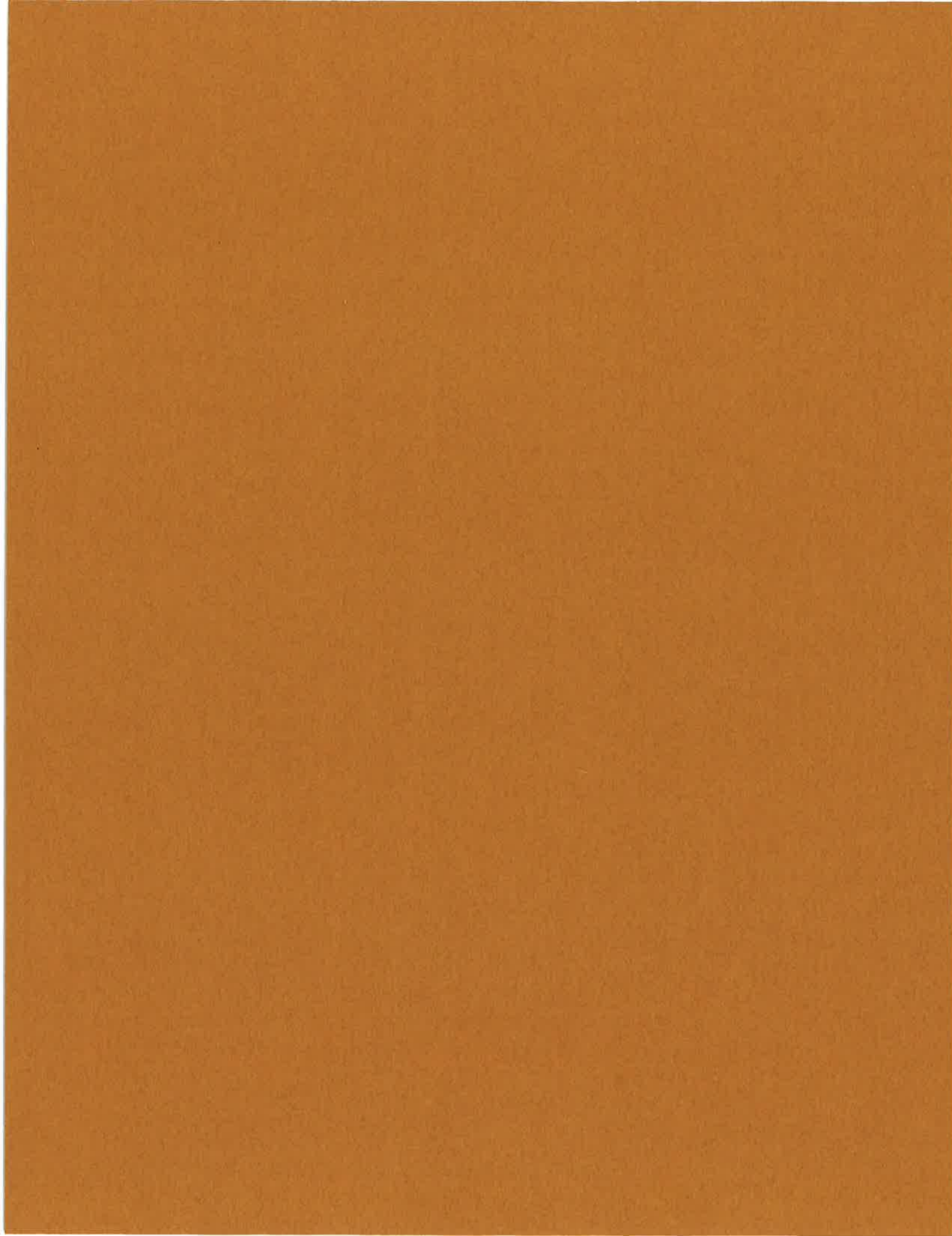
What's The Scoop On SUGAR?

- * We taste sugar with the taste buds on the tips of our tongues.
- * Sugar is a carbohydrate; it gives us energy.
- * Pure sugar is a crystal. Each piece has six sides.
- * Beet sugar and cane sugar are chemically identical

And The Sweet Goes On

How many ways can you spell S-W E-E-T? Solve the clues below and you'll name other sweeteners in treats you eat. Draw a line from the product to its phrase.

- | | |
|--------------------------|----------------|
| 1. Made by bees | A. Rice syrup |
| 2. Comes from trees | B. Sugarcane |
| 3. Nice with ice | C. Maple syrup |
| 4. Rhymes with slice | D. Corn syrup |
| 5. The stalk's a treat | E. Fruit juice |
| 6. The kernels are sweet | F. Honey |



DRY BEANS

Hats Off to Bean Growers

"Can you imagine life without a steaming bowl of chili on a cold fall day? Or never again having the Deluxe Beef Burrito Combo at Taco Bell? Well, without bean growers, life just wouldn't taste as good. I talked with four bean growers recently and learned that just like the many different kinds of edible beans, bean growers come in all shapes and sizes.



check out

www.northharvestbean.org

Dwight, short, blond and blue eyed, has been growing beans for about fifteen years. When asked why he grows beans, he stated firmly, "The Money!" Beans have been profitable for Dwight and his wife. Dwight states that growing beans is also good for crop rotation. It helps the soil be better for wheat the next year.

Lyle, a tall lanky bean farmer from Pembina County, says that the hardest thing about growing beans is to get them harvested without losing quality. Lyle grows pinto and navy beans. He says that his favorite bean dish is Baked Pinto Beans.

Jason, short and stocky, raises 700-800 acres of beans in the North Valley. Jason says that beans have to be babied. A bean grower has to plant, spray, and cultivate the beans. Harvest

is tricky. Jason says that all the hard work is worth it if the market is good.

Lynn, who is tall with brown curly hair, says that he enjoys growing beans. He says that they put nitrogen back in the soil and are a good crop. The income from beans, Lynn says, is what has kept him in farming.

Dwight, Lyle, Jason and Lynn are different in many ways, but they all agree that growing beans is well worth all the effort that it takes. The next time I put my spoon into a steaming bowl of chili, I'll be thinking of all the hard work the bean growers do. Bean-Appetit!"

Joshua J. Jennings essay about bean growers from the story "Beans and Basketballs," by Esther M. Hylden.

Dry Beans: Feeding the World

Farmers around the world have grown dry beans for 10,000 years. Dry beans can grow in poor soil. They have a lot of protein, they make soil more fertile and they can be used to feed animals. Dry beans may also help end hunger and feed the world in the future.

Early Farmers

When we think of dry beans today, we often think of Latin America because of the familiar “bean foods” such as refried beans, tacos, burritos and chili. The first farmers to grow dry beans, around 8,000 B.C., were in the Near East, near where Egypt is today. The farmers started with wheat and barley, then grew certain kinds of dry beans: fava beans, chickpeas (garbanzo beans) and lentils. In North and South America, farmers began growing the common dry bean – pinto beans, kidney beans, pink beans, etc. – around 6,000 to 5,000 B.C. There was no wild wheat and barley in the Americas, so dry beans were one of the first plants farmers grew. In China and other parts of Asia, soybeans and other dry beans were grown starting around 3,000 B.C.

Why didn't farmers in Europe and Africa grow dry beans? There is only one kind of dry bean native to Europe, the broad or fava bean. In early times, Greeks and Romans thought fava beans held the souls of dead people. This may have occurred because, traditionally, funerals ended with a bean feast. Europe had to wait for Columbus to discover America, and bring back dry beans for farmers to grow. In Africa, early farmers grew other plants, but not dry beans.

America and China — Early Uses of Dry Beans

Dry beans were important staple foods in early times in the Americas and Asia; especially China. In the Americas, the Mayas, Aztecs and Incas grew dry beans. They left behind pottery decorated with pictures of people holding dry beans. Different American Indian tribes grew different kinds of dry beans, then traded them. A good example is the lima bean. It was first grown in Guatemala, then traded to Mexican Indians. These Indians traded lima beans to North American tribes in the Southwest, Virginia and the Mississippi Valley. Meanwhile, lima beans were also traded to Peru, where the natives developed the best, biggest variety. When Spaniards came, they named the bean “lima,” after the capital of Peru.

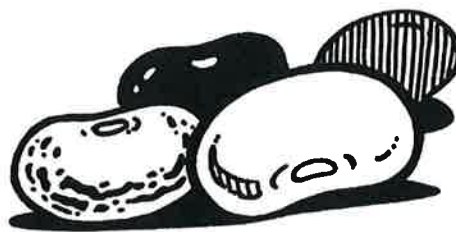
Europe and America in the 1800s

North American Indians adapted to the area they lived in. Many Plains Indians hunted bison and other animals as their main food. Others, such as the Iroquois, lived in forests near lakes and rivers. They raised native plants in large gardens and ate a plant-based diet. The main food of tribes like the Iroquois was a mixture of corn and dry beans called *misequatash*. You may know it as “*succotash*.” Corn and dry beans eaten together supply complete protein, carbohydrates, and many vitamins. The Iroquois planted beans and corn in the same hills, so bean vines could twine around the cornstalks as they grew. Many tribes had bean dances and ceremonies to show how important dry beans were. The name of the Papago tribe of the American Southwest means “Bean People.”

Dry beans were also important in China and other parts of Asia, where people didn't eat much meat. Scientists have dug up skeletons dating to 1600 B.C. in China, of small people with weak bones. Later excavations and historical records show that people became larger and stronger after they began eating more soybeans, which are high in protein.

Dry beans and soybeans also improve the soil in which they grow. They bring nitrogen from the air into the soil. This makes other crops grow better, too. Common dry beans (like pinto beans) came from America to Europe in the 1800s and were planted to help the soil. Instead of leaving fields lying “fallow” – unused – for a year between wheat crops, farmers planted dry beans. The soil got richer, and the farmers got more protein. Dry beans were called “the poor man's meat.” People in Europe were much better fed after dry beans, potatoes and corn came over from the New World, and that was one reason Europe's population grew between 1500 and 1900.

But in America, things were different. Settlers had so much rich land to farm that they could easily raise wheat, corn and livestock. They did not need to grow dry beans for protein because they had plenty of meat. Even today, North America grows a huge amount of soybeans, but most of the crop is fed to animals.



The Future

Most people in the western world do not eat a lot of dry beans these days. Meat is the main source of protein. Will dry beans become more important again in the future? Many people believe they will have to. For example, African people have grown a huge amount of corn for the past 25 years. Now the population has grown because of corn! Whole forests have been cut down, pesticides and fertilizers have been heavily used, the land has been overfarmed and many acres have been turned to desert. Many people now go hungry. Some experts think one solution is for Africans to grow more high-protein, nutritious native plants that can resist pests and drought. These “famine plants” include several kinds of dry beans.

Meanwhile, in America and the rest of the industrialized world, as well as the Third World, populations are rising. It is possible that people all over the world will have to change their diet in the 21st century in order to feed everyone. We may all have to eat more grains, dry beans and vegetables, and much less meat and other animal products, which take more water and resources to produce. We may return to eating the way early farmers did, all those years ago.

Written by Rosalind Iiams.

Eating Dry Beans

Dry beans are recommended as a part of a healthful diet by nutritionists and dietitians. Beans furnish fiber, protein and complex carbohydrates and, because they are a vegetable they contain little fat and no cholesterol. (Only animal products contain cholesterol.) Choosing to eat main dishes that combine meat and dry beans lowers fat and cost per serving.

Eating dry beans and grains along with corn or animal products furnishes all the amino acids the human body needs to use protein. Beans and rice furnish the best match of amino acids to make a complete vegetable protein. The complementary foods of meat, fish, milk, cheese or eggs complete the protein.



Tips for Bean Eaters

Dry beans contain two harmless, indigestible sugars and lots of fiber. Bacteria in the lower intestine may react to the fiber and sugars by producing gas. The secret is regular helpings of bean dishes to allow the digestive system to adapt.

Eat cooked dry beans at least three times a week, starting with a small portion and increasing the amount over a number of weeks.

Dry beans offer:

- complex carbohydrates for quick, long-lasting energy
- natural source of fiber
- low-fat protein for mental alertness
- low-sodium food
- low-cost food choice
- no cholesterol
- vegetable serving



- A Variety of Beans**
- A. Hard dry plant seeds; they have approximately the same nutrients, must be soaked and cooked in water until tender before they can be eaten.
- B. Color, shape, size, taste.
- C. Vegetable and meat/protein.
- D. Protein, B vitamins, complex carbohydrates, iron, fiber.

- Answers: Great Beans in History**
- A. Dry beans supply protein, enrich the soil and feed animals.
- B. Fertile Crescent, near where Egypt is today.
- C. Fertile Crescent or Egypt — fava beans, chickpeas or garbanzo beans, lentils; America — limas, pinto, kidney beans; China — soybeans.
- D. People were much better fed, healthier, after dry beans, potatoes and corn were introduced from the New World.
- E. Dry beans may help end hunger and feed the world in the future.

Bean Brain Activities

Time line

1. Make a time line using either a long wall or a wire stretched across the room with centuries beginning at 8,000 B.C. through today noted on it. Draw pictures of significant dates already known, and place these at proper points along the line.
2. After reading the "Dry Beans: Feeding the World" text in this section, add bean dates and well-known historical dates to the time line.
3. Indicate on a world map how and when beans were introduced to the continents.

Great Beans in History

Discuss how crop cultivation has influenced historical development.

Discussion questions:

- A. What are dry beans good for?
- B. Where were dry beans first cultivated?
- C. Which dry beans originated in the Fertile Crescent, America and China?
- D. What did the crops from American contribute to Europe and Africa?
- E. What use might dry beans have in the future?

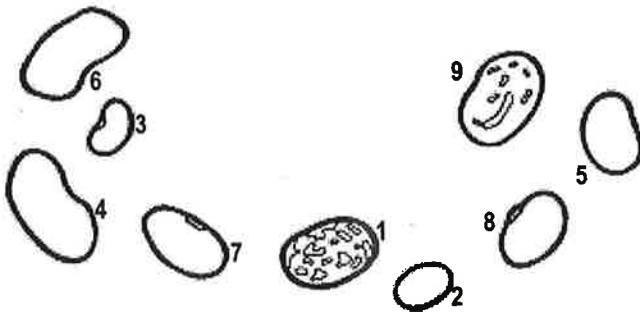
The Literary Bean

Write a poem about beans. Brainstorm a list of 20 or 30 words that tell about beans. List words or phrases about how beans grow, their color, size, shape, name and your favorite kinds to eat. Use powerful and precise words.



A Collection of Bean Classes

1. Pinto bean, light tan with amber spots
2. Navy bean, white
3. Black turtle bean, black
4. Dark red kidney bean, maroon
5. Pink bean, pink
6. Light red kidney bean, salmon
7. Great Northern bean, white
8. Small red bean, red
9. Cranberry bean, pink with maroon spots



Gather up as many different kinds of beans as possible. Create collages or maps with dry beans of different colors, shapes and sizes.

Discussion questions:

- A. What is the same about all dry beans?
- B. What are their differences?
- C. What two food groups do cooked dry beans belong to?
- D. What nutrients do cooked dry beans furnish?

Bean Counting —

Estimating and Measuring

Materials:

Empty cans and cardboard boxes,
including narrow and wide containers

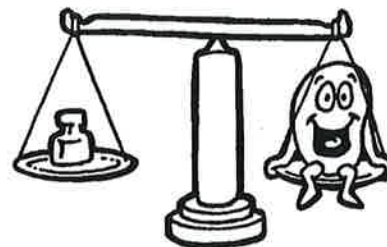
Balance scale

Bag of assorted dry beans

1-pound package of dry beans

Exercises:

1. Estimate the number of dry beans in a 1-pound (453 gm) package by first weighing a small number of beans. Determine if weight or volume gives a more accurate estimate.
2. Mark some containers at 1 inch with masking tape. Estimate and then count the number of dry beans required to fill the containers to 1 inch and to the top. Tap containers to settle the contents before weighing and counting. If different groups use different kinds of dry beans, compare weight and count to see if variations occur due to bean size.



The Scientific Bean

Sprouting Dry Bean Seeds

Have students plant, observe and record changes in growing dry beans.

Materials:

A set of the following for each group:

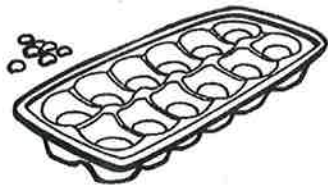
Small utensil to dig up seeds

Water sprayer

12 dry beans

Planting soil

Egg carton

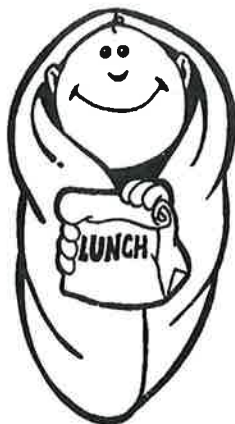


Procedure:

Fill each carton almost to the top with soil, make a small hole, put seed in hole, cover with more soil and water lightly. Keep moist using a sprayer. Every two or three days dig up one seed to observe. Keep a record. A few plants should be allowed to grow several weeks.

For faster sprouting, soak dry beans in cold water for up to 6 hours (no longer) before planting.

A seed may be described as a baby in a blanket with its lunch!



Bean Graphs

Materials:

Small plastic pots (leftover from purchased plants or margarine containers)

10 beans per week

Water sprayer

Procedure:

Plant two seeds each day in separate small pots. Label with date and keep moist. Remove extra seed from each pot when it becomes clear one is heartier than the other. With luck, you will have a growing graph of bean seeds after a few weeks.



Keep a Record of Plant Growth

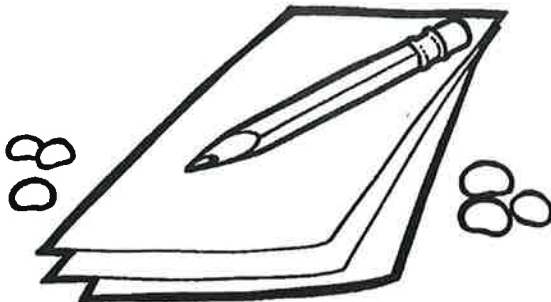
Record Keeping — Encourage students to devise their own methods of record keeping.

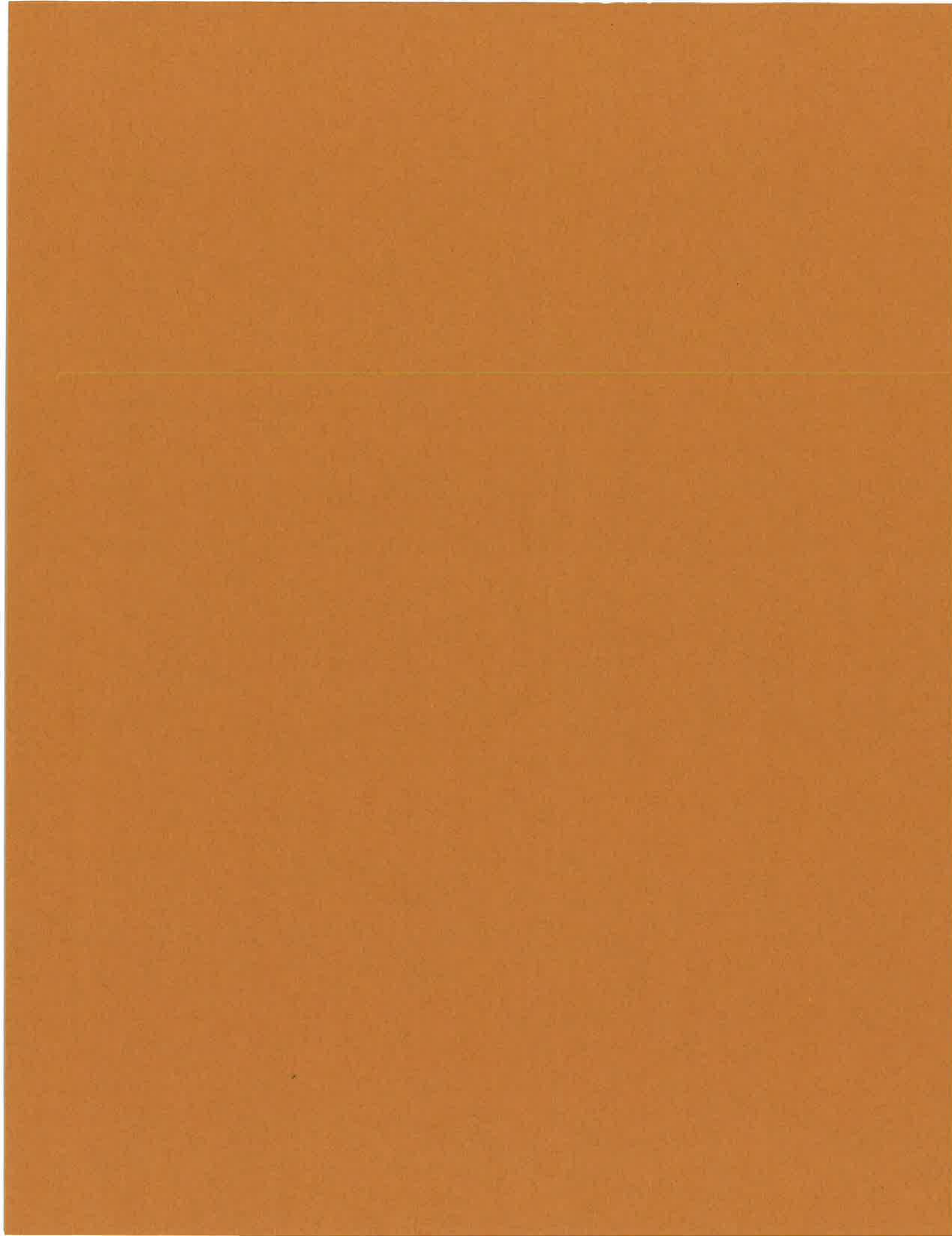
Ask “What can we do to help us remember what our seeds looked like as they grew?” Most will think of drawing pictures and writing descriptions. Some may want to make a graph of growth. If so, have them measure the growing bean on a strip of paper, cut the strip to the length of the bean, date it and paste it on a sheet of paper.

A simple record keeping format includes:

- What I want to find out.
- What I did.
- What I observed.
- Why I think that happened.

Additional activities and information in *Dry Beans, Agriculture in the Elementary Classroom, Teacher Resource*.





OILSEEDS

Sunflower

Sunflower was a native plant to North America long before European explorers set foot on the continent. The American Indian first domesticated the plant into a single-headed plant with a variety of seed colors including black, white, red and black/white striped.

It was a common crop among Indian tribes throughout North America. It is believed the plant was cultivated by Indians in present-day Arizona and New Mexico about 3000 BC.

Sunflower was used in many ways throughout the various Indian tribes. Seed was ground or pounded into flour for cakes, mush or bread. Some tribes mixed the meal with other vegetables such as beans, squash and corn. The seed was also cracked and eaten for a snack. There are references to squeezing the oil from the seed and using the oil in making bread. Non-food uses include purple dye for textiles, body painting and other decorations. Parts of the plant were used medicinally for snakebite to body ointments. The oil of the seed was used on the skin and hair. The dried stalk was used as a building material. The plant and seeds were widely used in ceremonies.



check out

www.sunflowernsa.com

Spanish explorers took the plant to Europe some time around 1500. It became an important crop in Russia by the 19th century. By the late 19th century, sunflower was back in the United States as a crop. Today's sunflower hybrids represent scientific research to improve the plant and create sturdy plants with high oil content, large seeds, better height to survive wind, and disease resistance. There is a sunflower research facility in Fargo, ND.

Sunflower production

Not just another pretty face — sunflower is a major part of North Dakota's economy. North Dakota grows about half of the 2.6 million acres grown in the United States. There are plants in North Dakota, Minnesota and Kansas that crush the oilseed into edible oil for U.S. and world use. There are plants in North Dakota, Minnesota and Kansas that take the striped confection seed and clean, bag, dehull, and roast the seed, sending it all over the world for use as a snack food and ingredient in other foods. Both types of sunflower are used as birdfood.

Sunflower is planted in spring when the ground is warm, usually around mid-May to June. Sunflower is a sturdy plant with deep roots. The roots can grow deep into the soil to reach moisture and collect nutrients left behind by other crops. Within six to eight weeks, the sunflower has formed the bud. The bud is covered by the bracts, long, skinny leaves that protect the bud. As the plant grows, the bud opens. The bright yellow petals are called ray petals. They circle the center of the sunflower head. The head of the sunflower is made up of hundreds of small flowers, called florets.

At the base of each floret is a sunflower seed. The head of the "sunflower" is actually hundreds of small flowers growing in rows and producing hundreds of seeds. By late summer, the ray and bract petals begin to dry and all the plant's energy goes into the seed.

Sunflower producers harvest the sunflower when the seed is ready, usually October through November. The seeds are trucked to the local elevator or directly to the oil crushing plant or the confection processing plant. Oil variety seeds are crushed, squeezing out the oil content, which is about 44% of the seed. The remaining portion is the meal. Meal is an excellent protein source and is used for animal feed.

Confection sunflower goes to the confection plant to be cleaned. It is either roasted and bagged in-shell or hulled, roasted and sold in kernel form.

Sunflower Facts

Of the 2.6 million acres of sunflower grown in the U.S., North Dakota grows about 55% and South Dakota is second with about 25%, followed by Kansas, Colorado, Minnesota, Texas and Nebraska as major producing states.

Nutrition

Sunflower oil is a heart-healthy fat. It is either predominantly polyunsaturated (linoleic) or predominantly monounsaturated (NuSun oil and high oleic). It is low in saturated fat.

Sunflower oil is very rich in vitamin E. It has a light taste that does not cover up the taste of any food cooked in it. Try popcorn popped in sunflower oil.

For confection sunflower, processors sometimes add other flavors for variety, like salsa or sour cream and onion. The sunflower kernel is high in many kinds of nutrients, including vitamin E, iron, protein and fiber.

Sunflower Oil Uses

Bottled sunflower oil for home use

Snack products

Chips and fried snacks

Crackers and cookies

Margarine

Cereals and granola

Cosmetics and lotions

Kernel Uses

Roasted and sometimes flavored, seeds in the shell or ready-to-eat kernels

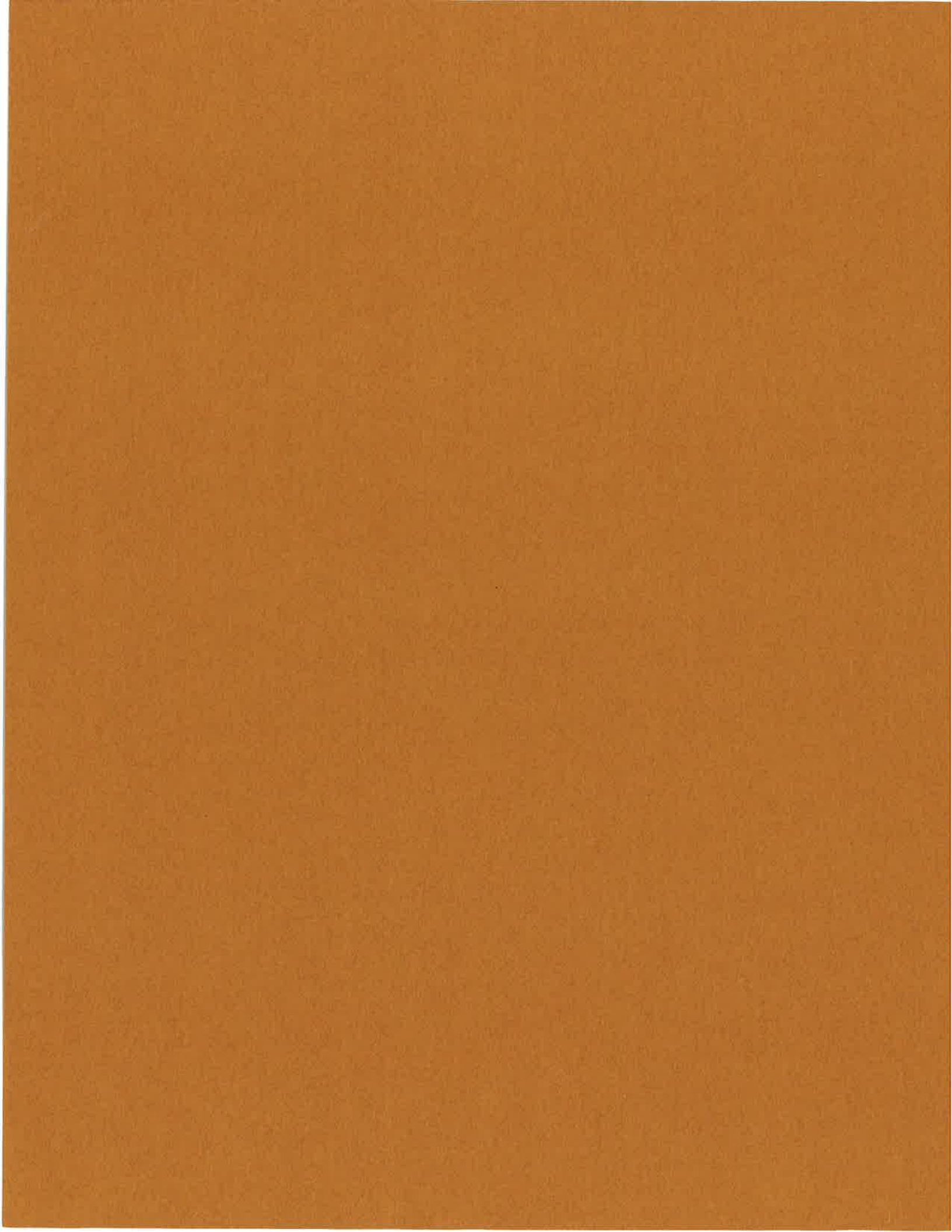
Ingredient and topping for breads, bagels and other baked goods

Granola and trail mixes

Salad topping

Candy

Stir in to pasta, stir-fry and vegetable dishes



OILSEEDS

Flax

Flax production goes back to ancient history. Ancient Egyptians made fine linens from flax fiber. Flax production moved west across the northern U.S. and Canada during the 1800s. North Dakota farmers have grown flax since the first sod was broken.

Two types of flax are grown — seed flax (for the oil in its seed) and fiber flax (for the fiber in its stem). Most Midwestern producers grow seed flax. Flax seed is crushed to produce linseed oil and linseed meal. Linseed oil is used in industry and for livestock feed. Seed flax stem fiber is used to make fine paper and cigarette paper and to pad furniture.

Flax is an annual that is recognized by its purplish-blue flowers. The boll or capsule contains about 10 seeds and it is grown on the same type of land as wheat and barley. Seeding should occur in late April. Flax is ready to harvest when 90% of the seed pods or bolls have turned brown. Flax is sold to a plant to be crushed for oil and meal.

Uses of Flax

Uses of Whole Flaxseed

Baked Goods Breads Muffins



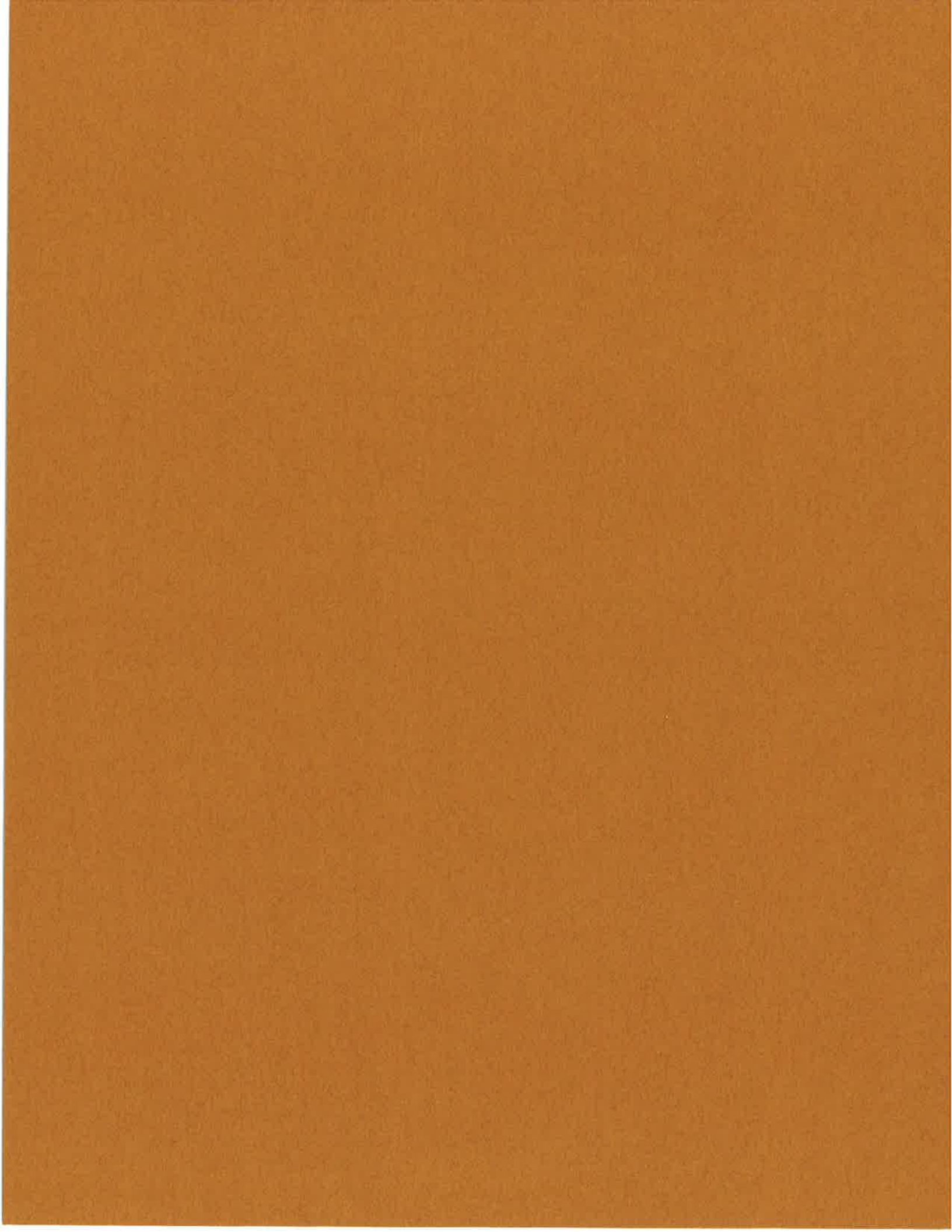
Linseed Oil

Crushed flax seed produces linseed oil, which is used in:

Linoleum	
Paint/Varnish	Stains
Concrete Sealers	Printer's Ink

Flaxseed has recently gained popularity as a nutritional food product. Flaxseed is one of the richest plant sources of alpha-linolenic acid, an omega-3 fatty acid, and it is an excellent source of fiber, protein and other nutrients. Flaxseed oil and/or ground flaxseed can be used in baking and cooking. You can also mix ground flaxseed into orange juice, tomato juice, oatmeal, cold cereal or peanut butter, or try an omega-3 enriched egg from hens fed flaxseed.

Flaxseed is now being fed to cattle. Research is showing that adding flaxseed to cattle diets improved animal health, increased carcass value and may enhance the omega-3 fatty acid profile in beef products.



OILSEEDS

Canola

Although canola's history can be traced back to the rapeseed plant, it is no longer the same. Canola is a genetic variation of rapeseed and differs from rapeseed in two distinct ways. Canola's level of glucosinolates and erucic acid are lower than those found in rapeseed. Glucosinolates (which contribute to the hot taste of mustard) and erucic acid have no nutritive value to humans and, therefore, were reduced in canola by plant breeders. Rapeseed is used for industrial purposes and is grown only under special contracts. Canola and rapeseed are words that cannot be used interchangeably.

Production

Canola varieties have been developed as both spring and winter annuals. The spring type is best adapted to North Dakota conditions. Canola is planted when the ground is warm but early enough to achieve the highest yields. Canola can be recognized by its bright yellow blossoms in early spring.



As the plant ripens, the seed pods turn brown. Canola is ready to harvest when plants turn a straw color and seeds become dark brown. Because shattering is a problem, the crop should be swathed, or cut to dry, when 25% of the seeds on the main stem have turned brown. When harvested, each pod is cracked open to yield about 20 seeds that are about 1/16 inch in diameter. The crop is combined and trucked to an elevator and/or crushing plant and crushed for its oil.

During processing, seeds are crushed to extract the oil and to make meal. Each seed contains about 40% oil. In addition to its edible uses, canola oil is used in a number of inedible applications, such as cosmetics and printing inks. Canola meal is used as a feed for livestock, poultry and pets and as a fertilizer.

Canola seeds produce a high-quality edible oil. Canola oil is recognized for its nutritional attributes — it contains the lowest level of saturated fat of any vegetable oil. It is high in monosaturated fat, which has been shown to reduce serum cholesterol levels and has moderate levels of polyunsaturated fat, which is essential to the human diet. Canola plays a beneficial role as part of a nutritious diet.

Canola meal, which is made of canola seeds after the oil has been removed, is a high-protein feed supplement for livestock and poultry.

Uses of Canola Oil (edible)

Shortening
Liquid shortening
Margarine
Salad oils
Mayonnaise
Cooking sprays
Coffee whiteners
Creamers
Cookies, cakes, breads
Fried snack foods

Uses of Canola Oil (inedible)

Cosmetics
Printing inks
Plasticizers
Suntan oil
Antistatic

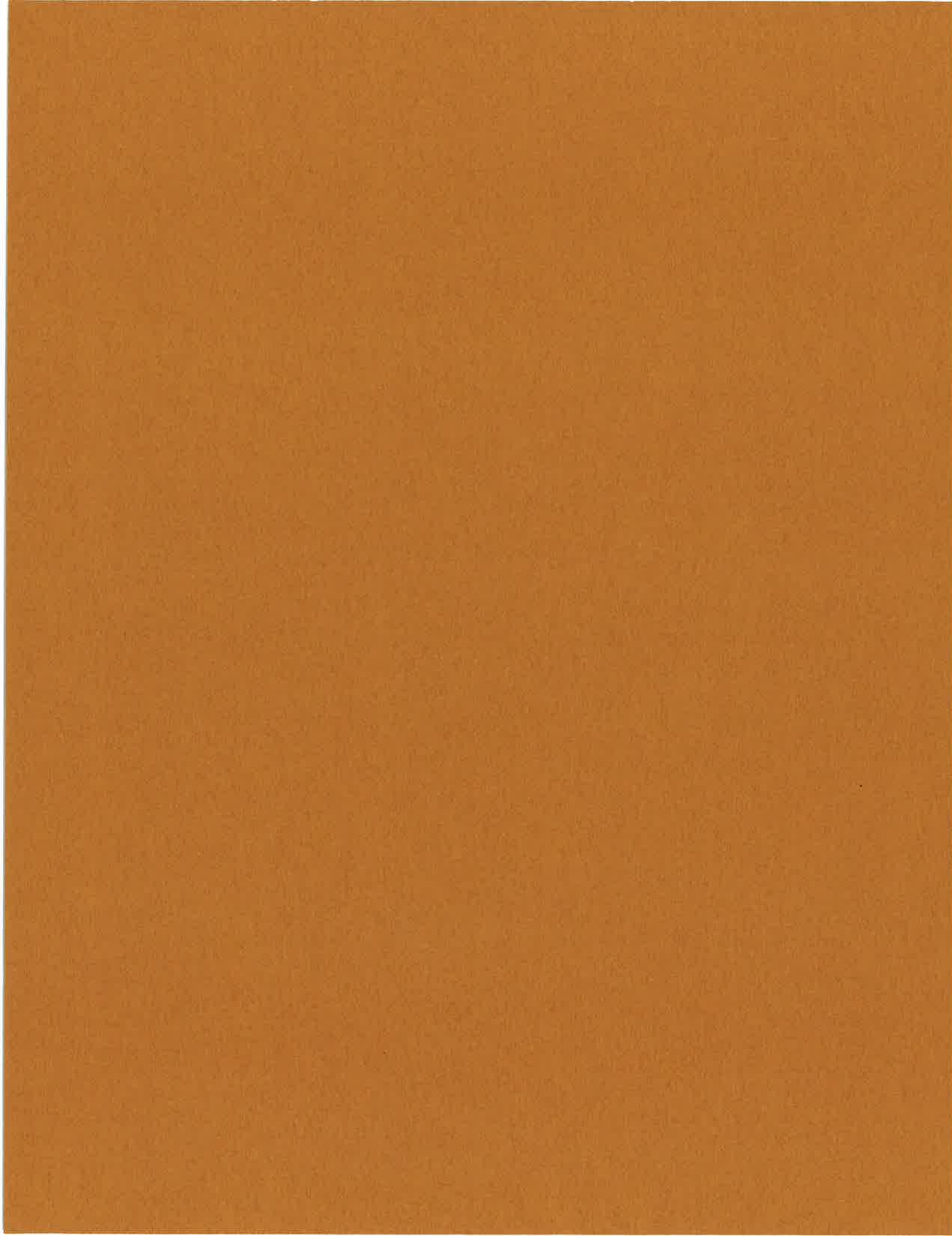
Answers Canola Unscrambling
1. Oilseed, 2. Mustard, 3. Pods, 4. Combine, 5. Crushing, 6. Processor, 7. North Dakota, 8. Cholesterol, 9. Baking, Salads, 10. Inedible, 11. Feed

Canola Unscrambling Exercise

1. Canola is an _____ crop grown by farmers in North Dakota. DOLIESE
2. Canola is a member of the _____ family. SUMDART
3. Seeds come from _____ on the canola plant. DSOP
4. Farmers use a _____ to harvest the canola seed. BOCMIEN
5. After the seeds are harvested, they are brought to a _____ plant where the oil will be squeezed out. GRUHNICS
6. The oil is shipped by train or truck to a _____ who cleans the oil. SORCSORPE
7. The state of _____ is the number #1 producer of canola. HORTN OKATDA
8. Like all vegetable oils, canola is _____ free. TEHOLOLCESR
9. Canola oil is excellent for cooking, _____ and _____. AGIBNK LASADS
10. Canola is also used in _____ uses such as cosmetics and printing. BELIDINE
11. Canola meals is used as a _____ for livestock, poultry and pets, and as a fertilizer. DEFE

Available Words

Mustard	Combine	Salads	Crushing	Inedible	Processor
Baking	Pods	Cholesterol	Feed	Oilseed	North Dakota



OILSEEDS

Safflower

Safflower is an annual oilseed crop adapted primarily to the cereal grain areas of the western Great Plains. In North Dakota, safflower has been grown in experimental plots since 1928 and commercially since 1957. Acreage is concentrated in the western part of the state. It is well adapted to drier areas of North and South Dakota and Montana.

Safflower is a thistle-like plant with a strong central stem and a root system that can reach 8 to 10 feet into the ground, deeper than most small grains. Planting is done between April 20 and May 10 using a small grain drill. Most safflower in North Dakota is harvested with a combine in early to late September.

Safflower is grown under contract in North Dakota, which means a buyer promises to buy a set amount of a producers' crop at a set price. North Dakota farmers plant about 25,000 acres of safflower.

There are two types of safflower varieties: those high in monounsaturated fatty acids (oleic) and those high in polyunsaturated fatty acids (linoleic). In the 1980s, only linoleic safflower was grown commercially in

this area. This oil is used primarily for edible products such as salad oils, soft margarines and as a non-yellowing industrial oil in paints and varnishes. High oleic varieties are also available. High oleic oil can be used as a blending oil or as a substitute for olive oil, or to fry potato chips and French fries and can be used as a diesel fuel substitute.

Uses of Safflower

- Frying potato chips and french fries
- Infant food formulations
- Cosmetics
- Diesel fuel substitute

Uses of Safflower Seed

- Birdfeed

Uses of Safflower Meal

- Supplement for livestock and poultry

OILSEEDS

Crambe

Crambe is a member of the mustard family, similar to canola. Crambe is native to the Mediterranean region. It was introduced to the U.S. during the 1940s and has been grown off and on at North Dakota Research Centers since 1958. Commercial production of crambe in North Dakota began in 1990. Crambe seed yields an industrial oil that contains a high level of erucic acid. Crambe oil is not used for food purposes.

Crambe is an erect annual with large feather-like leaves. Plants are usually 24 to 40 inches tall. The many flowers are white and small. Each seed is enclosed in a pod that usually remains on the seed after harvest.

Crambe is a cool-season crop that grows well in North Dakota. Planting is typically done in late April to early May, after the risk of frost. Crambe requires adequate soil moisture for flowering, podset and filling, and a dry period as the plant approaches maturity. Timely harvest is important to avoid losing yield to pods shattering. The average yield per acre is about 1,200 pounds.

Crambe oil is a specialty oilseed with a limited market. Production is small but growing. North Dakota farmers plant about 10,000 acres of crambe.

Uses of Crambe

Oil from crambe seeds range from 50 to 60% erucic acid by weight.

Erucic acid is used for:

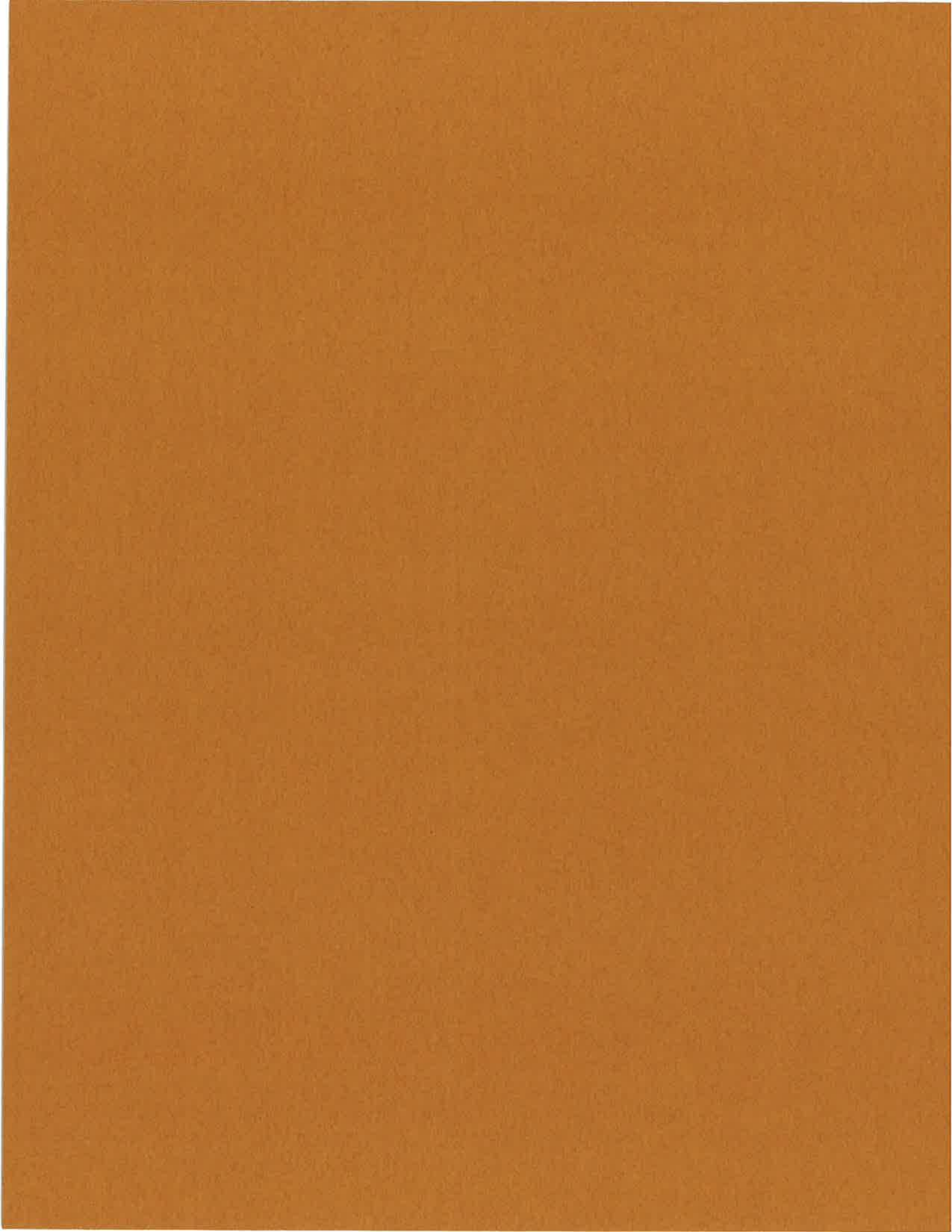
- Plasticizers
- Lubricants
- Corrosion Inhibitors

Other derivatives from crambe oil can be used in:

- Rubber additives
- New type of nylon
- Base for paints and coatings
- Pharmaceutical Products
- Cosmetics
- Waxes

Uses of Crambe Meal

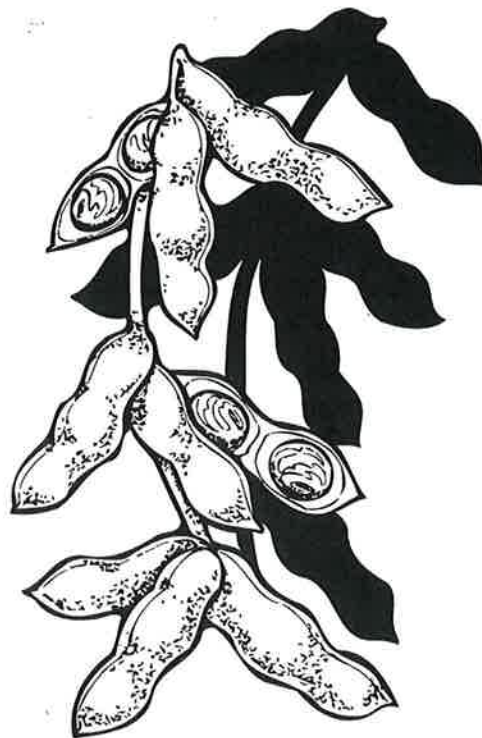
- Livestock Feed
- Fertilizer



SOYBEANS

Soybeans provide an amazing diversity number of important products in the world's agricultural, manufacturing, pharmaceutical and foodservice industries. For example, soy foods (foods made from soybeans) are nutritious foods that are central to the diets of much of the world's population. The first record of soybean cultivation appeared in 2838 BC in the "Materia Medica" by Chinese Emperor Sheng Nung. In ancient times substances from soybean curd were commonly used as primitive antibiotics to treat wounds and reduce swelling. From China, soybean cultivation spread into Japan, Korea and throughout Southeast Asia. Soybeans were introduced to Europe in 1712 and were brought to America in the early 19th century. By the 20th century many American farmers were growing the crop for livestock feed.

In 1896, George Washington Carver researched new crops to grow in the depleted soil in the South. He found soybeans, a legume that enriches the soil with nitrogen. Carver's research led to the development of soybeans' two main uses on the American continent: edible oil and soybean meal used to feed hogs, chickens, exotic birds, cattle, etc.



In 1920, combines were first used to harvest soybeans; in 1922, the first U.S. soybean processing plant opened. As a result of the new soybean technology and research, the U.S. increased its production of soybeans significantly.

Today soybean farming is a major American industry. Ideal climate, fertile soil and advanced farming techniques make the United States the world leader in soybean production. North Dakota's average annual soybean production is 85 million bushels.

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www.ndsoybean.org

Farm to Market

Production

A soybean plant bears its seeds or beans in hairy pods that grow in clusters. Each pod contains two or three beans.

Soybeans are usually round or oval and yellow with a black speckle.

Stages of production

Most soybeans are planted in May or June. Soybean sprouts need fertile soil and plenty of rain alternating with periods of sun. Most soybeans are therefore grown in the midwestern or southern U.S. Soybeans are generally ready to harvest in September and October. When the seeds are mature, the upright vine and foliage shrivel. Soybeans must be harvested before the pods shatter and burst open. A combine cuts, threshes (removes the beans from the plant) and cleans the beans.

Varieties

Today there are thousands of varieties of soybeans, each with special characteristics suited to different growing conditions. There are industrial varieties of soybeans for non-human consumption, and food-quality soybean varieties for human food use.

Marketing

U.S. soybean farmers either sell their crop directly to a commercial elevator, or they may sell directly to the consumer. Or farmers may store their beans as they wait for a better price.

Utilization

Soy is traded on the world market in three major forms: soybeans, meal and oil. Soybean meal is a major feed for livestock in many parts of the world. Soy flour, concentrates and grits made from soybean meal are used in industry and as ingredients in many commercially manufactured foods. Soybean oil is the most consumed oil worldwide. It's also used for technical and pharmaceutical applications.

Agricultural industries

Livestock feed

Protein-rich soybean meal's essential amino acid content makes it very valuable as an ingredient in livestock and poultry feed.

Other uses include biodegradable pesticide, fungicide and herbicide carriers and soybean oil sprays that reduce dustiness and improve the safety of storage grains and feeds.

Non-agricultural industries — non-edible products

Industrial products

Soybean oil, meal, protein and lecithin are used for technical, non-food purposes. Coatings, soaps and detergents, caulking, cosmetics, biodiesel and inks are just a few soybean industrial products.

Dust suppressants

Soybean oil applied to roads penetrates below the road's surface, "bonds" with the bed material of that surface, and forms a protective shield for the road with no toxic runoff.

Printing ink

Soybean oil is an increasingly popular alternative to petroleum in the manufacture of printing inks for printing. Soy ink consumes 44 million pounds of soybean oil annual. More than 90% of all daily newspapers use soy ink.

Building Material

Soy proteins and other soy products are now being used to manufacture particleboard, oriented strand board, plywood and fiberboard. Composites are useful because they make it less costly to manufacture products like plywood and they are stronger compared to many existing products.

Renewable Fuel

Biodiesel is a clean burning alternative fuel made from renewable resources, such as soybean oil. More than 150 major U.S. vehicle fleets use the alternative fuel that works in any diesel engine with few or no modifications. Biodiesel can be used in pure form or blended with petroleum diesel. Pure biodiesel is biodegradable, virtually non-toxic and emits fewer hydrocarbons, sulfates, carbon monoxide and particulate matter.

Plastics

Soybeans can be used to make a soy resin for reinforced fiberglass. Prototype parts made from this process are being tested by the John Deere Company to make light, strong parts for agricultural equipment. These plastics may be used in many automotive, marine and construction components.

Scientists are also working on soy foams for insulation, soy films (like plastic wrap) and soy additives to make rigid plastics more flexible are being researched. Soy additives are available in great quantities and are cost effective.

Pharmaceuticals/ medicine

Hundreds of research reports indicate that soybean products are beneficial in reducing cholesterol, protecting against heart disease, reducing the risk of cancer, blocking the development of cancer at several stages, minimizing the effects of PMS and menopause, treating leukemia, boosting the immune system and fortifying bones against osteoporosis.

Other important soybean plant chemicals include protease inhibitors, phytate, phytosterol, saponins, phenolic acids, lecithin and omega-3 fatty acids.

Lecithin, extracted from soybean oil, is a natural emulsifier and lubricant. It also improves the nutritional quality of food products by reducing the fat content and increasing the vitamin and mineral content. Research is currently being conducted on possible medicinal applications for lecithin.

Non-agricultural industries — edible products

End products

The following are examples of edible products that can be made from soy-based ingredients:

- Bakery Products
- Batters and Breadings
- Breakfast Cereals
- Chocolate
- Coffee Whiteners
- Confectionery Products
- Cooking Oils
- Creamers
- Filled Milks
- Frozen Desserts
- Liquid Shortening
- Margarines and Soft Spreads
- Peanut Butter
- Salad Dressings
- Salad Oils
- Sandwich Spreads
- Snack Foods
- Soups, Stocks and Bases
- Vegetable Shortening
- Whipped Toppings

Health benefits

Nutritional Value

Soybeans are packed full of nutrition and can offer a great deal to a healthy diet. They are rich in high-quality proteins, contain iron, B vitamins, calcium and zinc, and are cholesterol-free, low in saturated fat, and an excellent source of dietary fiber. A half-cup of soybeans, four ounces of tofu, a glass of soymilk or a snack of soy nuts provides one serving of soy. Adding soy to favorite recipes is quick, unnoticeable and an easy way to eat healthier.

Soybeans are the only vegetable that contain complete protein with all eight amino acids in the amounts humans need. The amino acid pattern of soy is virtually identical to that of meat, milk and egg products. The Food and Drug Administration (FDA) and the American Heart Association have recognized the cholesterol-lowering effects of soy protein.

Recent and emerging research suggests soy may lower the risk or occurrence of some cancers, osteoporosis, high blood pressure and other health concerns.

Edible products

Soy Protein Isolates

Foods manufactured with soy protein isolates to improve their texture and taste include:

- Breads and Baked Goods
- Breakfast Cereals
- Pastas
- Beverages such as Milk Shake Bases and Drink Mixes
- Snacks and Desserts
- Soups and Sauces

Soyoil

Nearly 75% of our total vegetable oil intake is soyoil. Soyoil is used in a variety of products including salad dressings, mayonnaise, margarine, coffee creamers and sandwich spreads.

Soyoil may be used in any recipe that calls for vegetable oil. Soyoil is cholesterol-free, low in saturated fat and high in polyunsaturated fat.

Texturized Soy Protein

Texturized soy protein (TSP) is made from soy flour and used as a nutritious extender in a variety of products. When it is rehydrated with boiling water, TSP has a texture similar to ground beef. TSP is rich in protein, low in fat and sodium and a good source of fiber.

Soy Flour

Soy flour is ground from roasted soybeans. Rich in high-quality protein and other nutrients, soy flour adds texture and flavor to a variety of products. There are two kinds of soy flours. Natural soy flour contains the natural oils that are found in the soybean. Defatted soy flour has the oils removed during processing.

Tofu

Tofu is a soft, cheese-like food made by coagulating fresh hot soy milk. Tofu was first used in China around 200 B.C. Today it is a dietary staple throughout Asia. In recipes, tofu acts like a sponge, soaking up surrounding flavors. Crumble it into a pot of chili sauce and it tastes like chili. Blend it with cocoa and sweetener and it becomes chocolate cream pie filling.

Soy Milk

Soy milk is made by grinding soaked and cooked soybeans and pressing the dissolved milk out of the beans. Soy milk is rich and creamy and has a nutty flavor.

Soy milk is an excellent source of high-quality protein, B-vitamins and iron. Some brands of soy milk are fortified with vitamins and minerals and are good sources of calcium, vitamin D and vitamin B-12. Soy milk is free of the milk sugar lactose and is a good choice for people who are lactose intolerant.

Vocational opportunities in the soybean arena

Potential areas of development

There are many potential areas of employment related to the production, processing and retail of soybeans.

Advertising/Public Relations

Soybean Promotion Specialist

Agribusiness

Salesperson of soy-based products

Agricultural Engineering

Industrial Engineer

Banking/Finance

Ag Loan Officer

Biotechnology

Scientist (soybean breeding research)

Chemical

Chemical sales representative

Communications/Public Relations

Community education specialist

Information specialist

Consulting

Crop consultant

Education

Agricultural extension education

University Professor (Ph.D.)

Food Service

Director of school/hospital nutrition

Management

Elevator management

Production manager

Manufacturing

Product line manager

Marketing

Marketing manager

Merchandising

Grain merchandiser

Commodity broker

Nutrition

Dietician

Production

Farm/ranch manager

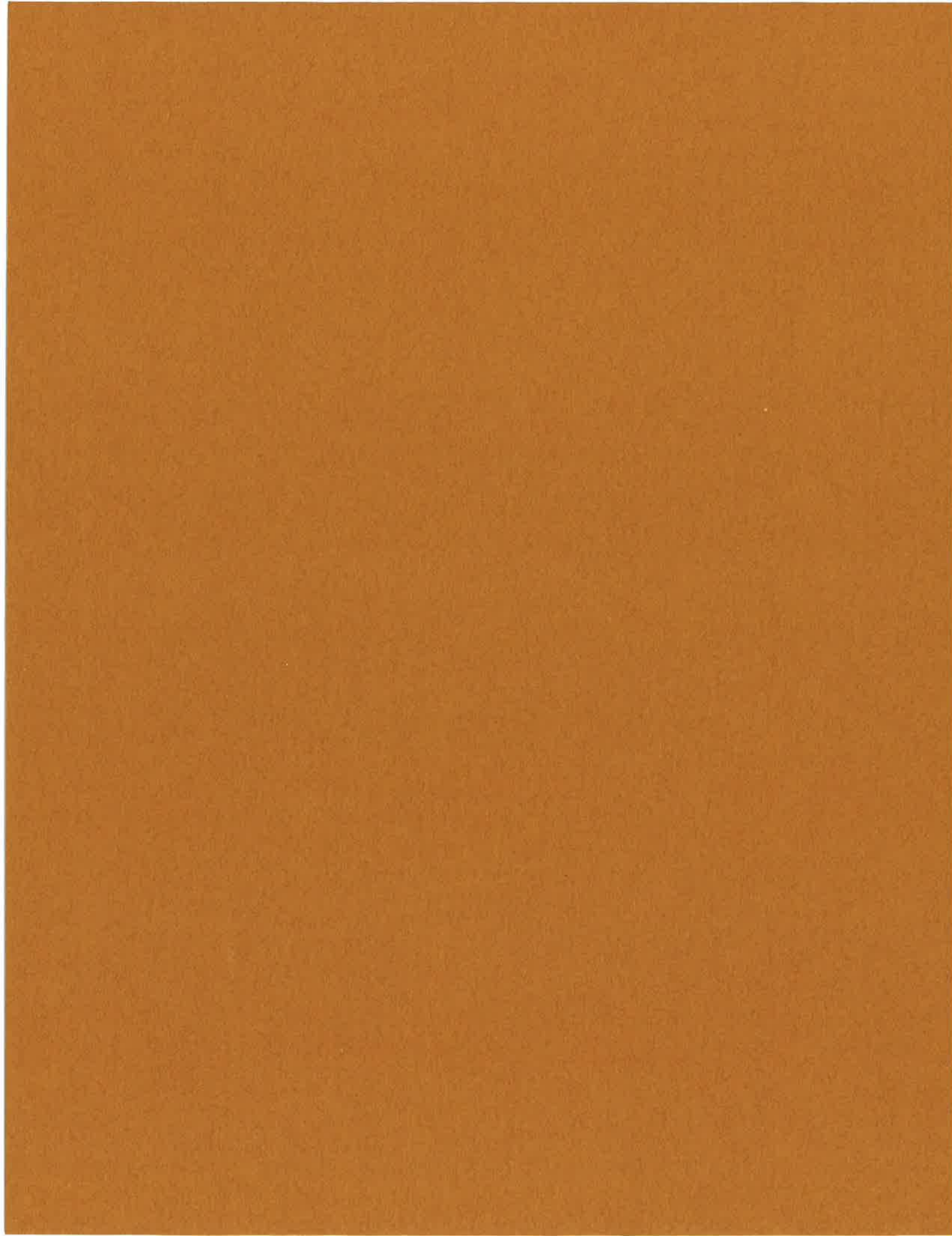
Processing

Food technologist

Research

Agronomist

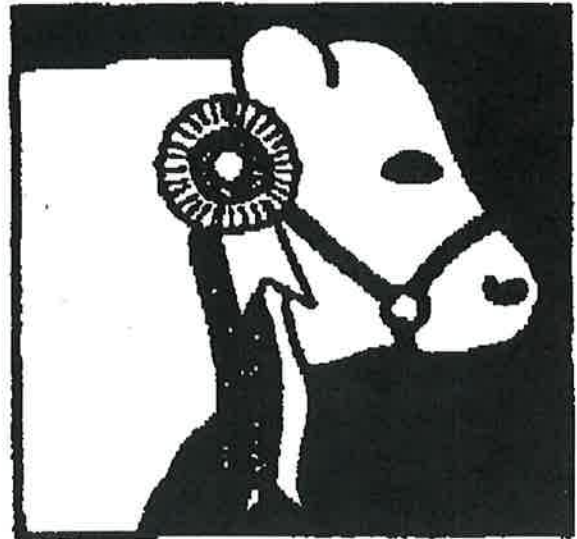
Product development specialist



BEEF

Beef Facts

Cattle are big business in North Dakota. Did you know each year more than 1,000,000 calves are born in North Dakota? There are more than 1.97 million head of cattle in North Dakota. This makes the cattle business the state's second largest segment of agriculture, second only to wheat. In Minnesota, the cattle business (including both beef and dairy cattle) is the largest segment of agriculture.



check out
www.beef.org

Growing Cattle

It may seem like much of the land in the upper Midwest is used to grow crops. Although large areas are cultivated and seeded each year, much of the land is not suitable to grow crops. Much of the land, and our climate, is well suited for beef and dairy production. Even with very cold winters, cattle adjust very quickly to our weather conditions and can be very productive during our winter months. They can thrive on pasture, or grassland. Cattle change grass to beef or milk. They allow a farmer or rancher to use land that otherwise wouldn't produce any food at all. We cannot eat grass. We do not like the taste of it and our bodies cannot use it.

Grass provides cattle with nutritious food to graze on, and grass is the natural protective covering for much of the soil. Sandy or rocky soils need this protective covering, or they are more likely to be damaged by weather elements such as rain, snow and wind. This damage may leave the soil to erode or blow or wash away. When grass grows in this soil, the roots reach through the soil and hold it down. Hay and grass are perennial (grow every year) and do not require the soil to be worked or tilled to grow a crop.

How can the producers make any money if they don't seed a crop on their land each year? The calves and cows are their crop. Why can cows eat grass? What's so special about a cow? Why can a cow be put on land like this and a pig can't?

There are a lot of things to learn about cattle. This section will help you to understand cattle better, why the food they produce is part of our diet and why they are a positive part of our environment.

Amazing Ruminants

What is it about beef cattle, or all cows, that allow them to turn grass into beef?

Cattle have four stomachs, which makes them part of a group of animals called **ruminants**. The word ruminates means to chew a **cud**. Cattle, sheep, camels, goats, buffalo, elk, and deer are all ruminants. This allows them to convert coarse fiber, grass, hay and roughage of any kind, into high-quality protein. Animals like pigs have only one stomach and need low-fiber grains.

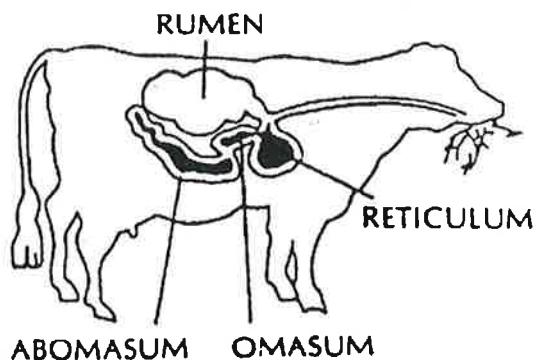
Ruminants do not chew their food as people do. These animals do not chew the grass fully as they eat. They wrap the grass around their tongues and pull it into their mouths. From there the food

is swallowed and goes in the first and largest stomach, the rumen, where micro-organisms help to break the food down into small balls of cud.

When the animal has eaten enough, it rests and regurgitates (brings back up) the cud and chews it further. A cow can make almost 10,000 jaw movements in a day. The chewed food then goes on through the other three stomachs, the reticulum, the omasum and the abomasum, to be further digested. A blade of grass may stay in the rumen for 30 hours.

Beef cattle are efficient users of our resources. Not only are they able to use grass to produce food, but they use far less water than the amount we use each day to drink, shower or flush the toilet.

Land and livestock work together. Cattle also help keep the pasture land healthy by fertilizing it with manure.



Care of Cattle

Manure is a natural fertilizer and contains the chemicals nitrogen and phosphate which make our soil healthier. These chemicals dissolve in water and become valuable for the soil. Manure produced by animals in feedlots is spread on cropland or dried, bagged and sold as natural fertilizer to gardeners.

In the winter when snow and cold stop cows from feeding out on the pasture, hay or silage is used for feed. Cattle can withstand very cold temperatures as long as they have protection from the wind and good hay to eat. Cattle producers grow and bale hay in the summer so it can be used for feed in the winter.

Hay is really dried grass. It is usually baled from an area where it has grown quite tall. The roots are left to nourish the soil and help it withstand wind and water erosion.

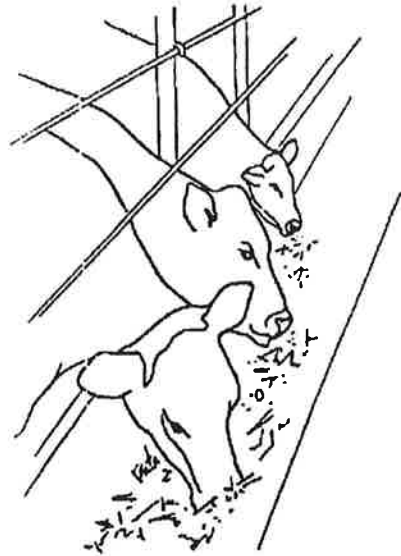
Sometimes grasses, or in some places corn crops, are cut and put immediately into silage tanks or pits. The silage is then fed to cattle throughout the winter.

In addition, grain may be fed to cattle to finish them; finishing allows the beef to become more flavorful and tender. However, cattle do not need grain to survive. In fact, too much grain can give a cow indigestion.

Each spring, thousands of **calves** are born in North Dakota. At birth these newborns weigh about 90 pounds. Even when it is very cold, calves can be born outside. Within hours the newborn calf is walking. (Ask your parents how long it took you to learn to walk.)

Soon after it can stand, the calf begins to nurse on its mother's milk which gives the calf a healthy start. The calf needs this healthy start because there are many things that can harm a calf.

The weather has a big effect on the health of calves. Damp weather from an early spring or a very wet snowstorm can cause problems like pneumonia or scours (diarrhea) for the calf.



Producers use straw left over from harvest as bedding to keep the animal dry. If a calf gets sick, the veterinarian (animal doctor) will be called and the calf will get medicine to keep it healthy. Just like you, calves receive vaccinations to protect them from disease.

Over the spring and summer, producers regularly check the herds to make sure young calves don't have diseases.

Keeping a healthy herd of beef cattle means making sure there is enough water and grass. Today's modern cattle producers don't want cattle to eat all the grass in one area (over graze), so they move them from one area to another. This allows the grass to stay healthy so the producer can use a grazing area (pasture) year after year.

Very dry summers are difficult for producers because an over-dry pasture doesn't produce enough hay to feed the cattle. That means producers may need to reduce the size of the herd, or sell cattle, so he doesn't have to feed as many. Often this means selling the cattle at a lower price and his work doesn't make a profit.

It is important for producers to keep pastures in good condition for cattle, as well as natural wildlife like deer and antelope that also need food, water and shelter.

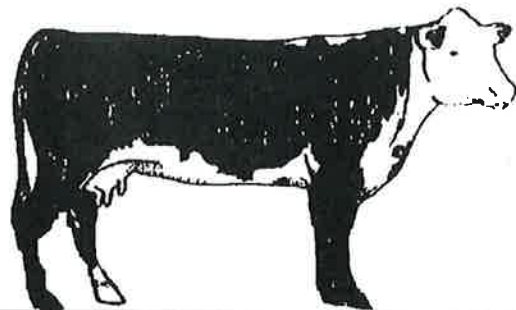
Feedlot

When an animal is 8 to 10 months of age, it may be transferred to a feedlot. A feedlot is a special farm where cattle are finished on a mixed diet of grains like corn, barley, silage, special protein and minerals. Finishing means to complete the feeding of animals to maximize the lean meat produced.

At 1,100 to 1,200 pounds, the cattle are ready to be marketed and sold. Some heifer (female) cattle will be kept to replace the older cows.

What's In A Breed?

There are more than 50 cattle breeds. Some breeds of cattle in North Dakota are Hereford, Charolais, Limousin, Simmental and Angus. Why is an animal's breeding so important?



Each breed offers special characteristics, or genetic traits, just like humans. If both your parents have brown hair and brown eyes, chances are pretty good you will too. Producers looking to produce cattle with specific traits will use a particular breed so their cattle will have the desirable traits of that breed.

Cattle today have more lean meat and less fat (finish) than cattle produced 30 years ago. This leanness is due to improvements in genetics and feeding. That means today's beef has fewer calories, less fat and less cholesterol.

One of these nutrients is protein. Protein is very important because it lets your body do all the things necessary to help you live. Meat protein has all the essential amino acids your body needs in the right quantities. Plants can make their own protein, but our bodies cannot. We must eat foods that give us that protein. Meat contains quality protein that the animal has made from the grass it has eaten. Plant proteins need to be combined to get the right quality for your body. When it comes to being active, beef is a perfect food, and best of all, beef tastes great.

Why Do We Eat Beef?

Beef is a nutrient-dense food that provides many nutrients for a small amount of calories. Your body needs about 50 nutrients to promote growth and maintain the tissues in your body; these nutrients are in the food we eat. As you grow, exercise, play sports, go to school or work, your body needs food to give it energy and fight disease.

U.S. Recommended Daily Allowance in one 3 oz. 85% lean beef patty

Protein	42%
Vitamin B12	40%
Riboflavin (B2)	9%
Niacin	25%
Iron	13%
Zinc	35%
Calories	10%

Major Nutrients Found In Beef

Vitamins

Thiamin, Riboflavin, Niacin

- Maintain a healthy nervous system
- Help the body use energy
- Aid in normal growth and appetite
- Aid in protein metabolism
- Prevents anemia

B6

- Aids in protein metabolism
- Prevents anemia

B12

- Aids in red blood cell formation
- Maintains a healthy nervous system
- Aids normal bone and tooth development
- Promotes good night vision
- Maintains healthy skin and membranes

Fat

- Supplies energy and essential fatty acids

Protein

- Builds and repairs body tissues
- Builds antibodies, the blood components that fight infection

Minerals

Iron

- Combines with protein to form hemoglobin, the red blood cell constituent that transports oxygen and carbon dioxide

Zinc

- Aids in energy metabolism and tissue formation

Phosphorus

- Works with calcium to build and maintain strong teeth and bones

Inspection Standards Ensure Top Quality

Before a cut of beef is sold for your table, it is inspected many times to ensure wholesomeness — quality and cleanliness.

At the meat processing plant, health inspections are done by the United States



Department of Agriculture (USDA) meat inspectors to ensure that the cattle are healthy and the meat is good to eat. Both the live animal and the carcass are inspected. If the carcass meets all of the standards, it receives a USDA Inspected stamp of approval.

Grading

After the carcass is inspected, it may be graded (just like your test papers!). Grading tells you about the quality of meat you are purchasing.

Grades give us an idea of the different levels of tenderness, flavor and fat content of beef. By knowing the differences in the grades of beef, consumers can choose the grade of beef that best suits their needs.

The higher the grade of beef, the more tender and flavorful it will be. A beef grader looks at several points to determine the grade.

Some of these include:

- Age and maturity of the animal.
- Amount of fat, including fat on the outside and fat in the meat itself. The tiny streaks of fat throughout the meat are called “marbling.”
- Bright red colored lean tissue.

The three most common quality grades of beef, starting with the highest, are prime, choice and select.

Prime beef is most commonly found in fancy restaurants.



Choice beef is found in many restaurants and is most common in grocery stores.



Select beef is found in grocery stores, and is somewhat leaner than choice beef.



Meat and More

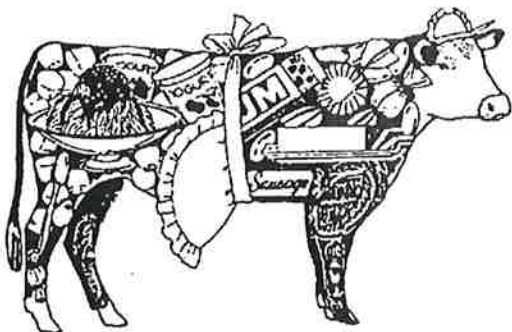
Cattle are a lot more than steak and roast beef. With by-products we can use 99% of every animal.

It's A Meal

We normally think of beef as a hamburger, steak or roast for a satisfying meal, but there are other edible parts in addition to the protein-packed muscle.

A few "variety meats" include the liver, heart, tongue and kidneys.

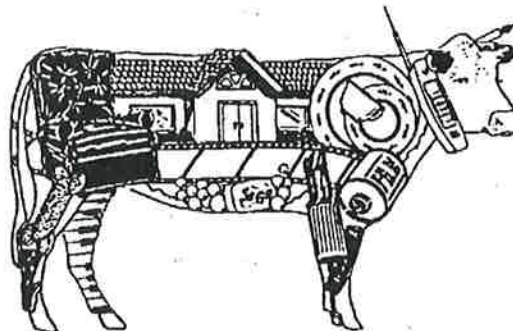
There are also edible by-products that are not quite so obvious. Do you know that gelatin in such products as ice cream and yogurt is made from the bones and connective tissue of the cow?



Other parts are used in making sausage casings, shortening, chewing gum, mayonnaise, candles, marshmallows, cookies, salads, paté and much more.

It's a Household

You may not have a cow in your house, but there are a lot of items made from beef by-products in your house.

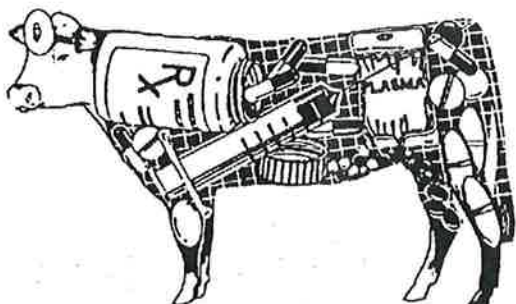


Normally only a part of a non-edible product uses a beef by-product. It's like one ingredient that's needed for the final product to come out right. The soap you washed your face with this morning, the baseball glove in the closet, the sheetrock in the walls of your house — all likely contain a beef by-product.

Other items that might use by-products include candies, cosmetics, crayons, deodorants, shampoo, hair conditioners, detergents, fabric softeners, insecticides, paints, plastics, shoe cream, shaving cream, textiles, pet foods, floor wax, toothpaste, doggie chews, bonemeal biscuits, leather sporting goods, luggage, boots and shoes, upholstery, wallpaper, glue, photographic film, violin strings, bone china, candles, wine and beer. That's a lot, but there's more!

It's a Pharmacy

The medical world also relies on cattle by-products for the pharmaceutical wonders it produces and uses. Because cattle are quite similar in organic chemical structure to humans, our bodies will easily accept a medication or treatment made with these animal components.



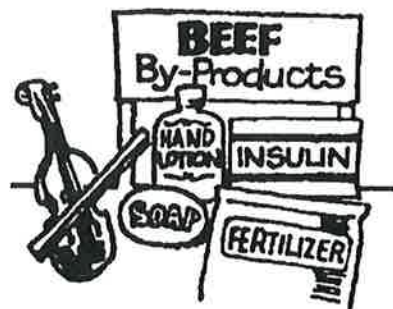
Some products are synthesized without animal products. However, many are made at a lower cost from beef products.

By-products are used to treat diabetes, help blood to clot, stimulate the thyroid gland so it works properly, cleanse wounds and ulcers, fight infections and treat allergies, rheumatoid arthritis and rheumatic fever.

It's in Industry

By-products are used in all sorts of manufacturing. Chemical manufacturers use numerous fatty acids from inedible beef fats and proteins for all sorts of lubricants and fluids. Antifreeze contains a glycerol derived from fatty acids to keep your car running cool. Tires have stearic acid which makes the rubber hold its shape under continuous road friction. Glue from colloidal proteins has been used in automobile bodies. Even the asphalt on roadways has a binding agent from cattle fat.

Some other unusual but necessary products are hydraulic brake fluid, lubricants, airplane runway emergency foam, car polishes and waxes, textiles for car upholstery, high-gloss coating for magazines, whitener for paper, explosives, cement blocks, industrial cleaners, molders for plastics, rubber tires, fertilizers and printing ink.

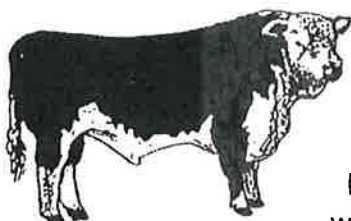
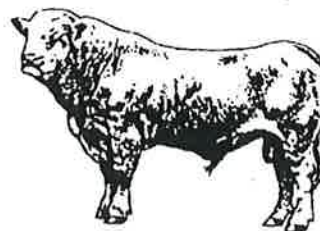


Answers: Beef Facts - All answers are true.

Beef breeds

Charolais

The Charolais breed originated in France. Charolais cattle are white and creamy beige in color. This breed has a rapid growth rate, is well-muscled at a young age, and produces a good amount of beef for the amount they eat.

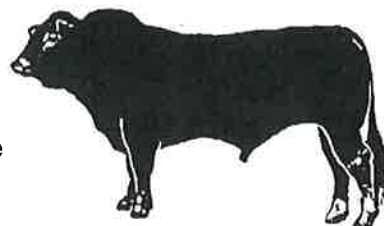


Hereford

This breed originated in England. They are very popular because of their ability to withstand our cold climate. Herefords have a rich red coat with white markings and a white face. This breed produces lean, high-quality beef.

Limousin

The Limousin breed also originated in France. These cattle have a light to reddish brown coat and may have white around their eyes. This breed has a rapid growth rate and an excellent amount of meat on each carcass.



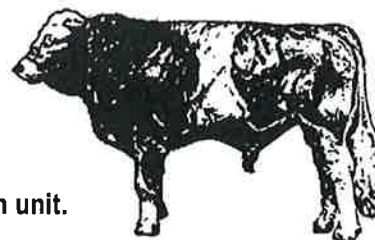
Aberdeen Angus

Angus cattle originated in Scotland. They are red or black in color. They produce a heavy carcass and high-quality beef.

Simmental

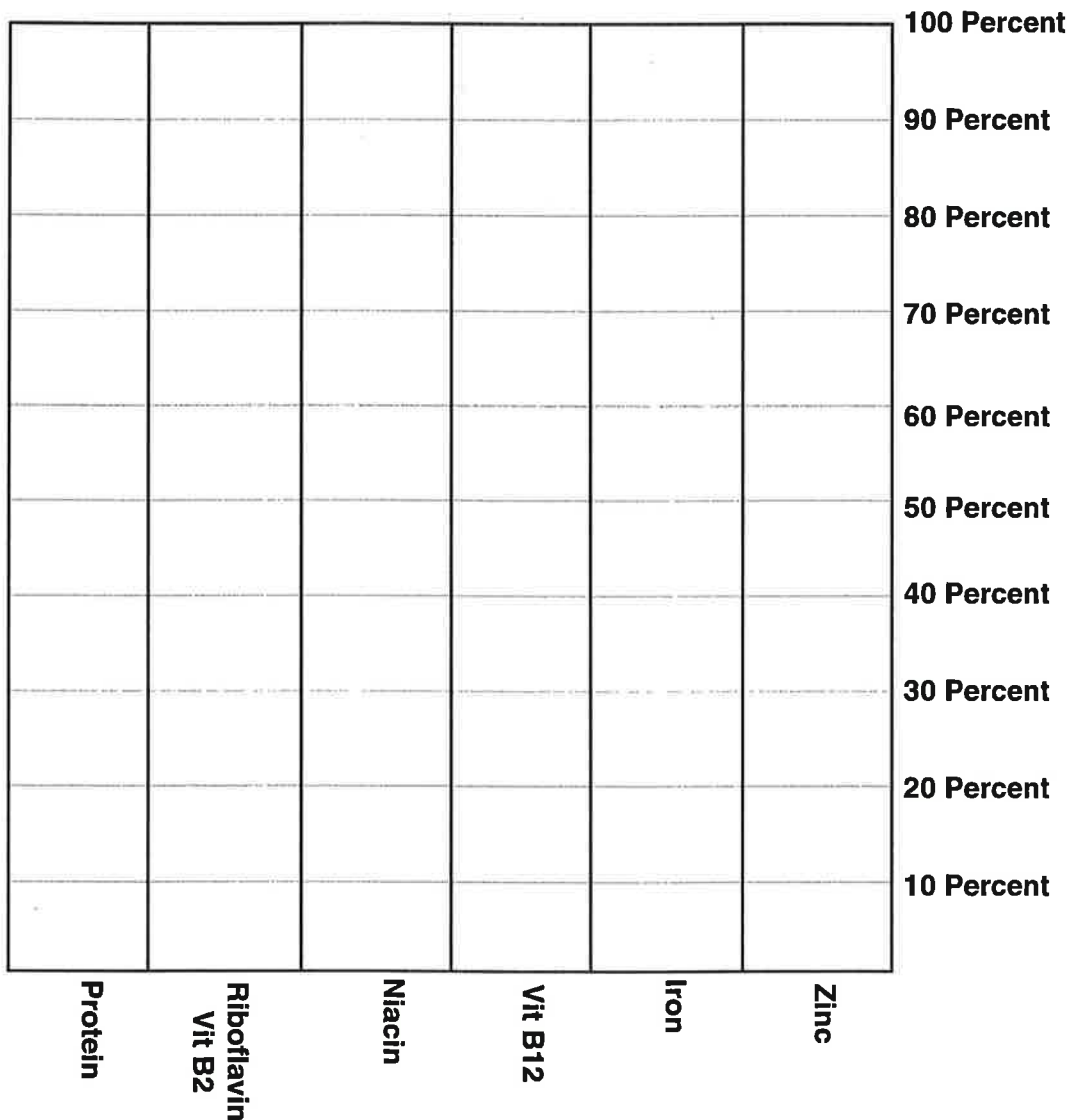
Simmental cattle came from Austria, Germany, Switzerland and France. Simmental cattle are noted for their fast growth and weight for their age. They tend to be yellowish to reddish brown with white markings.

The humble cow has become a well-studied, efficient production unit.



Fill in the chart

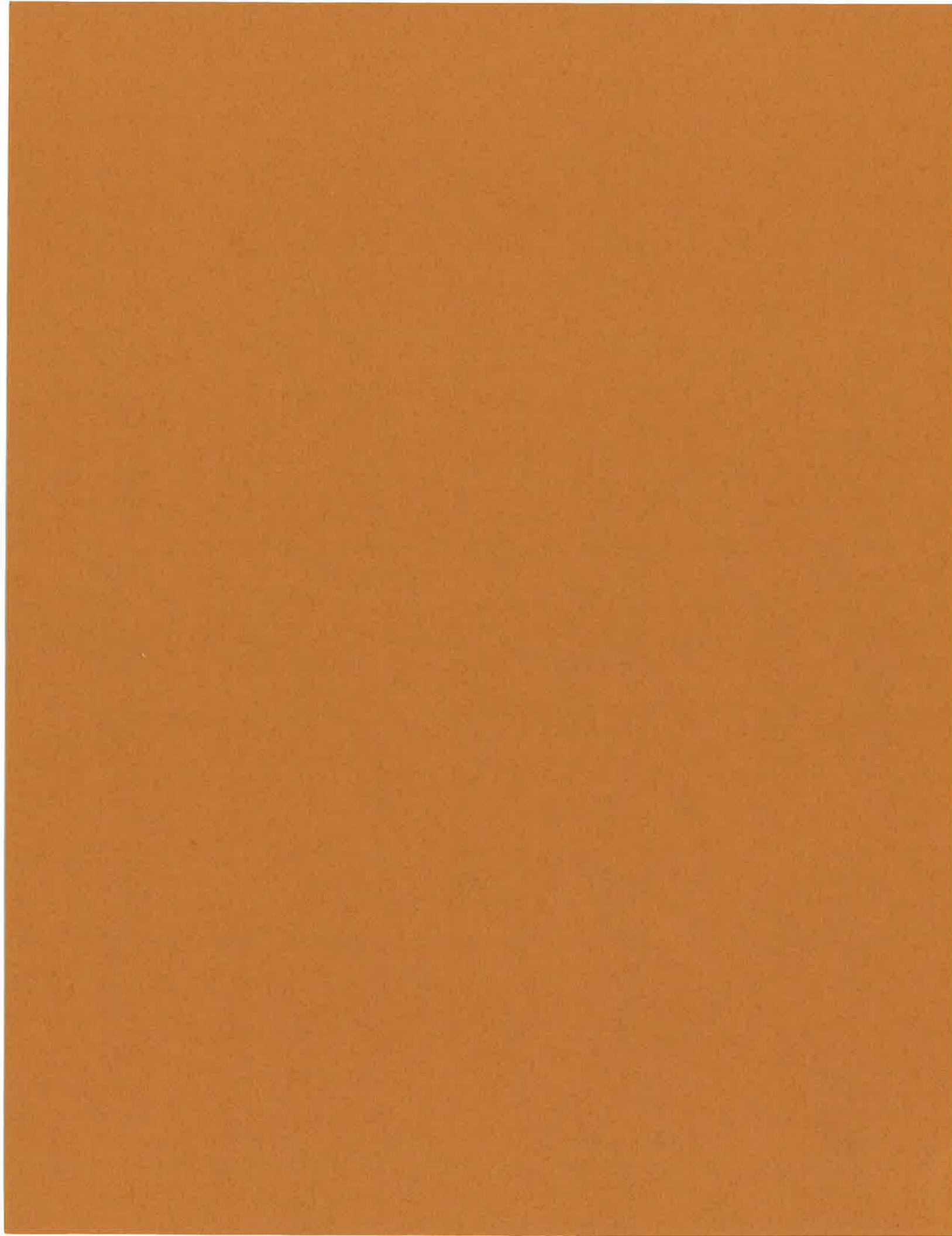
When you eat a 3-ounce (85g) cooked, 85% lean ground beef patty, what percent of the recommended amounts of beef's key nutrients do you get from it? Fill in the bar-chart below using the information from "Why Do We Eat Beef?"



Beef Facts

True or False

- ___ 1. The young of cattle are called calves
- ___ 2. It takes about nine months or 283 days from breeding to the birth of a calf.
- ___ 3. Beef producers may only get paid once or twice a year.
- ___ 4. The tail of a beef animal is used for oxtail soup.
- ___ 5. Beef cattle are bred to have their first calf at 2 years of age.
- ___ 6. An average steer weighs about 1,100 pounds.
- ___ 7. Most beef cows have five to eight calves in their lifetime.
- ___ 8. The once-swallowed food cattle eat is called a cud.
- ___ 9. A steer has four stomachs.
- ___ 10. Beef producers get up at night to check calving cows.
- ___ 11. At night or in bad weather, cattle tend to group together in a herd.
- ___ 12. Digestive waste from animals, manure, is used for fertilizer.
- ___ 13. A doctor for animals is called a veterinarian.
- ___ 14. The hides of cattle can be made into leather.
- ___ 15. Prices received by cattle producers are determined by supply and demand.
- ___ 16. Beef is 49% leaner than it used to be.



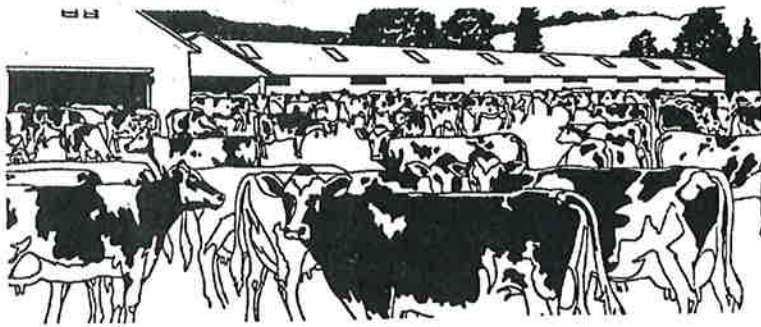
DAIRY

Milk From Cow to You

The main breeds of dairy cows are Holstein, Guernsey, Jersey, Ayrshire and Brown Swiss.

A cow eats about 90 pounds of food and drinks 25 to 50 gallons of water a day — all in about 6-1/2 hours.

The milk cow changes the grass and grain she eats into something delicious for you to drink — milk.



There are nearly 10 million milk cows in America. They make about 77 billion quarts of milk each year.

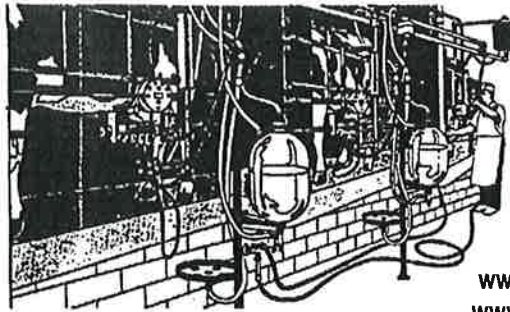
Milk Is Collected, Cooled In The Milking Parlor

Cows are milked at least twice each day.

Each time cows are milked, the dairy farmers wash the cows' udders and the milking machines. They do this to keep the milk clean.

It used to take a person one hour to milk six cows by hand. Today a person can milk 100 cows in an hour with modern machines.

A productive cow can give about 100 glasses (25 quarts) of milk a day.

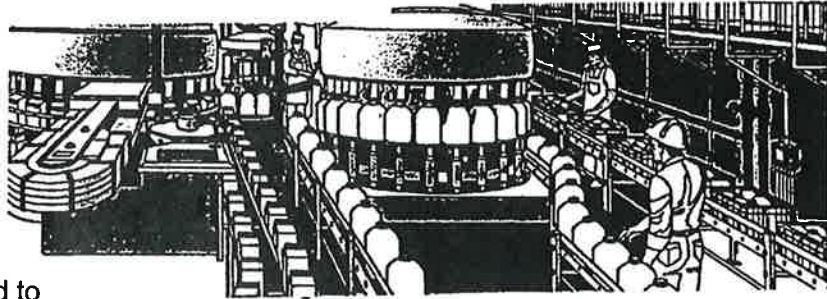


check out
www.3aday.org
www.hoards.com
www.whymilk.com
www.dairycam.com
www.ilovecheese.com
www.midwestdairy.com
www.nationaldairycouncil.org
www.nutritionexplorations.org
www.aipl.arsusda.gov/kc/kcindex.html

Milk Is Processed For Your Health At The Dairy Plant

Milk is one of the safest foods you can drink. No hands touch it as it leaves the cow, is collected in a big tank, then goes in a milk truck that keeps the milk cold to the dairy plant. There, the milk is tested for purity and, if it passes, is homogenized to break the butterfat particles into thin, uniform globules. If milk wasn't homogenized, the cream would rise to the top so you would have to shake or stir the milk before serving.

The milk is then pasteurized, or heated to 161°F for 15 seconds to kill bad



germs or bacteria, then rapidly cooled. Pasteurization was discovered by Dr. Louis Pasteur in 1856.

For milk to drink, vitamins D and A are added and chocolate, strawberry or even banana flavor may be added. Machines fill and seal the cartons, jugs or bottles. In the U.S., almost half of the milk is made into more than 300 types of cheeses.

Milk Is Delivered To Many Places

Before modern milk delivery, when people traveled they had to take their cows with them. The Pilgrims brought cows with them to America. The explorer Admiral Byrd took cows with him to the South Pole.

Sometimes people couldn't take their cows, so they made the cow's milk into foods like cheese and yogurt they could take along. Today, you don't have to travel with a cow. Thanks to a modern, fast, delivery system, you can find milk and other dairy foods wherever you go.



Visiting a Dairy Farm

Although we may be familiar with milk and other dairy products, we may not connect dairy foods with the dairy farm. If you can visit a dairy farm, you will see for yourself where dairy foods originate.

Students should be prepared for dairy farm smells (the barn, animals and feed) the animals' size and how they should act in the barn and around the animals.

It's important students understand that everything that touches the milk is kept very clean. Discuss how farmers wash the cows' udders and machines and emphasize that milk is never touched by human hands. Tell students they will draw pictures after their visit to tell the story of what they saw at the dairy farm.

See the Resources section for toll-free phone numbers for lesson aides.

Dairy Activities

Discuss the importance of milk and dairy foods in the diet.

Discuss the Milk, Yogurt and Cheese Group as one of the Five Food Groups and the dairy products in that group — milk, cheese, cottage cheese, yogurt and ice cream. Kids need calcium for stronger bones and better bodies and the best way to get calcium is from dairy foods. Children ages 4 - 8 need 800 milligrams of calcium, or three dairy servings, a day. Children ages 9 - 18 need 1300 mg of calcium per day or four servings. One serving equals one 8-ounce glass of milk, one cup of yogurt, or 1-1/2 ounces of cheese. Have students keep track of what they eat to see if they are getting enough dairy a day.

Discuss the steps involved in bringing dairy products to homes.

Describe how milk is processed from the cow, to the milking parlor, to the dairy plant, to dairy products and to the grocery store.

The 3 Cs of Handling Milk at Home

- Keep milk clean by storing milk in the original container.
- Keep milk carton or jug closed to maintain its good flavor.
- Keep milk cold by storing it in the coldest part of the refrigerator. Always put milk promptly back in the refrigerator.

Interesting facts about cows.

Discuss the size of cows and how much they eat. Use comparisons to help students visualize amounts. For instance, a cow weighs about 1500 pounds. Ask students how many children it would take to make 1500 pounds. Ask students if they could eat 480 hamburgers a day. These burgers would weigh about 90 pounds — cows eat about 90 pounds of feed in a single day. Cows also drink a bathtub full of water (45 to 30 gallons) each day. Cows spend about 6-1/2 hours a day eating — longer than a school day.

Make a Milk Mustache

Kids can have fun making and wearing a milk mustache. Mix 1 part milk to 2 parts ice cream, mix in a blender then put the mixture into cups. Have the students tip a glass of the mixture on to his or her upper lip to create a mustache. Use a Polaroid or digital camera to capture the moment. Take individual or group pictures and post them in the classroom, lunchroom or hallway. Faculty and staff can get involved by having the students “Guess Who’s Wearing a Mustache?” Take a picture of faculty/staff wearing a milk mustache. Cover the top part of the picture to show only the face below the nose. Number each picture and post where students can guess the mustache wearers.

Dairy Snacks

It’s easy and fun to make your own dairy snacks. Here are some to try.

Purple Cows - Mix equal amounts of grape juice and milk.

Yogurt Sundae - In paper cups, top your favorite yogurt with nuts, raisins, or fruits such as strawberries, bananas, grapes, peaches, etc.

Kabobs - Bananas, cut in thick slices. Whole fresh strawberries, washed. Green seedless grapes, washed. Bite size cubes of colby or cheddar cheese. Fruit flavored yogurt. Toothpicks or thin wooden skewers. For each kabob, put an assortment of cheese and fruit on each skewer. Dip the kabob in the yogurt and eat.

Answers
1. Cattle; 2. Cows; 3. Udder; 4. Teats; 5. Silage; 6. Heifer; 7. Calf; 8. Freshen; 9. Bulls; 10. Milking parlor; 11. Pasteurize; 12. Silo; 13. Holstein; 14. Milk; 15. Milking Machine

Match words heard on a dairy farm

Certain words may be used almost only around a dairy farm. Draw a line from the word to the definition.

- | | |
|---|------------------------|
| 1. Cows and bulls collectively. | Silage |
| 2. Female cattle; give milk. | Bulls |
| 3. Part of the cow where milk is made and released. | Milking Parlor |
| 4. Milk comes out of the cow through this part of the udder. | Freshen |
| 5. A mixture of chopped green grasses or corn. | Milk |
| 6. A young cow over one year old that has not yet produced a calf. | Silo |
| 7. A cow's baby. | Milking Machine |
| 8. To start giving milk after calving. | Pasteurize |
| 9. Male cattle. | Cattle |
| 10. Area of the barn where cows are milked. | Cows |
| 11. Heat milk at the dairy plant to kill any bacteria. | Holstein |
| 12. Cylindrical structure on a farm where cattle feed is kept. | Teats |
| 13. One breed of dairy cattle. (Some others are Guernsey, Jersey, Brown Swiss, and Ayrshire.) | Udder |
| 14. White liquid food that comes from dairy cows. | Calf |
| 15. Machine that collects milk from cows. | Heifer |

Highlights of a Dairy Farm Visit

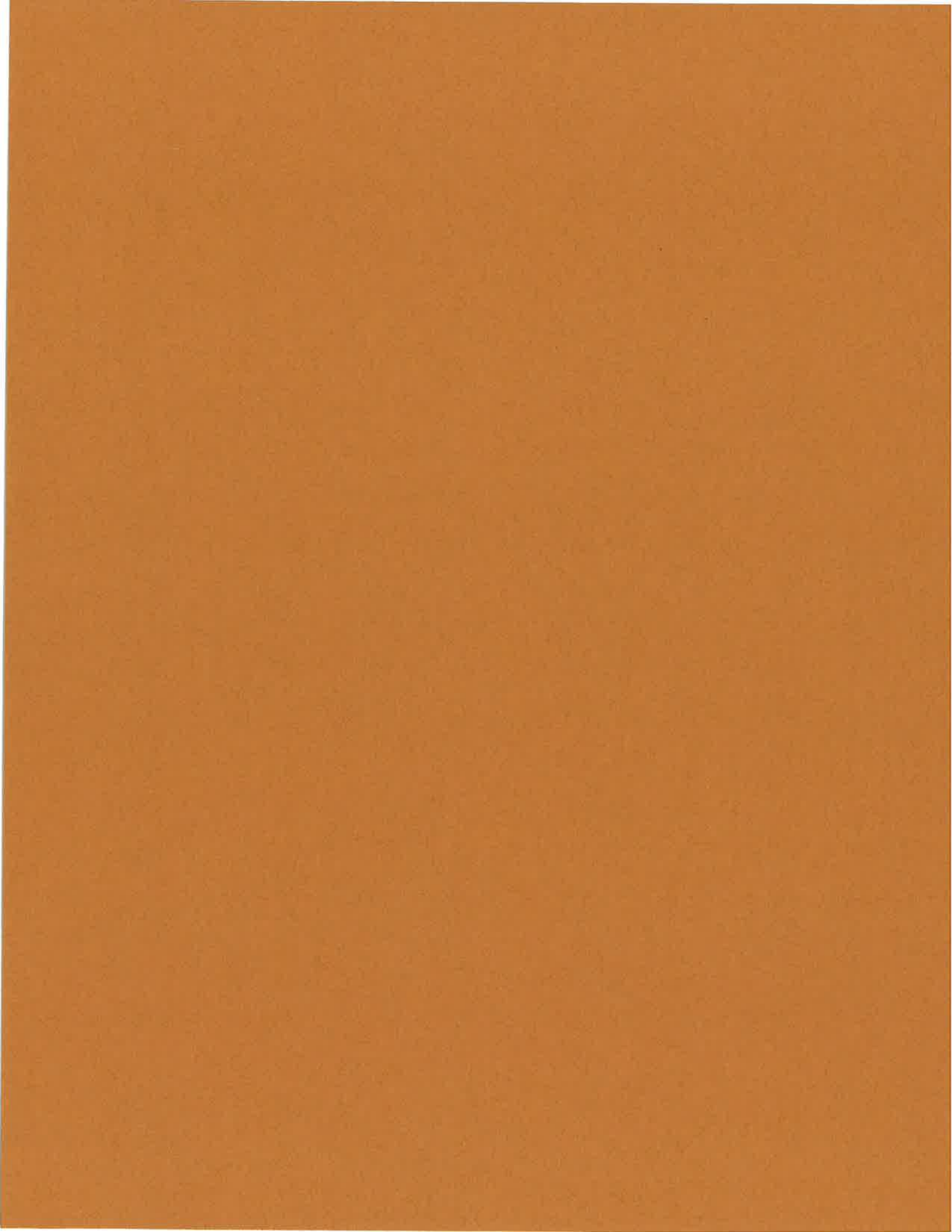


Name _____

Draw four pictures that tell what you found or might find on a dairy farm.

A large, empty rectangular box with a black border, intended for a student to draw a picture related to a dairy farm visit.A large, empty rectangular box with a black border, intended for a student to draw a picture related to a dairy farm visit.

A large, empty rectangular box with a black border, intended for a student to draw a picture related to a dairy farm visit.A large, empty rectangular box with a black border, intended for a student to draw a picture related to a dairy farm visit.



SHEEP

"Baa, baa, black sheep, have you any wool? Yes, sir. Yes, sir. Three bags full."

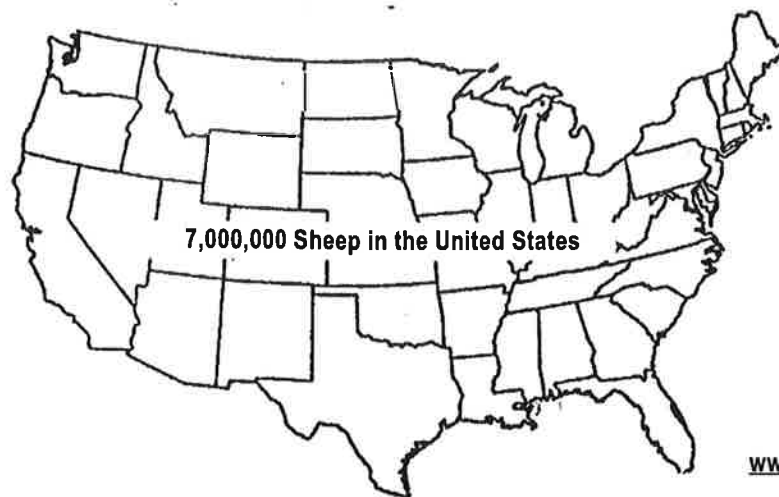
Sheep have been included in nursery rhymes for centuries in countries worldwide. Maybe that's because sheep exist on every continent and can be found in almost every country.

For more than 10,000 years, sheep have played an important role in the lives of people. Sheep provided food and clothing. They were one of the first animals domesticated and have no defenses against predators, other than the sheep producers who care for them.



A female sheep is called a **ewe**. A male sheep is called a **ram**. A baby sheep less than one year old is called a **lamb**, and a neutered male is called a **wether**.

Sheep are raised all over the United States. There are about 7 million sheep in the U.S. Texas has the most at 1.1 million. North Dakota has about 140,000.



Check out
www.sheepusa.org

Sheep Breeds

There are 35 different breeds of sheep in the United States. The most popular breeds are Rambouillet, Columbia, Suffolk and Hampshire. There are 914 different breeds of sheep in the world.

Sheep in the U.S. fall into six categories: meat, fine wool, long wool, dual purpose, hair and minor breeds.

Meat breeds include: Suffolk, Hampshire, Montadale, Southdown, Dorset, North Country Cheviot, Cheviot, Oxford, Shropshire, Texel and Tunis. They grow fast and are muscular.

Fine wool breeds produce high-quality wool: Rambouillet, Delaine-Merino, Debouillet, Booroola Merino and American Cormo.

Long wool breeds produce long-stapled, coarse wool: Border Leicester, Coopworth, Cotswold, Lincoln, Perendale and Romney.

Dual-purpose sheep, bred for meat and wool, include: Columbia, Corriedale, Polypay, Finnsheep, Panama, Romanov and Targhee.

Hair breeds have hair rather than wool: Barbados Blackbelly, Katahdin and St. Croix.

And there are small populations of minor breeds.

History

When seep originated in the mountains of central Asia more than 10,000 years ago, they were large and wild and looked like goats. They had long coarse hair rather than wool. The sheep were tamed and raised to produce hides and milk, but not meat or wool.

By 4000 B.C., the coarse hair had been replaced by soft wool. Sheep then furnished wool for people to weave into cloth to make clothing. Sheep have become important as meat animals only during the past 200 years.

Sheep's tallow or fat was the source of light for 6000 years. Tallow and grease from the wool are still used extensively today in the arts and trades.

Sheep Attributes

Sheep are docile and naturally gregarious, which means they tend to stay together in groups. They have poor eyesight, an excellent sense of smell and hear so well a lead sheep may wear a bell to help guide the flock.

Small and very agile, sheep can climb steep inclines using their split hooves. Sheep belong to the family of hollow-horned ruminants. Sheep breeds that don't have horns are called polled.

Sheep are ruminants, which means they have four stomach compartments and can digest plants that humans and most other animals can't.

Instead of top front teeth, sheep have a dental pad that, with their small flexible lips, allows them to eat vegetation very close to the ground. Sheep eat lush, green grasses, clover and alfalfa, as well as coarser vegetation and weeds other livestock pass by. Sheep will eat 90 out of every 100 kinds of plants grown.

In many areas of the country, sheep are used to graze leftover stalks after crops have been harvested. Sheep also help control weeds in ditch banks, roadsides, pastures and new forest plantings — cutting down the need for chemical herbicide.

While we know about wool and meat, other parts of the sheep, such as bones and hooves, are used as well. Items produced from sheep by-products include:

instrument strings
paint
chewing gum
medicines
creams and lotions
crayons
piano keys

buttons
wallpaper and paste
insulation
nitrogen fertilizer
cosmetics
biodegradable detergents
dice
cellophane wrap
candles

Lambing

Sheep are one of the few animals that can produce young in the spring and in the fall, although most lambs are born in the spring.

Lambs weigh about 10 pounds when they are born. Immediately after the lamb is born, the ewe begins to lick the lamb dry. Soon after, the lamb tries to stand and nurse the ewe. Lambs need to drink the ewe's milk within an hour of being born, or else the lamb may become too weak and not be able to get up on his own. The ewe's first milk, called colostrum, has lots of nutrients and antibodies in it to help the newborn lamb gain strength and stay healthy. Lambs recognize their mothers by her bleat as well as her scent.

Multiple births are common in sheep, often producing twins or triplets. Some breeds of sheep are known for their prolificacy, or multiple births, and give birth to four or five lambs at one time. After 24 hours, lambs will have their tails docked. Docking removes most of the lamb's tail, preventing feces build-up around the sheep's back end.

In about six months, lambs will reach 110 to 120 pounds and are ready to breed or provide food or fiber. An average ewe weighs 150 to 220 pounds while a ram weighs 250 to 300 pounds.

Caring for Sheep

Sheep ranches with more than 1,000 sheep often hire shepherds. Shepherds are men or women who care for the sheep on the range and live alone in a sheep wagon or a tent.

Shepherds and sheep ranches use sheep dogs — working dogs and guarding dogs — to help with the sheep.

Working dogs are very intelligent and help the shepherd herd the sheep. They bark and run around the sheep to make them move in the direction the shepherd wants them to go. Shepherds may have two to three working dogs for every 1,000 sheep. Common working dogs are Border Collies and Australian Shepherds.

Guarding dogs are used to protect the sheep from wild animals such as coyotes, bears and cougars. Guarding dogs prefer to be with sheep and are very protective of them. They stay with the sheep at night and bark to scare wild animals away.

From Fiber to Fabric

Sheep are covered with wool, a soft fiber that keeps them warm in the winter and cool in the summer. The transformation of this fiber to fabric begins at the sheep farm.

Shortly before lambing, the wool, or fleece, is taken off the ewe. Eight to 12 pounds of wool is shorn from each animal.

The wool is bagged and shipped to a warehouse where it is washed to remove dirt, plant matter and grease. The grease is separated from the wash water and purified to produce lanolin, which is used in cosmetics, creams and lotions.

Next, the wool is carded, which means brushing and straightening the wool fibers so they can be spun into yarn. The yarn will be knitted or woven into fabric.

Coarser wool is made into woolen yarn used to make carpet and upholstery. Finer wool, called worsted, is used for lighter fabrics for suits, sweaters and dresses.

Wool is a pure, organic product and is unlike any other fiber in the world. It's naturally durable, resilient and absorbent. It is flame retardant, so it won't burn. It is also static free. However, wool will shrink due to heat, moisture and agitation.

Lamb Production

Australia is the world's largest sheep producer with about 140 million sheep. There are 13 times more sheep in Australia than people.

In the United States, 1.2 pounds of lamb are eaten per year per person, or about four servings of lamb a year. This is the lowest consumption of all red meats.

Our grandparents might talk about eating sheep. During World War I and II, mutton was served to soldiers. Mutton is meat from older ewes. Today, only meat from lamb under one year of age is marketed as meat in the United States.

Lamb is delicious and nutritious to eat. Lamb contains many important vitamins and minerals and is a good source of

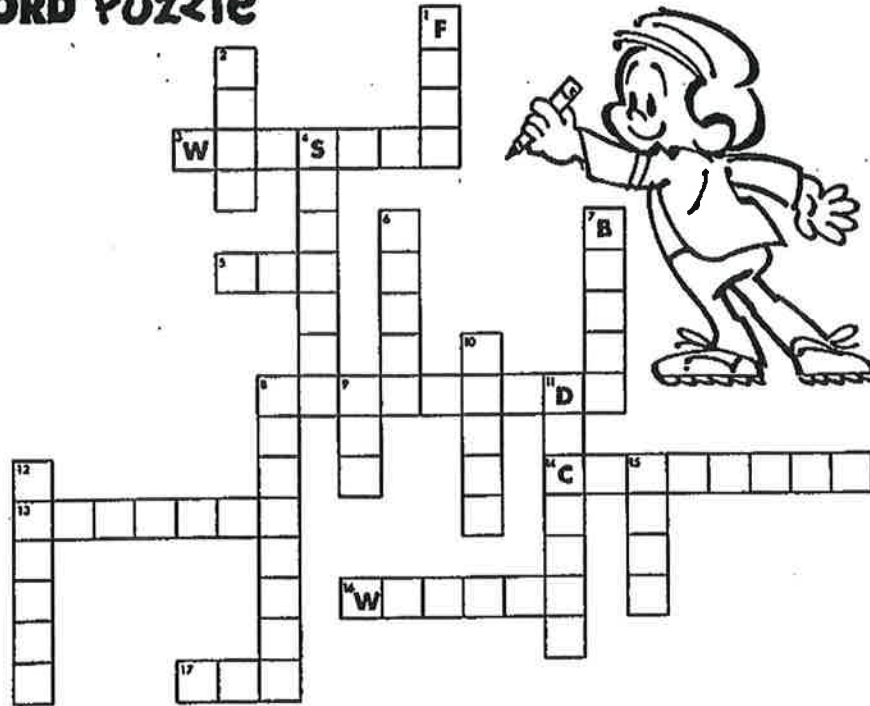
protein. Protein helps build muscles and strong bones, and builds antibodies to keep us healthy. Lamb is a good source of iron and the B-vitamins, which give people energy and aid in bone and tooth development. Also, lamb is a good source of zinc, which helps make hair look healthy and shiny.

Other nutrients found in lamb include phosphorus, magnesium, thiamin, riboflavin and niacin. These help maintain a healthy nervous system, help us grow, give us a good appetite, help the body use energy, aid in protein metabolism and prevent anemia.

Lamb is the most easily digested of all meats. It is recommended by doctors for sufferers of ulcers and various allergies.

Answers: Crossword Puzzle
Across - 3. worsted; 5. ram; 8. shepherds;
 13. protein; 14. Columbia; 16. woolen;
 17. dog
Down - 1. food; 2. wool; 4. stomach; 6. sheep;
 7. bears; 8. spinning; 9. ewe; 10. Texas;
 11. docking; 12. spring; 15. lamb

CROSSWORD Puzzle



ACROSS

3. W_____ yarn is usually used to make lightweight fabrics.
5. A male sheep.
8. These nomadic people care for the sheep.
13. This nutrient builds muscles and strong bones.
14. C_____ sheep are one of the most common breeds in the U.S.
16. W_____ yarn is usually used in carpets or thick sweaters.
17. This animal works or guards the sheep.

DOWN

1. Sheep give us f_____ and fiber.
2. Sheep grow this fiber.
4. Sheep are ruminant animals which means their s_____ has four compartments.
6. This animal has split hooves, no top front teeth and grows wool.
7. Guard dogs protect sheep from coyotes, cougars and b_____.
8. How to turn wool into yarn.
9. A female sheep.
10. This state raises the most sheep in the U.S.
11. D_____ means to cut off the tails of sheep.
12. Most lambs are born during this season.
15. A baby sheep.

Craft Activity

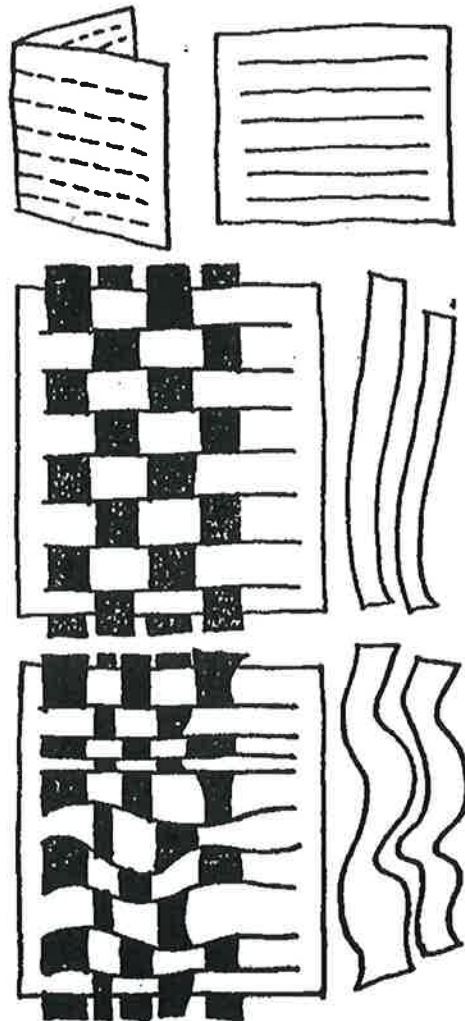
Supplies needed:

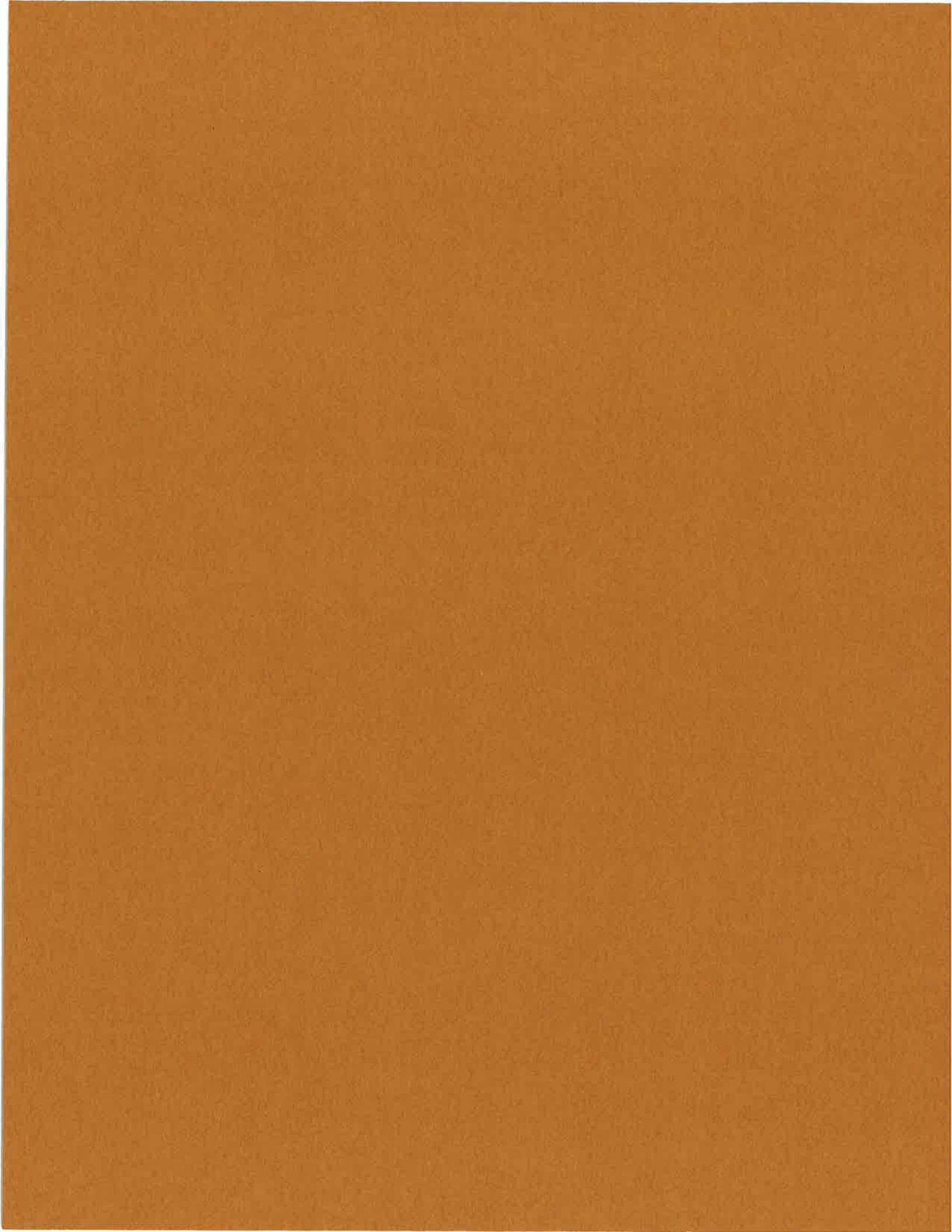
- 1 sheet of white paper
- 3 sheets of different colored paper, cut into strips of varying widths
- scissors
- glue

PAPER Weaving

Paper weaving is a good place to start if you've never tried to weave before.

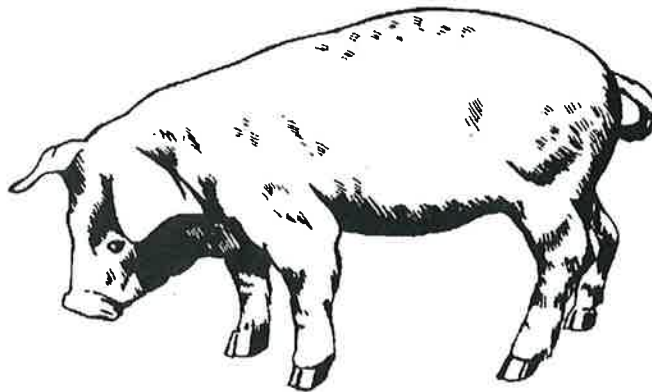
1. Fold a piece of white paper in half and make cuts from the fold out to about 1" from the edge. Open the paper. This will be your "warp."
2. From another piece of paper cut long narrow strips to weave in and out of the warp.
3. To make your weaving more interesting, you can vary the width of the spaces between your warp cuts or make your warp cuts wavy. You can also vary the width and shape of the strips you weave in. Use several different colors of paper.
4. To finish, glue or staple the strips in place along the edges.





PORK

Some 40 million years ago, hog-like animals roamed forests and swamps in what is now Europe and Asia. More recent history indicates that by 4900 BC hogs were domesticated in China, and by 1500 BC were being raised in Europe.



The first pigs arrived in America in 1539 with Hernando de Soto who could be called “the father of the American Pork industry.” He landed at today’s Tampa Bay, Fla., with 13 pigs. Some of the worst attacks on de Soto’s expedition were due to the Indians’ fondness for the taste of pork.

By the time of de Soto’s death, just three years later, his hog herd had grown to 700 head, not including the ones his troops had consumed, one that ran away, and those given to the Indians.

The pork industry in America had begun. The hog population in the early colonies continued to grow, with the typical farmer owning four or five hogs. After the Revolutionary War, pioneers headed west, taking their indispensable hogs with them. A crate filled with young pigs was often hung from the axles of covered wagons.

check out
www.nppc.org

Early in the colonies, pigs were often fed Indian corn. As settlers moved west, more pigs were fed and the need for processing facilities became apparent. Packing plants sprung up in major cities.

Shortly after the Civil War, the first refrigerated railroad car was developed. This allowed fresh meat to be transported, helping the entire nation to enjoy pork. Today the United States is one of the leading pork-producing countries, with the majority of our pork being produced in the midwestern states.

Production

When a mother pig, called a **sow**, gives birth to baby pigs, it's called **farrowing**. From the time of birth, baby pigs are carefully observed and treated to prevent diseases. At three to five weeks they are moved to a nursery. The small pigs are fed a balanced diet including vitamins and minerals. For each pound the small pig gains, it must eat 2.5 pounds of feed. At eight to nine weeks, or at an average weight of 50 pounds, the small pigs are sold as feeder pigs. A feeder pig is raised by a producer who will sell the pigs when they reach market weight. At six months of age the pigs will weigh about 230 pounds. The pigs are now ready to market.

Hundreds of pigs are shipped to processing centers and auction markets around the Midwest. There the pigs are processed so they can be made into food products for human consumption and by-products.

A New Lean Meat

The most important development in the pork industry has been development of a leaner pig. It used to be that the heavier the pig, the better. But in the early 1950s, U.S. pork producers focused on developing a leaner hog that would meet increasing consumer demands for leaner meat products that were relatively low in cholesterol and fat.

Today, improved breeding, better feeding practices, and the efforts of pork producers, have resulted in a market hog 50% leaner than it was in the late 1960s. Pork is also lower in calories than ever before, averaging just 165 calories per 3-ounce serving.

Some popular meat cuts include pork chops, pork roasts, pork ribs and ground pork. All provide protein for important body functions while being low in calories and cholesterol.

Everything But The Oink

Not only is today's pork a source of high-protein meat products, but the by-products from hogs play a vital, though less-visible role in maintaining and improving the quality of human life.

Medicine

Insulin from hogs is used in medicines to treat diabetes.

Hog heart valves are used to replace damaged or diseased human heart valves.

Skin from hogs is used for skin grafts to treat severe burn victims.

Hogs are a source of nearly 40 drugs and pharmaceuticals.

Consumer Products

Leather - Clothing, Shoes, Handbags, Footballs, Upholstery

Glue

Fabric Printing and Dyeing

Fertilizer

Pet Foods

Chalk

Linoleum

Weed Killers and Insecticides

Cement

Floor Waxes

Oils & Polishes

Crayons

And much more...

Answers:

Pork and Nutrition: Vitamins — Thiamin, Niacin, Vitamin B12, Riboflavin

Minerals Phosphorus, Iron, Potassium, Calcium

Match The Nutrients: A. B vitamins; B. Protein; C. Zinc; D. Iron

Poem: speed, play, lots, get, pork, for us

Puzzling Pig Pointers: 1-A; 2-P; 3-D; 4-Q; 5-H; 6-R; 7-K; 8-B; 9-O; 10-G;

11-C; 12-N; 13-L; 14-E; 15-F; 16-M; 17-J; 18-I

Piggy Puzzler: Across — 2. Bacon; 3. Lean; 6. Pork Chops; 8. Wart; 9. Piglet;

10. Market; 11. Pen; 12. Feeder

Down — 1. Pork; 2. Boar; 3. Lamps; 4. Litter; 5. Bone; 7. Ham; 8. Water

Pork and Nutrition

Pork provides us with many nutrients that are needed by the body. Without these nutrients, our body cannot function properly. One 3-ounce (90g) serving of pork can provide half of our daily protein needs and a good portion of the B vitamins — especially Thiamin. Pork is a leading food source of Thiamin.

All of these nutrients are found in pork. Circle the ones that are vitamins and underline the ones that are minerals.

Thiamin Phosphorous Iron Niacin Vitamin B12
Potassium Riboflavin Calcium

Match the nutrient on the left with its correct function on the right.

- | | |
|------------|---|
| Protein | a) Maintains normal nervous system. Maintains healthy skin and eyes. Releases energy to body cells during metabolism. |
| B vitamins | b) Builds and repairs tissues. Builds antibodies to fight infection. |
| Iron | c) Builds new cells for growth. Helps body release energy. |
| Zinc | d) An important part of the blood. Without it, we feel tired. |

Now try this poem

Pork provides protein — which is what you need

For growth and health and super _____.

Look good, feel good, as you _____

Eat your vitamins every day.

For healthy blood and _____ of pep

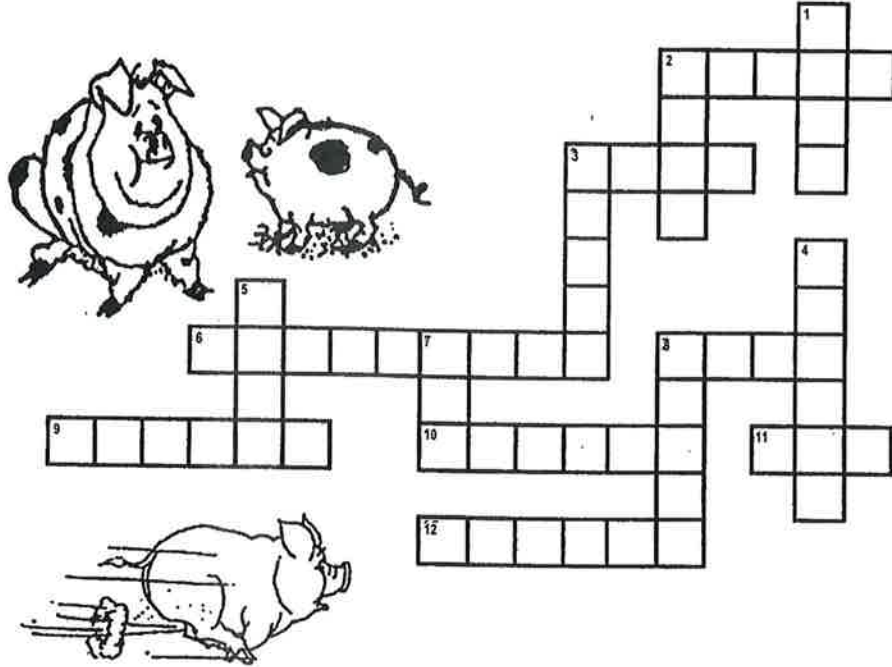
Iron from pork is what you _____.

Our bodies need zinc for energy plus

So we eat _____, it's good _____.

for us
play
pork
lots
speed
get

PIGGY PUZZLER



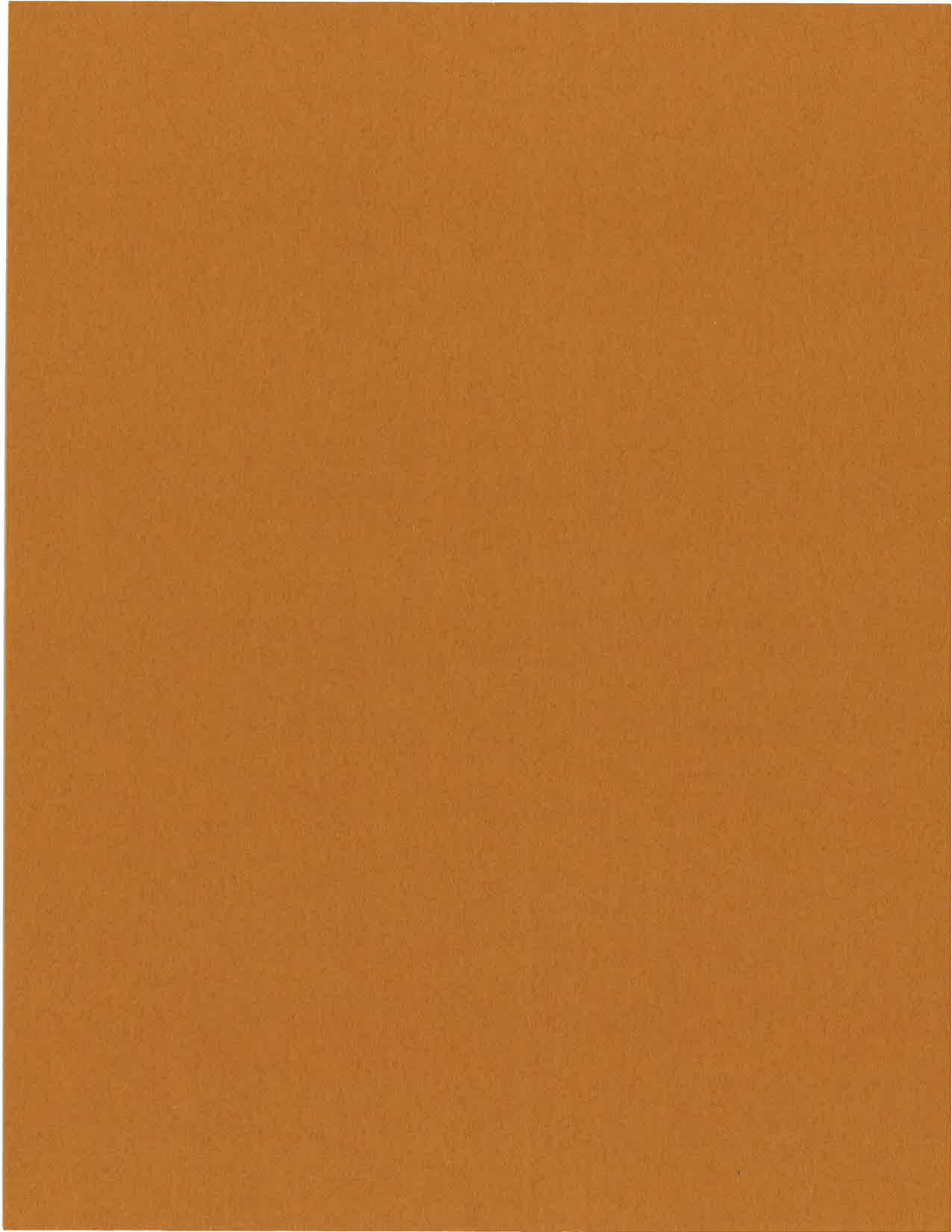
- | | | | | | |
|------------|--------|--------|--------|--------|-------|
| bacon | boar | bone | feeder | ham | lamps |
| lean | litter | market | pen | piglet | pork |
| pork chops | wart | water | | | |

Across

2. Smoked pork for breakfast.
3. With little fat.
6. Popular pork for grilling.
8. Name of a wild hog.
9. Name of a baby pig.
10. Where pigs are sold.
11. Where pigs live.
12. Place to put pig feed.

Down

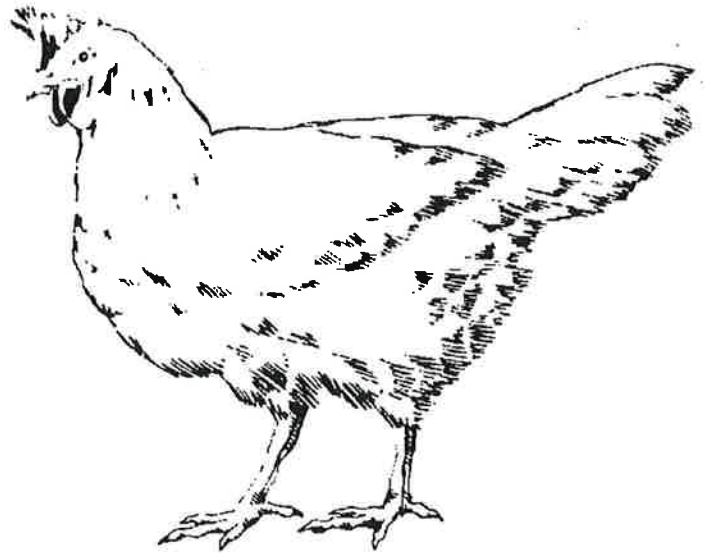
1. Meat that comes from a pig.
2. A male pig.
3. Lights used for heat.
4. A name for a group of baby pigs born at the same time.
5. Something that dogs chew.
7. Smoked meat from a pork leg
8. What pigs drink.



POULTRY

Poultry production in North Dakota includes chickens, turkeys and some wild birds like pheasants. Chickens and turkeys begin as fertilized eggs on the breeder farm. The eggs are shipped to the hatchery where they are sorted onto trays and placed in a special machine called an incubator. This machine controls the temperature and humidity of the egg and turns the egg at regular intervals. In 21 days a chicken will hatch. In 28 days, a turkey will hatch.

After hatching, the chicks or poults (baby turkeys) journey to their home on a special farm. To live to maturity, the chicks' living facilities must be clean and disease free, and proper temperature, humidity and light conditions must be maintained. The chicks also require a properly balanced diet and must have plenty of fresh water. Turkeys and chickens are very efficient meat producers because they require only about 2 to 2-1/2 pounds of feed per day to produce an average-sized bird.



Egg Production

For egg production only, the female chicks are grown. For the first 20 weeks after hatching, a female chick is called a "pullet." During this time the body develops and grows larger until she is an adult bird; now she is mature enough to lay eggs. She is called a hen. The average laying hen will produce about 260 eggs in one year! The white of an egg is called albumen, and the yellow of the egg is called the yolk.

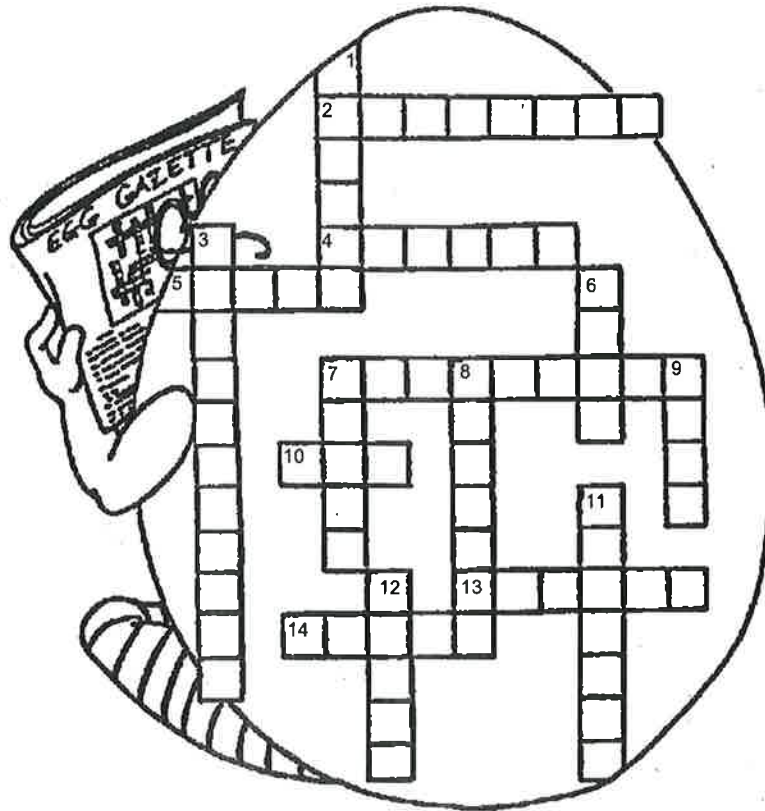
How are eggs used as food products?
Did you know eggs are also used in cosmetics and shampoo?

8. Albumen; 9. Duck; 11. Ostrich; 12. Dozen
Down: 1. Boiled; 5. French Toast; 6. Yolk; 7. Shell;

Across: 2. Omelette; 3. Eggnog; 4. Fried; 7. Scrambled; 8. Hen; 12. Brown; 13. Easter

Answers: Egg Crossword

Egg Crossword

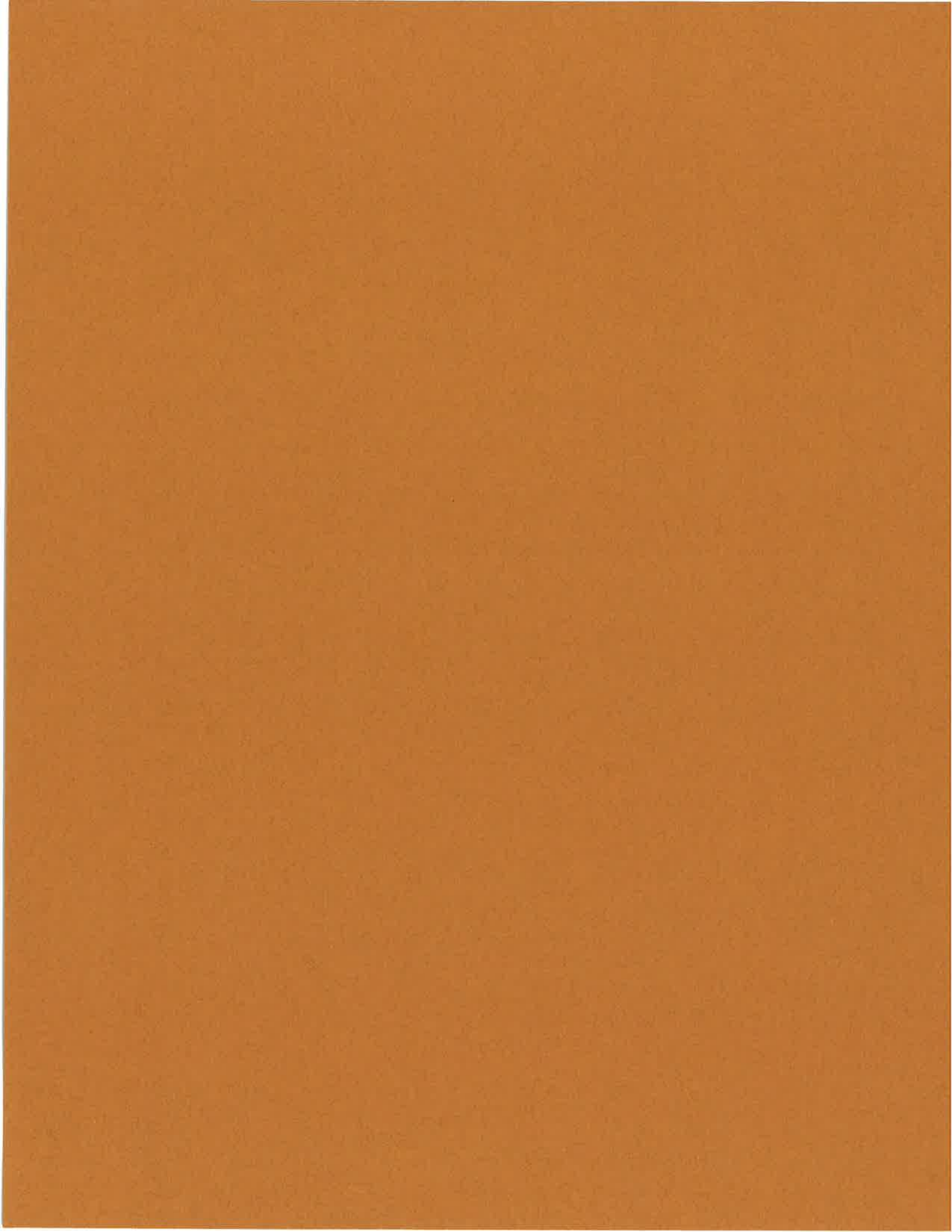


Across

2. Egg dish with lots of ingredients.
4. A drink with milk and eggs.
5. _____ eggs and hash browns.
7. Mixed up cooked eggs.
10. Lays eggs.
13. A holiday that features eggs.
14. Color of shell can be _____ or white.

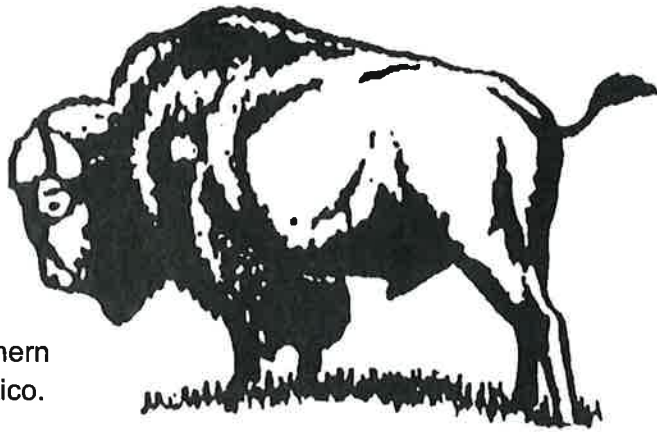
Down

1. Egg in shell cooked in hot water.
3. Bread dipped in egg and fried (two words).
6. Yellow inside of an egg.
7. Outer coating of an egg.
8. The white of an egg.
9. Says quack and lays eggs.
11. Lays the largest bird egg.
12. Word for 12 eggs.



AMERICAN BISON

The American bison, or buffalo, is a real survivor. While most cattle and other animals are not native to our state, bison once roamed this area in great numbers. It is estimated as many as 200 million of these mammals grazed the lush plains grasses that stretched from the northern forests of Canada to the Gulf of Mexico. They were the most populous game species known to man. The plains Indians used the bison to meet many of their needs, but most importantly as a primary source of food and clothing. However, when European settlers arrived in the West, they used their guns to hunt the bison, dramatically reducing their numbers. Fortunately, a few hundred bison were saved by ranchers and the National Park system. These people have rebuilt the herds to a total of more than 350,000 today. In North Dakota, the bison have become a part of production agriculture, with a bison processing plant near Rockford, N.D. The bison is well-suited for North Dakota's land and our climate. Bison graze on pasture land, even when the grass is covered with snow. They can dig as deep as four feet into the snow to feed. They have a hairy outer coat that keeps them warm in sub-zero



temperatures. Because of the bison's ability to digest low-quality feed, it is well suited to feed on marginal range lands.

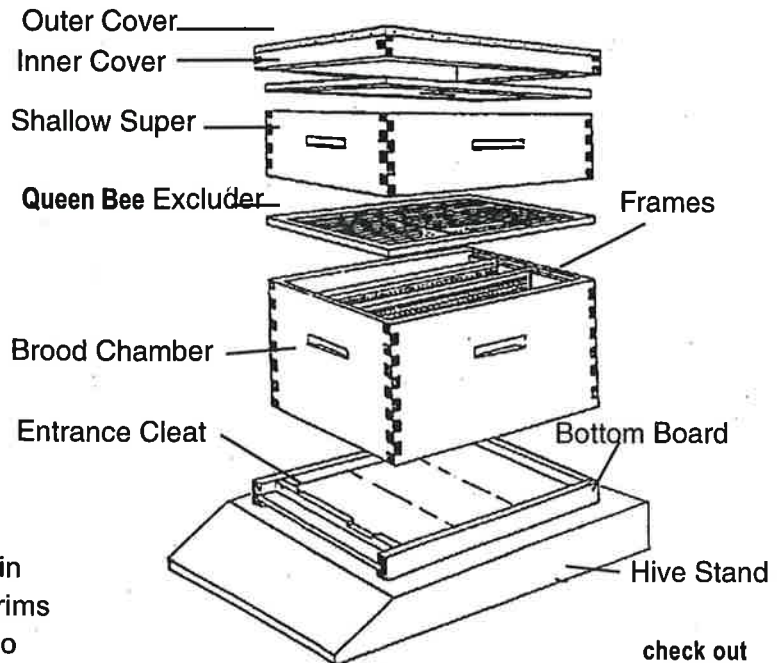
Although bison have been around for a long time, they are new to America's diet. The demand for buffalo meat is increasing primarily because consumers enjoy the taste and have learned it contains less fat than beef or pork. Buffalo meat is lower in cholesterol, higher in protein, and contains fewer calories than other meats. And, buffalo meat is gaining in popularity worldwide, especially in European and Asian countries. This would mean that massive herds of buffalo, grazing on the prairie, could once again become a common sight.

HONEY BEES

The little honey bee has a triple job to do — pollinating crops, creating honey and even producing wax. In ancient times, humans learned to follow bees to their hives, calm the bees with smoke from their torches, and take the honey from the hives. Eventually man started bee keeping around 2500 B.C. Ancient Egyptians kept bees in mud and clay hives. The Pilgrims brought the first honey bees to North America in the 1600s and by the 1850s honey bees had found their way to California.

North Dakota Honey Facts

North Dakota is one of the top honey-producing states in the U.S., producing nearly 25 million pounds of honey each year. More than 300,000 colonies of honey bees, managed by about 200 beekeepers in North Dakota, produce top-quality honeys and support crop pollination. Some of the state's major crops that produce honey and benefit from pollination are alfalfa, sweet clover, sunflowers, canola, safflower and buckwheat.



check out
www.honey.com

Hives

Honey bees live in large groups of 30,000 to 60,000 bees called colonies. Each colony occupies its own nest or hive. Wild honey bees usually build hives in hollow trees or other sheltered places.

In 1852, a teacher and part-time beekeeper invented the movable-frame hive. These modern hives are made of wooden sections stacked on each other. Each section, or super, holds 8 to 10 wooden frames, each with a thin wax foundation on which the bees build their combs. Honey is stored in combs in the upper part of the hive. When the combs are filled and covered with wax caps, the beekeeper takes away the combs to extract the honey.

Pollination

Plant flowers contain a plant's reproduction components, including nectar and pollen. When a bee feeds on a flower's **nectar**, pollen from the flower sticks to the bee. As the bee flies to and feeds on another flower, that pollen transfers to the other flower. This pollen fertilizes the plant, making it able to produce seed for more plants. Or, for many crops, the seed is harvested and used for human and animal food.

Different insects are attracted to different types of flowers, depending on the flowers' color, scent and size. Bees usually prefer blue, purple and yellow flowers that have a sweet scent. Butterflies, moths, birds, bats, wind and rain can also transfer pollen among plants.

About one-third of the total human diet is derived directly or indirectly from insect-pollinated plants. An estimated 80% of insect crop pollination is by honey bees. Honey bees are needed to pollinate a variety of fruits, berries, vegetables, tree nuts, oil seeds and legumes. One study estimated the value of honey bee pollination, due to increased crop yields and quality, is more than \$14 billion each year.

Honey

Honey is the only food eaten by humans that is made by insects. Honey is produced by honey bees from the nectar of flowers. Worker bees transform the nectar they gather from flowers into honey by adding enzymes and reducing the moisture (water). They store the honey in the wax cells of the honeycomb in the hive.

Honey is a rich source of fructose and glucose with maltose, sucrose and other complex carbohydrates. Honey is about 17% water, and contains small amounts of vitamins, minerals, amino acids and antioxidants (which help delay damage to our body's cells and tissues). Throughout history, people used honey for healing and as a sweetener.

Honey is sweeter than table sugar. Although its taste and color will vary depending on what type of flower (plant) the bees have visited. Nearly colorless honey usually has a mild flavor and darker honey usually has a stronger flavor.

We can buy honey as comb honey — still in the cells of the wax comb in which it was produced — as a liquid that has been extracted from the honeycomb, or whipped so it can be spread like butter.

Beeswax

Bees secrete **beeswax** from their abdomens. They chew it to make it pliable then use it to build wax combs within their hives. Combs are built vertically, side by side. Each comb is made up of thousands of six-sided cells that are used to store honey and pollen, the powder bees pick up from plant flowers and as nurseries for developing bees. Beekeepers sell beeswax for various purposes.

Beekeeping

Honey bees have remained unchanged for 20 million years while the world and its plants and animals changed around them. Humans learned to follow bees to their hives, calm the bees with smoke and take the honey from the hives. Eventually man learned to work with the bees and started bee keeping around 2500 B.C. Beginning in the 1850s, with the movable-frame hive, the honey business boomed.

Many agricultural products can be harmed by heat waves or freezing weather, but for bees, honey thieves such as bears and skunks also threaten their production. Beekeepers keep hives protected from extreme weather and hungry animals and make sure the hives are near flowers and water.

There are about 140,000 to 210,000 beekeepers in the United States. Most are hobbyists who managed fewer than 25 hives. An estimated 1,600 are commercial beekeepers who manage more than 300 colonies each. About one half of commercial beekeepers are migratory who rent their bees to farmers, following the pollination seasons of various crops throughout the U.S. In North Dakota, most hives are shipped to warmer climates to winter.

Answers:
 Honey Word Scramble - 1. Beeswax; 2. Colony; 3. Nectar; 4. Queen Bee; 5. Hive
 Bee Math - 1. 49,800 Miles; 2. 249,000 Miles; 3. 80,000 Bee Hours; 4. 960,000 Bee Hours; 5. 462 Trips;
 6. 7,392 Trips; 7. 576 Bees; 8. 960 Calories

Honey World Scramble

Identify the five beekeeping words scrambled below:

- 1) exabews _____
- 2) nlocoy _____
- 3) carten _____
- 4) uqene eeb _____
- 5) eihv _____



Bee Math

1. To gather one pound of honey bees must travel a distance equal to at least two times around the world. How many miles will it travel? (Hint: Equator = 24,900 miles)
2. Using the information from problem one, figure out how many miles the bees must travel to make five pounds of honey.
3. It takes 160,000 bee hours to produce one pound of pure ripened honey. How many hours would it take to make 1/2 pound of honey?
4. Using the information in problem three, figure out how many hours it would take to make six pounds of honey.
5. Honey bees must make approximately 154 trips to and from their hive to produce a teaspoon of honey. How many trips would it take to make a tablespoon of honey? (Hint: Three teaspoons = one tablespoon)
6. Using the information given in problem five, figure out how many trips the honey bees would make to and from their hive to make one cup of honey. (Hint: Sixteen tablespoons = one cup)
7. A worker bee can only make 1/12 teaspoon of honey in it's lifetime. How many bees does it take to make a cup of honey? (Hint: There are 48 teaspoons in a cup)
8. 1 tablespoon of honey has 60 calories. How many calories are there in a cup jar of honey? (Hint: A cup has 16 tablespoons)

Additional resources available from:

www.suebee.com

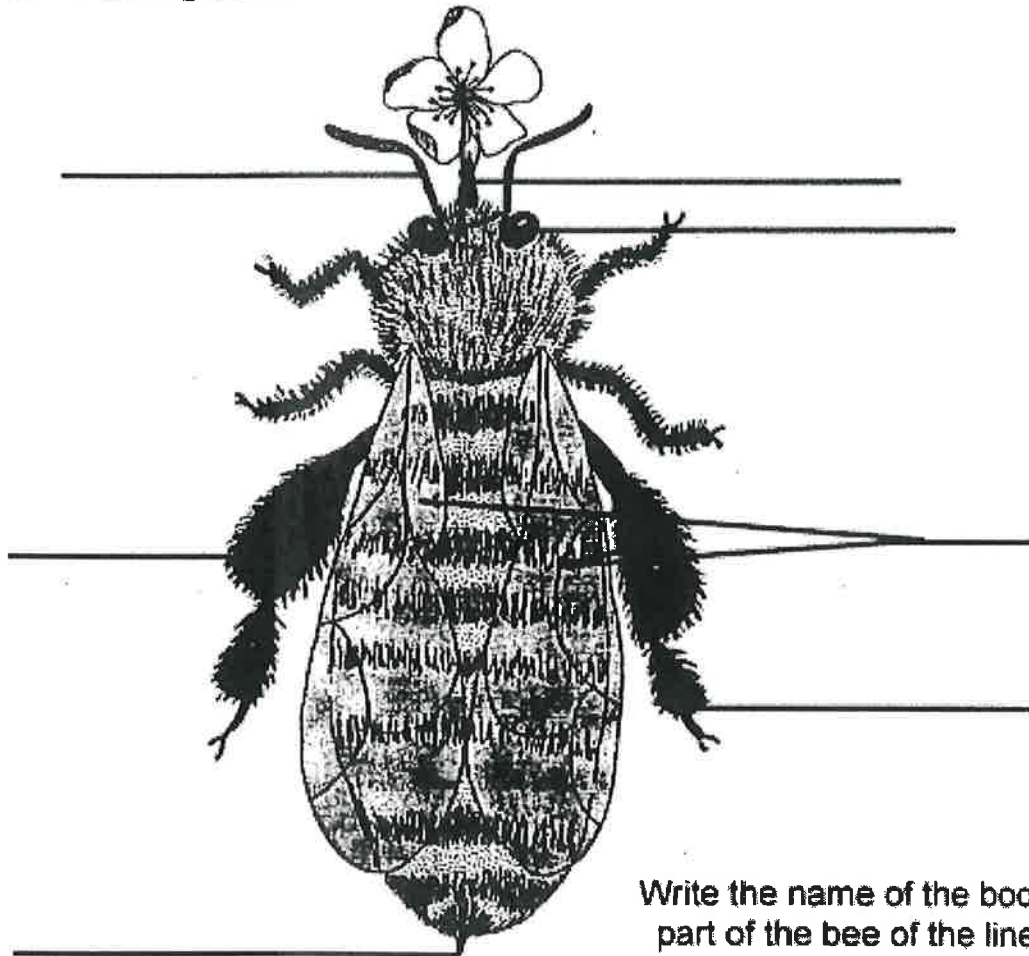
www.pbs.org/wgbh/nova/bees

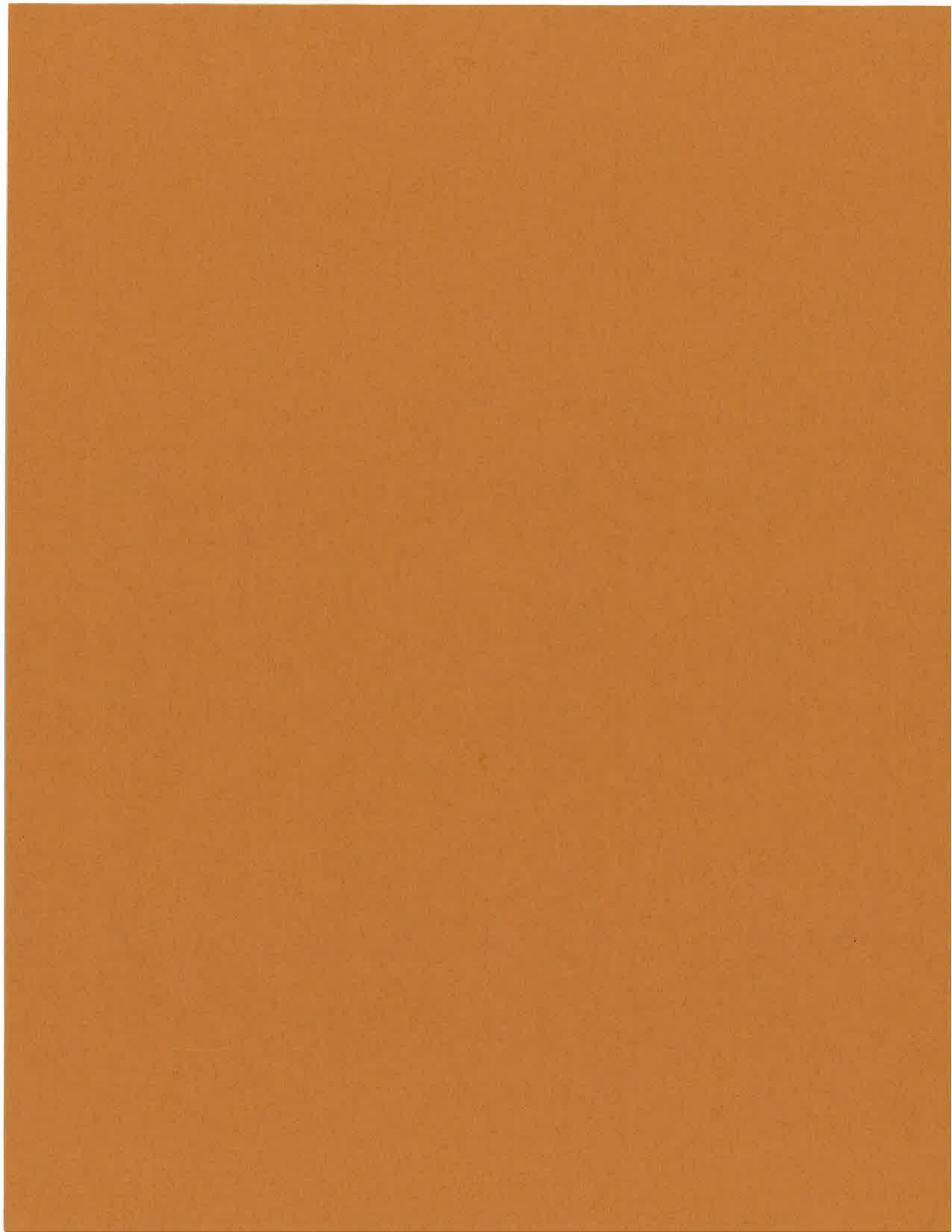
www.honeylocator.com

www.gears.tucson.ars.ag/gov

www.glorybeefoods.comwww.usda.gov/nass

Build a Busy Bee





SOIL

And What's In it

North Dakota's prairie land was formed more than 10,000 years ago by gigantic sheets of traveling ice called glaciers. Slowly, these ice-cold giants crushed large boulders into smaller rocks, which were then further worn down or eroded by wind, rain, heat and cold. These smaller particles became the basic material that forms our soil.

Soil Composition

Soil is made up of minerals, organic matter, air and water. This is a living combination and the beginning of the food chain.

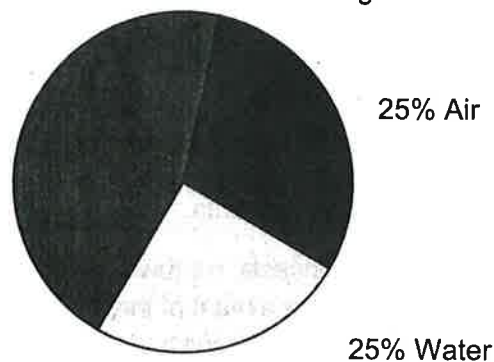
Mineral Matter

Mineral matter makes up 45% of the soil and is composed of particles of sand, silt and clay. Sandy soil particles are loosely packed together and lose water rapidly. With the loss of water is the washing away of important nutrients such as nitrogen, a chemical that plants need to grow. Silt particles are packed tightly and drain poorly. If dry, clay crumbles and cracks.

Crops thrive best in loamy soil, a combination of all the different sized particles. This soil holds water and nutrients well, yet drains properly.

Soil is:

45% Mineral Matter 5% Organic Matter



Water

Healthy soil contains tiny pockets of water that aid in plant growth by dissolving and carrying nutrients to be absorbed by the plant's roots as food. Water makes up 25% of the soil and is essential for photosynthesis and respiration or breathing.

Air

Air pockets make up 25% of soil volume. These spaces allow roots to breathe and help the decay of organic matter. Air pockets become homes to tiny organisms, small insects and animals.

check out

www.cass.nd.nacdnet.org

Organic Matter

The smallest part of our soil is decaying plants and animals called humus. This humus, or organic matter, makes up just 5% of most soil. However, this organic matter plays a very important part.

Have you heard of rich soil? This is soil with a lot of organic matter. The more organic matter in the soil, the darker and richer it is. This rich soil provides many needed nutrients for plants.

Tiny organisms, insects, earthworms and small animals make a meal of the organic matter. Now the soil has two links in the food chain: plants and animals.

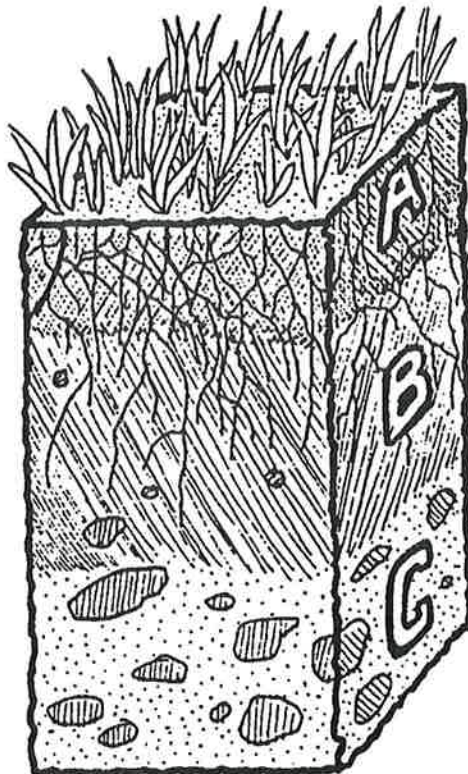
The Soil Profile Tells a Story

Perhaps when you were planting a tree in your yard or digging in the garden, you noticed layers of light and dark colored soil. These layers are called the soil profile and they tell a story of the life of the soil.

The top layer (A), called the topsoil, is usually the darkest. This is where most of the organic matter is found. No wonder earthworms like to make this their home; it's full of nutritious organic matter.

The next layer (B), called the subsoil, is lighter in color than topsoil since it contains less organic matter. Plants do not grow well in this soil since it has less air.

The bottom layer (C) has an orangeish or yellowish color. This layer has more rocks and pebbles, and the least amount of living and once-living things.



Soil Erosion and Conservation

North Dakota has an abundance of wind in its central plains climate. If a strong wind blows across a bare, dry field, then soil erosion will occur. The topsoil, with all its nutrients, can blow away and expose the middle layer of soil.

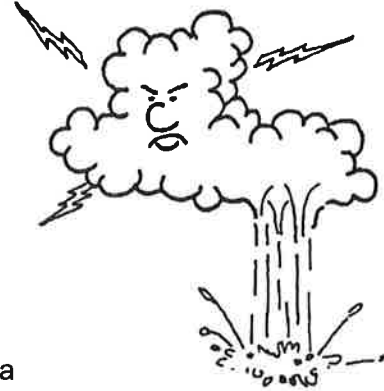


To prevent soil erosion, the farmer can alter the environment by planting shelterbelts. Shelterbelts are rows of trees correctly placed in rows that break the wind's force before it hits the field. Covering the soil is another means of preventing wind erosion. Grass, straw or the stubble left standing in a field are all ways of conserving the soil.

Water erosion also takes place in North Dakota on hilly or uneven fields. Water erosion washes away the soil either by splash erosion or sheet erosion.

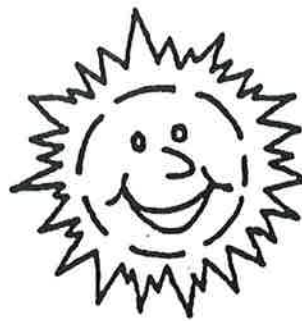
When raindrops hit the earth, they splash or explode like tiny water balloons. This splash erosion is the first stage of water erosion. The second stage occurs when rain has been falling for some time. The raindrops begin

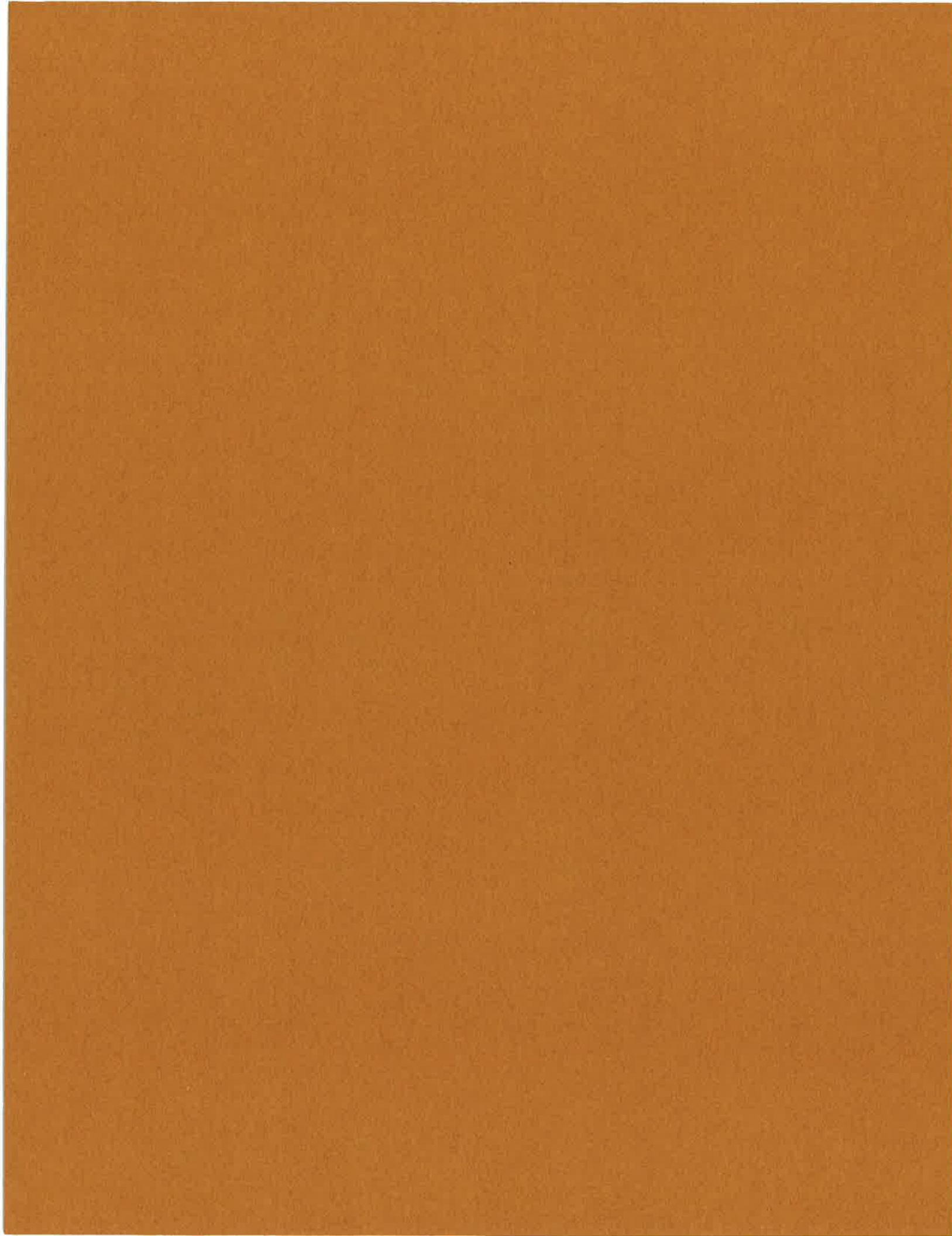
forming tiny rivers called rills, and they rush downhill. Sheet erosion is a thin layer of water washing the topsoil downhill. With the removal of the topsoil, plants and other crops have a hard time growing, so further erosion by wind and water is likely to occur.



Farmers cover their soil to protect it from water erosion. They sometimes plant rows of crops on hills from side to side rather than up and down to help catch the running water rather than allowing it to race downhill and take topsoil with it.

These are just a few of the methods farmers use to protect the soil. This is known as soil conservation.





FARMING in Your Backyard



Even though North Dakota is not a major producer of fruits and vegetables, many people have gardens during the summer months. They grow fruit and vegetables for their own consumption (eating) and preserve the excess to eat during the winter.

Garden List

Name some garden vegetables.

Place an X beside your favorite vegetables.

Gardens can also be a source of income. When a garden produces more than a family can eat, they may make money by selling some of the vegetables to people who may not have the time or space to have a garden.

You may have seen farmer's markets. There are many in North Dakota. At the farmer's markets, growers set up tables or small booths to display their products. The produce sold at these markets is fresh from the garden and tastes great!

Understanding a garden is a good way to understand production agriculture. There are many different plants in a garden, each producing a different type of fruit or vegetable. We don't eat the same part of every plant.

Farmers and gardeners plan their production areas carefully. Certain plants grow better in specific conditions. Sunlight, the type of soil, and moisture are important to farmers and gardeners.

Answers:
fruit

- Plant - 1. Carrot, F; 2. Cucumber, D; 3. Peas, E;
4. Rhubarb, C; 5. Lettuce, B; 6. Broccoli, A;
7. Asparagus, C; 8. Turnip, F; 9. Corn, E;
10. Cauliflower, A; 11. Spinach, B

Root Watch

We can learn a lot about plants by observing their roots. Do they grow deep or shallow? Are they small or large? Do they spread out?

This root watch activity can be done in your classroom. It gives students a “worm’s eye view” of what a plant looks like under the surface.

Overview: After imagining a “worm’s eye view,” students discover similarities and differences among the emerging roots of different plants.

Time: Laying the Groundwork: 30 min.
Observing: 45 min.
then 2 to 3 weeks
Making Connections and
Branching Out: 30 min.

Materials:

radish, corn, pea and wheat seeds
additional seeds of various plants
brown paper towels potting mix
clear plastic cups plastic bags

Laying the Groundwork

Objective: To examine students’ ideas about what plant roots look like underground.

1. Take students through an imagery exercise in which they experience the soil from a “worm’s eye view.”

“You are an earthworm on a journey under the soil. Close your eyes and imagine you’ve turned on a light switch underground. What kinds of things do you see all around you? Watch out, you’re heading right into a carrot bed! You are surrounded by plant roots. How does it make you feel to wiggle your way around these gigantic roots? What do they look like? It’s hard moving in and out of all these giant carrots.

You tunnel down, down, down. As you go deeper in the soil, the tips of the carrots get smaller and smaller. Now you’re underneath the carrot roots and you find it easier to move around. Because you are strong enough to move 40 times your own weight, you push the smaller roots out of your way. Push! There are lots of roots to squeeze past.

Soon you find your way through the roots and pass out of the garden, under a sidewalk. What does it look like? There’s a patch of weeds between the cracks of the sidewalk. What do you see? What do the plant parts look like here? How does it feel underground? How does it smell?”

2. When the guided imagery is complete, have students open their eyes and draw their underground visions. Ask how their pictures are similar or different. What kind of plant roots did each draw?

Observing

Objective: To observe early root development in different plants

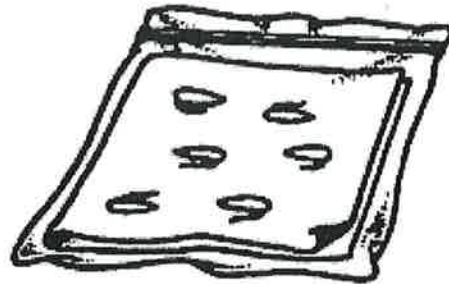
1. Place four seeds (one each of radish, peas, corn and wheat) against the inside wall of a clear plastic cup. Lay a brown paper towel inside over the seeds and fit another cup inside it to hold the seeds and towel in place. Keep the towel moist. Keep in darkness until seeds have sprouted. Set up two more cups with other plant seeds. (You may have seeds at home; use your imagination.)



Plant four seeds against the sides of a cup filled with moist potting mix. Keep in darkness until they have germinated.



Set some seeds on a moist paper towel in a plastic bag. Keep seeds in darkness until they have germinated.



2. During the next 2 to 3 weeks, have students observe root development and record drawings in a journal.
3. Discussion questions:
 - How long did it take for the roots to sprout from the seeds?
 - How did you know what was the root?
 - In what ways were the roots of each plant the same? Different?
 - Which plants' roots were thicker or longer, or had more branches?
 - Which direction did the roots grow?
 - Was the direction always the same?
 - Which roots grew faster than others?
 - Did any reach the bottom of the container? What did they do then?

Making Connections

How are the real roots like the ones you drew after pretending to be an earthworm?

After observing different plant roots, what ideas do you have about how roots help plants?

What kinds of roots do we eat? Can you think of other uses we have for roots?

What types of patterns are made by the roots? What other things in nature have a pattern of smaller and smaller branches (rivers, tree branches, human arteries)? What seems to be special about branching patterns?

Branching Out

Try to find root hairs, using hand magnifying lenses. Discuss how you think root hairs might help the roots do their job.

Carefully dig up some plants outside, such as dandelions and grass. Compare their root systems. Discuss what you notice about how roots affect soil.

Plant the top of a carrot to discover whether a new plant can be started from a piece of root.

Create a larger-than-life diorama of an underground scene, including worms, roots, soil and seeds.

Parts of a Plant

This is a tomato plant. The part of the tomato we eat is the _____.

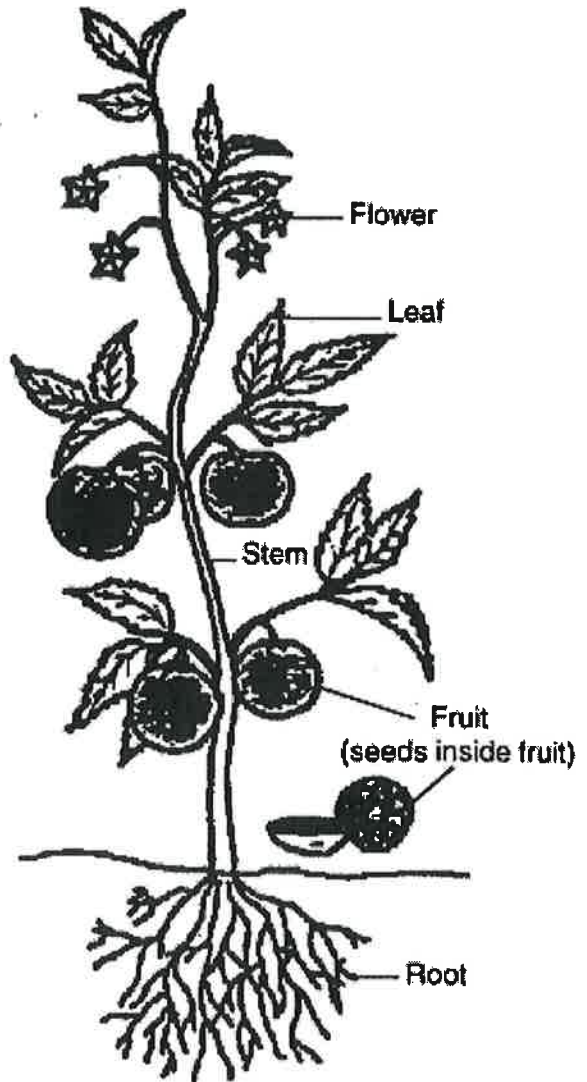
We eat different parts of different plants. Match the following plants with the part we usually eat.

Parts

- A. Flower
- B. Leaf
- C. Stem
- D. Fruit
- E. Seeds
- F. Root

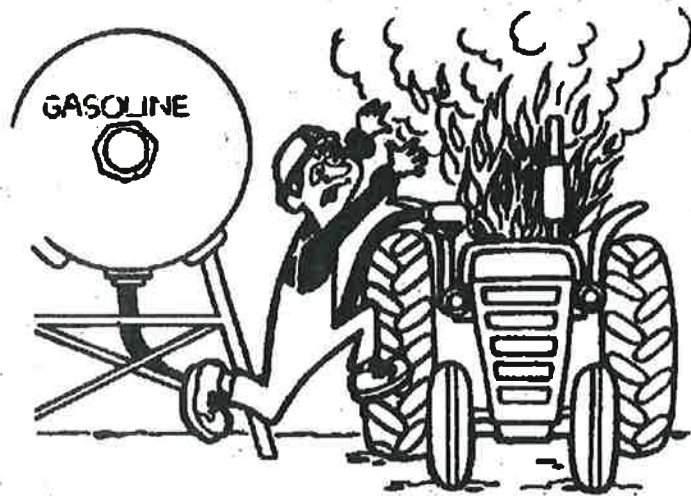
Plant

- 1. Carrot _____
- 2. Cucumber _____
- 3. Peas _____
- 4. Rhubarb _____
- 5. Lettuce _____
- 6. Broccoli _____
- 7. Asparagus _____
- 8. Turnip _____
- 9. Corn _____
- 10. Cauliflower _____
- 11. Spinach _____



FARM SAFETY

Safety at the workplace is important no matter what you do, and farming and ranching can be especially dangerous. Farmers and ranchers often work long hours, and often work with and around powerful machinery, big animals, or dangerous power sources. Agriculture is one of the country's most dangerous occupations. But farmers and ranchers, and anyone visiting a farm, should take proper safety precautions to reduce the risks.



A farm is a work place. A farmer cannot afford to be distracted when working with powerful equipment. That is when injuries or deaths occur.

Every year in the United States about 100 kids are killed on the farm. We want you to know about safety and dangerous areas when you are on a farm so you will enjoy the farm.

During the '90s the North Dakota Department of Health collected statistics on farm injuries and deaths in the state. School-age youth living on or visiting North Dakota farms were injured mostly by animals and agricultural machinery. During that time 16 young people (between the ages of 3 to 14) died due to farm-related incidents.

check out

www.ndfb.org www.fs4jk.org

(North Dakota Farm Bureau
and Farm Safety 4 Just Kids)

Farm Machinery Safety

Many farm deaths and injuries involve farm equipment. Farm machines help farmers get their work done, but they are very dangerous if not used properly — if the necessary safety precautions are not followed. About a third of farm injury victims are persons who are under age 20 who get in the way of a moving tractor, or who are riding machinery and fall off, or they are driving a tractor but are too young and inexperienced to operate it safely.

Farm Animal Safety

Being fond of and dependent on animals, we don't like to view them as potentially dangerous. But animals can cause injury so we have to treat them with caution. They may not purposely hurt you, but their size and bulk make them potentially dangerous.

To avoid accidents, always:

Avoid quick movements or loud noises that could frighten the animals. Cattle and hogs are very sensitive to noise.

Avoid poking, patting, teasing or imitating the sound the animals makes.

Beware of standing behind the rear legs. Livestock tend to kick forward, then back.

In a gentle voice, call out to announce your presence before getting close to an animal to avoid startling it.

Move slowly and deliberately around livestock. Cattle can see nearly behind them without moving their heads, so a quick movement from behind is just as likely to frighten them as a movement from the front.

Do not get close enough to livestock so that they might step on, or kick you.

Never prod or poke an animal when it has no where to go.

Most animals tend to be aggressive when protecting their young. Be extra careful around newborn animals.

Gently touch animals rather than shoving or bumping them.

Stay clear of animals that are frightened or spooked. When startled, they can easily injure to anyone in their way.

Activities

- 1) Discuss safety precautions around strange animals. Using a traffic light example, discuss when to use red, yellow and green.
- 2) Discuss what safety precautions should be taken around animals.
- 3) Observe what precautions an exhibitor or handler takes with his or her animals.

On the Farm

Look at the picture on the last page and write a story about what is happening on the farm. Include items or activities that may or may not be safe. Use the slogans to describe the picture.

Farm Safety Slogans

One of the biggest hazards for children your age is the tractor. Being an extra rider on any tractor is dangerous, even if the tractor has a cab. You could be injured or killed by falling from the tractor and being run over. The back end of a pickup truck is intended for cargo, not people. We know that riding inside a vehicle with a safety belt provides the safest ride possible. Ride inside the vehicle's passenger area, not in the cargo area.

No Seat, No Rider!

The power-take-off, or PTO, is the shaft that helps make the equipment work that is pulled behind a tractor. The PTO rotates (turns) at least nine times per second. It moves so fast that you could not get out of the way to save yourself if you or your clothing got caught in the PTO. When you are at a farm, ask an adult to show you what a PTO looks like.

Kids, Don't go near a PTO!

Grain that is moving or standing still can be very dangerous. When you are at a farm, you must stay away from grain bins, grain trucks and gravity flow wagons. If you are at a farm, playing or standing in grain that starts to flow, you could be trapped in just 3 to 4 seconds. Don't take chances. Never play in grain. It's not a big sandbox.

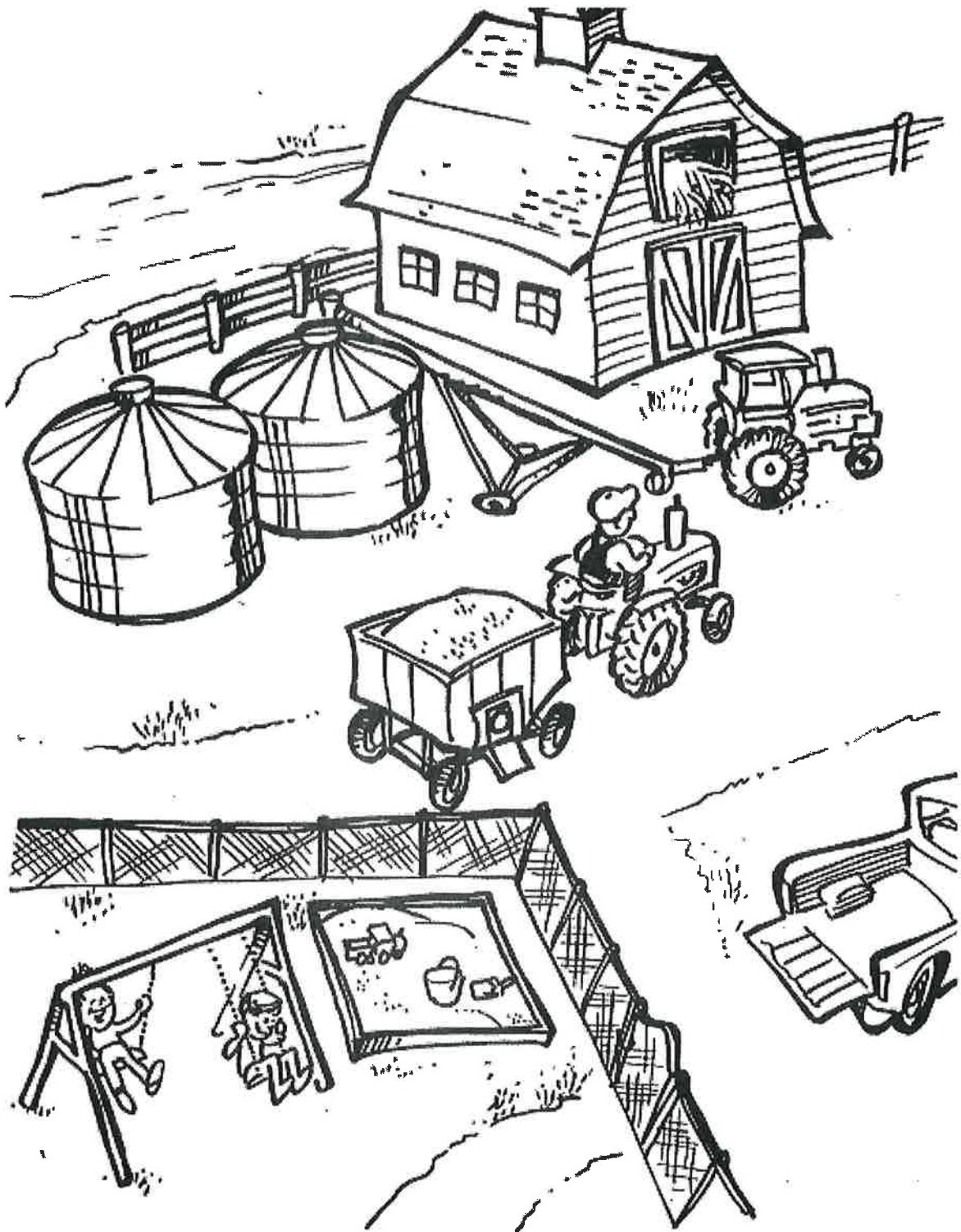
Don't go with the flow!

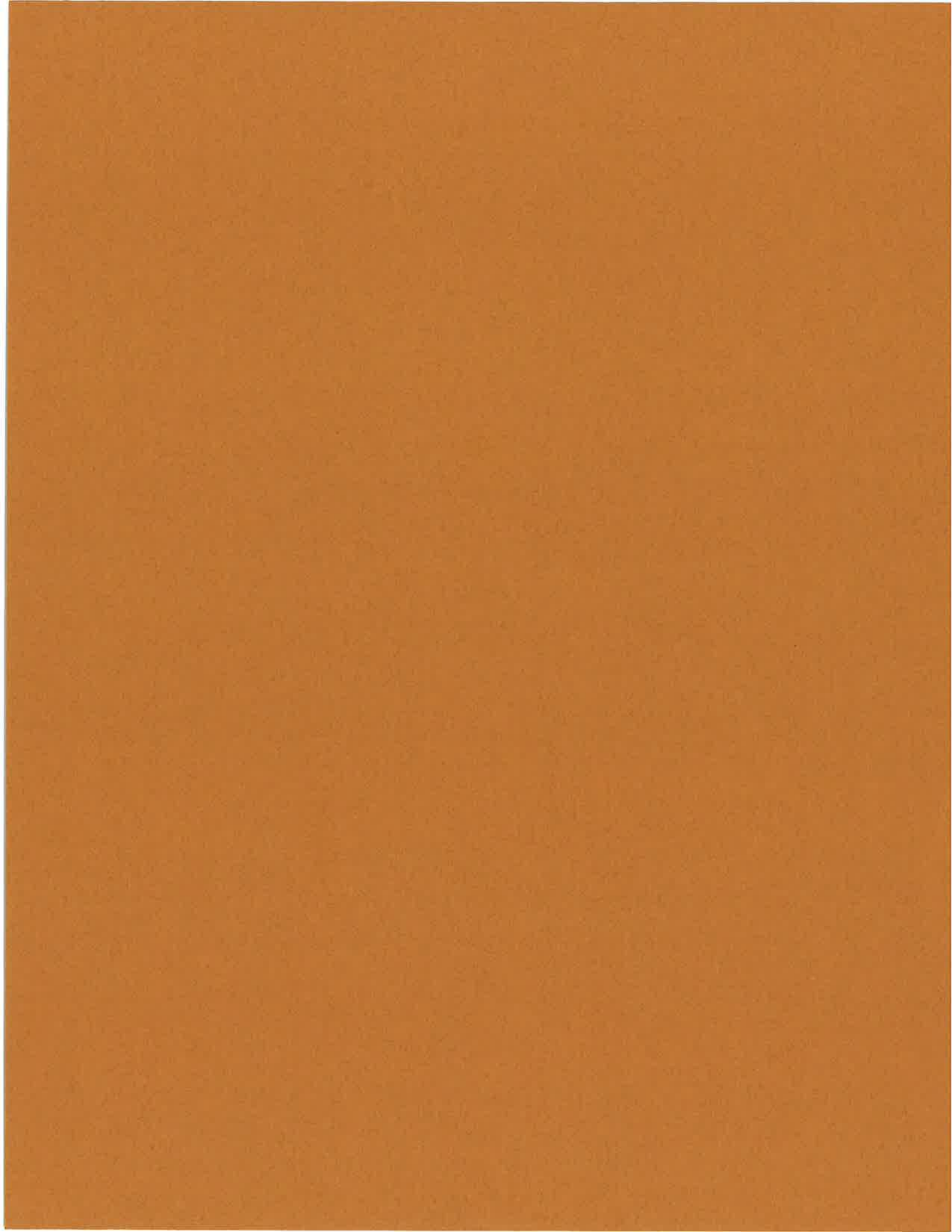
Even the gentlest animals can become deranged when they feel uncomfortable from the heat or if they are sick. They may not know you and will want to protect their babies or their territory. They may be having a bad day. We never know how an animal is going to act. When you visit a farm, never climb into an animal pen or hang on the fence of the animal. Be sure an adult is with you when you are around animals.

It makes sense to stay outside the fence!

Farmers are busy on the farm. This is their workplace. Their equipment is very loud and very large. They may not see you running up to them when they are operating farm equipment. The ponds and creeks on the farm or ranch are also dangerous places to play. There is no lifeguard to watch you swim. There could be chemicals in the stock pond. Never go near the water unless you have an adult with you. The water might be colder and deeper than you think. You should never be out in barns, shops or other farm buildings without an adult. These are a farmer's work areas and you should have a safe place to play.

Know where it's OK to play!





COOPERATIVES

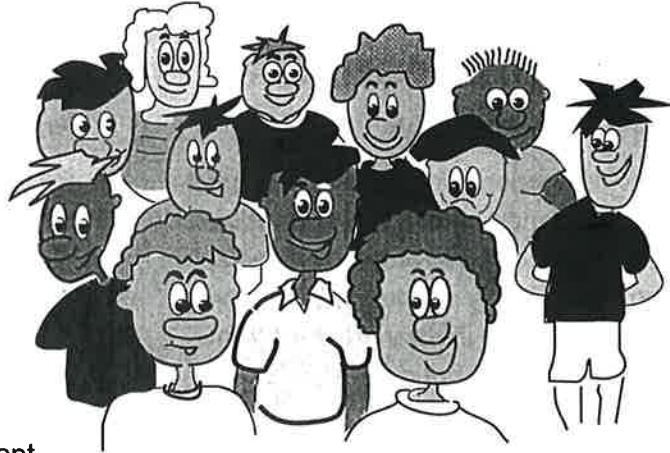
Cooperatives have been around for centuries. They are based on the idea of people working together for a common goal and are formed to benefit many people, not just a few.

Cooperatives are special businesses that are open to anyone willing to use their services and accept the responsibilities of membership. Membership is not based on race, religion, politics or whether you are male or female.

Cooperatives are owned and controlled by the people who belong to them — the members. They decide what goods and services the co-op will provide. Each member has an equal say in how the co-op operates.

Cooperatives members control the organization through a board of directors that are elected by the members.

Cooperatives use the money they make (called "profit") to pay their members. After each year's bills are paid, the co-op returns profits to its members. The money they return is called **patronage refunds**. The more a member buys from his or her co-op, the more patronage he or she receives.



check out
www.ndfu.org
(North Dakota Farmer's Union)

Cooperatives keep a portion of patronage in the form of **stock**, which is later repaid in cash to each member. Stock provides the money a co-op needs for everyday expenses and for buying equipment and buildings.

Cooperative guidelines used in today's co-ops were first created in Rochdale, England, in the 1840s by a group of weavers. They came up with the idea of cooperatively putting their money together to buy their groceries in large quantities, which reduced the overall cost of their food.

Cooperatives support their communities by providing services and jobs, and they also reward their members financially.

Types of Cooperatives

Service Cooperatives

Service cooperatives provide a special service to members. Rural electric and telephone cooperatives, for example, supply electricity and telephone service to many people in rural areas of the state who would not otherwise have access to electricity or phone service. Credit unions are also service cooperatives that provide financial services to members.



Marketing cooperatives

Marketing cooperatives sell produce or commodities for members. As a marketing cooperative, Harvest States grain elevators market grain for farmers. They try to get the highest price for their members' products.



Processing cooperatives

Processing cooperatives take a raw commodity and turn it into a product. For example, farmers grow a type of wheat called durum that is processed into pasta. And ranchers raise animals such as cattle and bison which are processed into products such as steak and hamburger.

Supply cooperatives

Supply cooperatives provide members with products or other things they need or want. For example, Cenex stations supply gas, oil, tires and machinery parts to members.



Cooperative story problem:

$$\begin{array}{r} \$1.00 \\ - .80 \\ \hline = .20 \text{ profit per student} \\ \times 10 \text{ student (members)} \\ \hline \$2.00 \text{ total profit} \end{array}$$

= \$1.00 divided by 10 members =
 \$.10 returned patronage to each member
 \$1.00 profit kept as stock

\$1.00
 2 | \$2.00 profit

Processing — Land O Lakes, Sue Bee Honey, American Crystal Sugar, North American Bison
 Service — Credit Unions, Rural Telephone Cooperatives, Rural Electric Cooperatives
 Supply — Cenex, True Value Hardware
 Marketing — Harvest States elevators

Match the Cooperatives:

Answers:

Match the Cooperatives

List examples of the four types of cooperatives from the list on the right:

Processing Cooperatives:

Service Cooperatives:

Supply Cooperatives:

Marketing Cooperative:

Land O Lakes

Credit Unions

Sue Bee Honey

Rural Telephone Cooperatives

Cenex

Rural Electric Cooperatives

American Crystal Sugar

True Value Hardware

North American Bison

Harvest States elevators

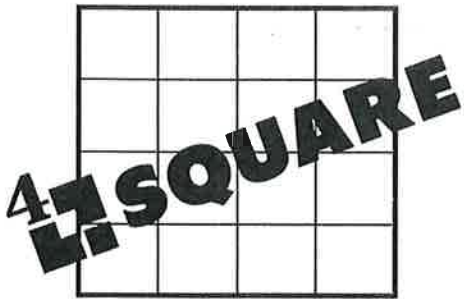
Four Square

Cooperative game

This game is a variation on traditional Four Square. Instead of competing against each other, students work together to see how long they can keep the game going.

This game is filled with fours. It is played by four players on four adjacent squares that are each 4 by 4 feet. The squares are outlined on the ground (with chalk or tape) by drawing one large square (8 by 8 feet) and dividing it into fours.

One student stands inside or just outside each of the squares. One student bounces a ball to another at random or in a pre-arranged order. The ball must be hit or pushed into a new square with each bounce, thereby being handled by a different player each time. The objective is to see how long the group can keep the ball going. Less skilled groups can catch the ball before bouncing it into another square; more skilled may hit it on the bounce without holding it.



Cooperative Story Problem

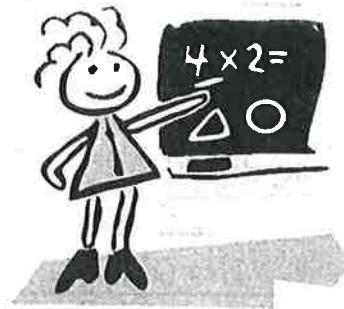
Ten students organize their own cooperative store.

Each student buys a candy bar for \$1.00 each. The candy bars cost the store 80¢ each to buy.

How much profit does the store make on each of the sold candy bars?

Half of the profit is kept as stock and half the money is returned as patronage.

How much money does each student get back?



Cooperative Word Search

Find these words:

COOPERATIVES
PROCESSING
PATRONAGE

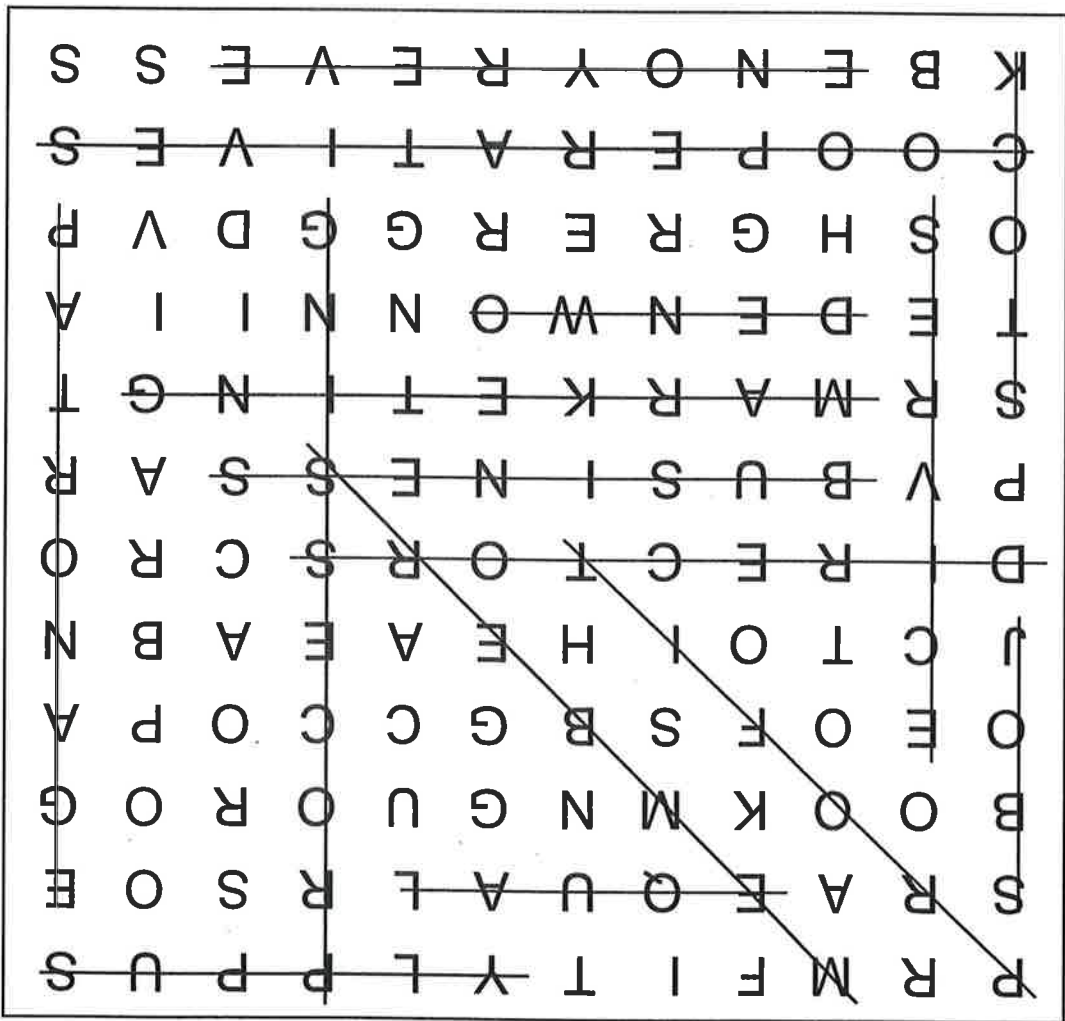
DIRECTORS
EVERYONE
MARKETNG

MEMBERS
BUSINESS
SERVICE

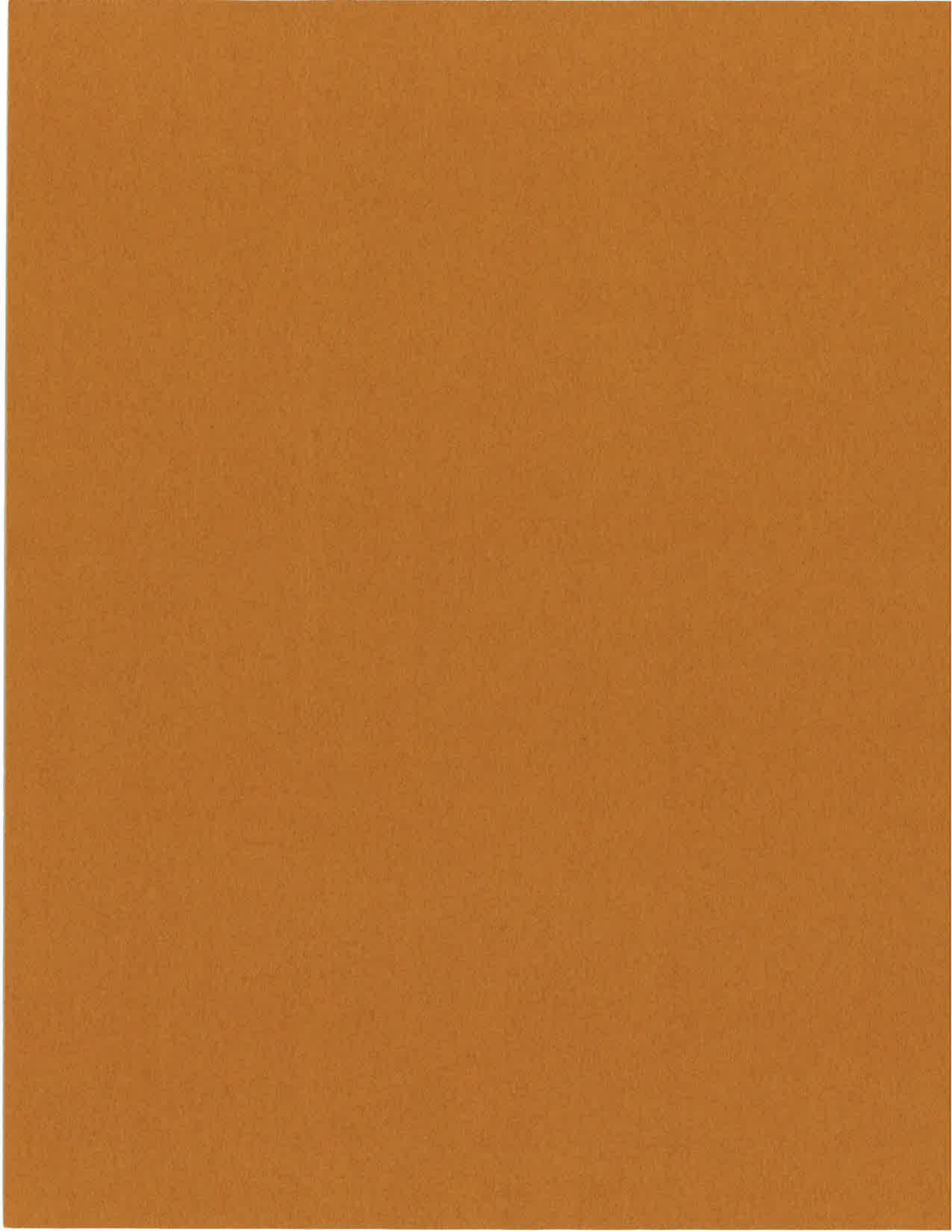
SUPPLY
OWNED
STOCK

EQUAL
PROFIT
JOBS





Answers: Word Search



CAREERS IN AGRICULTURE

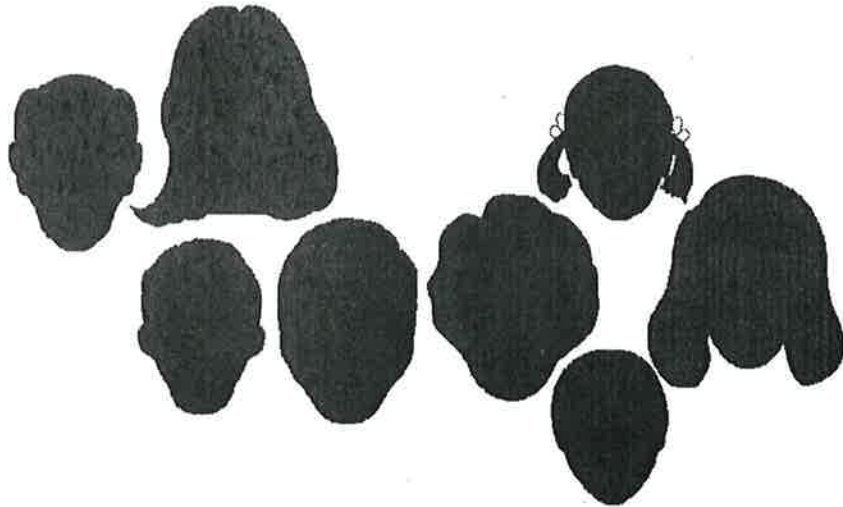
Agriculture is the nation's largest employer, with 21 million people working in some phase — from growing food and fiber to selling it at the supermarket.

Farming has created many jobs for the non-farming sector of our economy. Every year, farmers alone spend close to a billion dollars to purchase inputs such as seed, fuel, equipment and feed to produce crops and livestock. At the same time, farmers spend money for the same things that city people buy. This includes food, clothing and other consumer products and services. Thus farming is producing two-fold!



check out

www.ag.ndsu.nodak.edu/colag/teaching/htm



Encyclopedia/Dictionary Category Search

Supplies

Encyclopedia Dictionary

Procedure

1. Pass out the handout "Careers in Agriculture" and make sure the students are familiar with the vocabulary.
2. Remind the students this is merely a partial listing of the 500 jobs directly or indirectly related to agriculture.
3. Pass out the handout "Careers in Agriculture Category Sheet".
4. Some careers may fit more than one category. For example:
"meteorologist" may be placed under two categories — Science and Research, or Communications.

**Accept any category choice provided the student can justify his/her answer.

Other Ideas

Invite a representative from one of the eight areas to speak to the class. Have him or her talk about the duties, qualifications, training, etc. of this particular career.

Do a class survey of the various occupations the students' parents are engaged in.

How many are agriculture-related?

If it is about 40%, your class is within the national average.

Why might North Dakota's average be higher than the national figure?

A Career "Ist" Search answers: 1-A; 2-P; 3-D; 4-Q; 5-H; 6-R; 7-K; 8-B; 9-O; 10-G; 11-C; 12-N; 13-L; 14-E; 15-F; 16-M; 17-J; 18-I

Careers in Agriculture

Directions

Listed are some of the more than 500 careers in agriculture and related fields. Use this list to complete the "Careers in Agriculture" Category Sheet.

Advertising Executive
 Agriculture Consultant
 Agronomist
 Antipollution Program Officer
 Artist
 Bacteriologist
 Banking Official
 Beekeeper
 Biochemist
 Biologist
 Biophysicist
 Botanist
 Chemical Producer
 College Faculty
 Commercial Nursery Manager
 Communications Specialist
 County Extension Agent
 Dairy Plant Manager
 Dairy Producer
 Editor
 Power Plant Manager
 Elevator Manager
 Engineer
 Entomologist
 Farm Planner
 Farm Appraiser
 Farm Machinery Dealer
 Farm Equipment Specialist
 Irrigation System Manager
 Farm Manager
 Farmer
 Feed Dealer
 Fertilizer Producers
 Flood Control Project Manager

Pilot/Sprayer
 Food Services Manager
 Food Chemist
 Food and Agriculture Organization
 of United Nations Official
 Food Administrator
 Fruit Grower
 Geologist
 Graphic Designer
 Home Economist
 Horticulturist
 Food or Feed Inspector
 Insurance Broker
 Livestock Breeder
 Meteorologist
 Missionary
 Peace Corp Volunteer
 Photographer
 Poultry Producer
 Quality Control Specialist
 Radio or Television Announcer
 Rancher
 Realtor
 Rural Sociologist
 Salesperson
 Scientist
 Seed Broker
 Seed Grower
 Research Technician
 Soil Conservationist
 United States Department of
 Agriculture Official
 Veterinarian
 Vocational Agriculture Teacher
 Water Conservation Specialist
 Weather Person
 Wildlife Specialist
 Writer
 Zoologist

Careers in Agriculture Category Sheet

Services												
Conservation and Recreation												
Communi- cations												
Teaching and Education												
Business												
Manufacturing												
Science and Research												
Farming and Ranching												

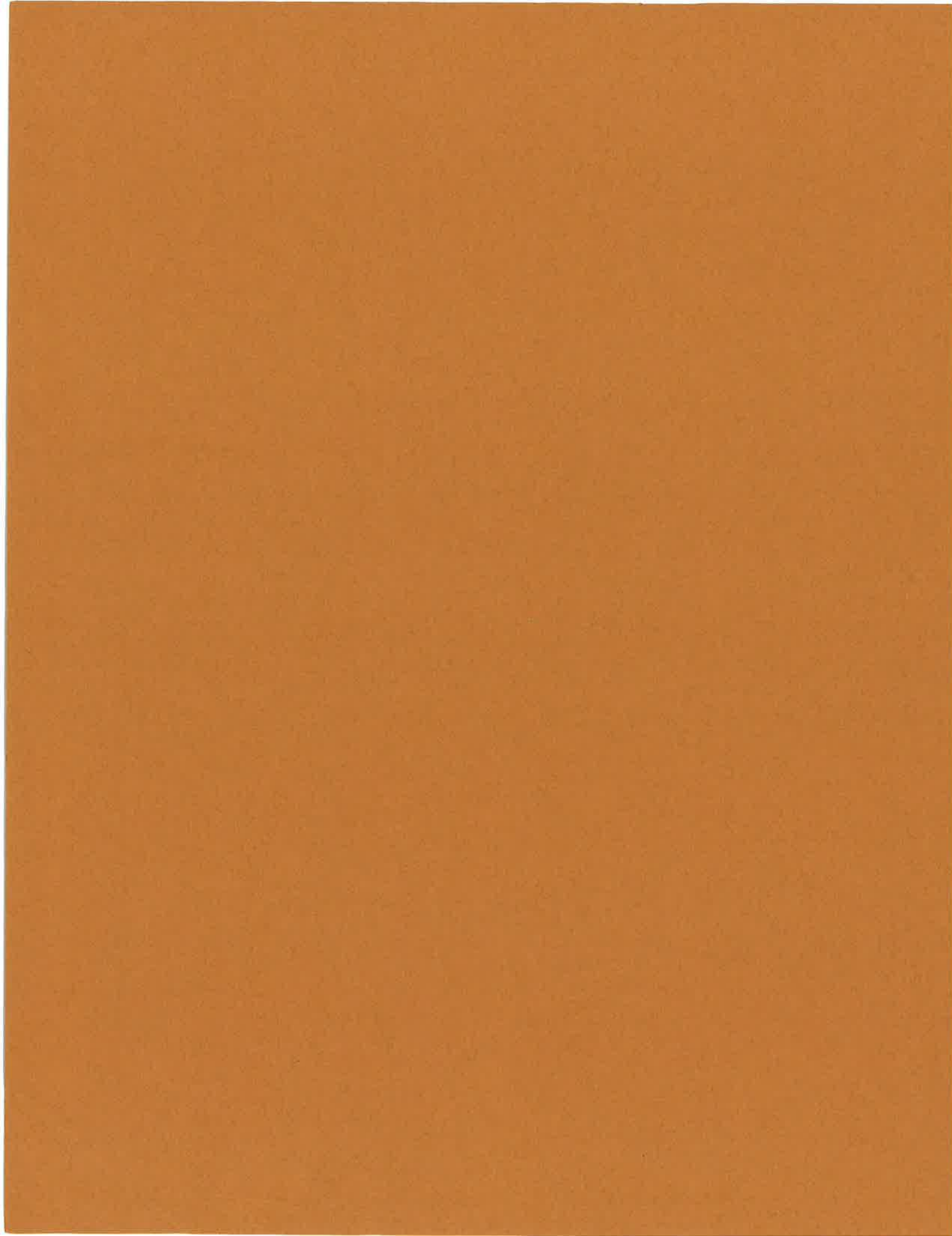
A Career “ist” Search

There are many “ist” occupations that can be related to agriculture. Match the following careers with their related jobs. Use a dictionary or reference books to help you.

- | | |
|--------------------|--|
| 1. Agronomist | A. Studies the soil |
| 2. Anthropologist | B. Scientific study of plants |
| 3. Agriculturist | C. Studies insects |
| 4. Bacteriologist | D. Scientific study of farming methods |
| 5. Biochemist | E. Studies water |
| 6. Biologist | F. Studies the atmosphere |
| 7. Biophysicist | G. Studies the production and distribution of goods and services |
| 8. Botanist | H. Studies chemicals in living things |
| 9. Conservationist | I. Studies animals |
| 10. Economist | J. Studies beekeeping |
| 11. Entomologist | K. Studies the physics of living things |
| 12. Geophysicists | L. Studies the raising and caring of plants |
| 13. Horticulturist | M. Studies living things seen through a microscope |
| 14. Hydrologist | N. Studies the physics of geology |
| 15. Meteorologist | O. Studies and supports saving the natural environment |
| 16. Microbiologist | P. Studies man |
| 17. Pedologist | Q. Studies bacteria |
| 18. Zoologist | R. Studies living things |

Careers in Agriculture Category Sheet answers

Farming and Ranching	Science and Research	Manufacturing	Business	Teaching and Education	Communications	Conservation and Recreation	Services
Beekeeper	Agronomist	Chemical Producer	Banking Official	Agriculture Consultant	Advertising Executive	Antipollution Program Officer	County Extension Agent
Dairy Producer	Bacteriologist	Power Plant Manager	Dairy Plant Manager	College Faculty	Artist	Commercial Nursery Manager	Food or Feed Inspector
Farm Manager	Biochemist	Farm Equipment Specialist	Elevator Manager	Food Services Manager	Editor	Irrigation System Manager	Missionary
Farmer	Biologist	Fertilizer Producer	Farm Appraiser	Home Economist	Graphic Designer	Flood Control Project Manager	Peace Corp Volunteer
Fruit Grower	Biophysicist	Seed Grower	Farm Machinery Dealer	Rural Sociologist	Communications Specialist	Soil Conservationist	Quality Control Specialist
Livestock Breeder	Botanist		Farm Planner	Vocational Agriculture Teacher	Meteorologist	Water Conservationist	Food Administrator
Poultry Producer	Engineer		Feed Dealer		Photographer	Wildlife Specialist	United States Department of Agriculture Official
Rancher	Entomologist		Insurance Broker		Radio or Television Announcer		Food and Agriculture Organization of United Nations Official
	Food Chemist		Salesperson		Weather Person		
	Geologist		Seed Broker		Writer		
	Horticulturist		Pilot/Sprayer				
	Meteorologist		Realtor				
	Research Technician						
	Scientist						
	Veterinarian						
	Zoologist						



Resources (revised 11.18.2020)

Eat Smart with MyPlate,
www.ag.ndsu.edu/extension/features/eat-smart-with-myplate

Northarvest Bean Growers Association
50072 E. Lake Seven Road
Frazee, MN 56544
218.334.6341
Email: nhbean@loretel.net
<https://northarvestbean.org>

National Honey Board
PO Box 2189
Longmont, CO 80502
303.776.2337
<https://www.honey.com>

National Sunflower Association
2401 46 Avenue SE, Ste. 206
Mandan, ND 58554-4829
888.718.7033
www.sunflowernsa.com

North Dakota Agriculture in the Classroom
ND Department of Agriculture
600 E Boulevard Ave. Dept. 602
Bismarck, ND 58505-0020
701.327.2231
1.800.242.7535
Email: ndda@nd.gov
www.nd.gov/ndda/ag-classroom

North Dakota Agricultural Experiment
Station
NDSU Dept. 7500
PO Box 6050
Fargo, ND 58108-6050
Email: NDSU.EXP-DIR@ndsu.edu
www.ag.ndsu.edu/research

North Dakota Barley Council
1002 Main Ave. W Ste. 2
West Fargo, ND 58078
701.929.0123
Email: ndbarley@ndbarley.net
www.ndbarley.net

North Dakota Beef Commission
4023 State Street
Bismarck, ND 58503
701.328.5120
1.877.321.BEEF
www.ndbeef.org

North Dakota Beekeepers Association
PO Box 55
Turtle Lake, ND 58575
www.ndbeekeepers.org

North Dakota Buffalo Association
701.208.0440
Email:
northdakotabuffaloassociation@gmail.com

North Dakota Corn Growers Association
4852 Rocking Horse Circle S
Fargo, ND 58104
701.566.9322
Email: info@ndcorn.org
www.ndcorn.org/corngrowers

North Dakota Department of Agriculture
600 E Boulevard Ave. Dept. 602
Bismarck, ND 58505-0020
701.328.2231
1.800.242.7535
Email: ndda@nd.gov
www.ndgov/ndda/

North Dakota Farm Bureau
4900 Ottawa Street
Bismarck, ND 58503
701.224.0330
1.800.932.8869
www.ndfb.org

North Dakota Farmers Union
1415 12 Avenue SE, PO Box 2136
Jamestown, ND 58401
701.252.2341
1.800.366.8331
<https://ndfu.org>

North Dakota Grain Growers Association
1002 Main Ave., W #3
West Fargo, ND 58078
701.282.9361
<https://ndgga.com>

North Dakota Lamb & Wool Producers
Assn.
7050 156 Ave. NW
Bismarck, ND 58503
701.333.8009
Email: ndlwpa@gmail.com
www.ndsheep.org

North Dakota Pork Council
www.ndpork.org

North Dakota Soybean Council
4852 Rocking Horse Circle South
Fargo, ND 58104
701.566.9300
Email: swolf@ndsoybean.org
<https://ndsoybean.org>

North Dakota State Soil Conservation
NDSU Extension
2718 Gateway Ave., Ste. 304
Bismarck, ND 58503
701.328.9715
www.ag.ndsu.edu/ndssc

North Dakota Turkey Federation
ND Department of Agriculture
600 E Boulevard Ave. Dept. 602
Bismarck, ND 58505-0020
701.328.2231
1.800.242.7535
Email: ndda@nd.gov
www.nd.gov/ndda/livestock-development-division

North Dakota Wheat Commission
2401 46 Avenue SE, Ste. 104
Mandan, ND 58554-4829
701.328.5111
ndwheat@ndwheat.com

Progressive Agriculture Foundation
888-257-3529
Email: safetyday@progressiveag.org
<https://www.progressiveag.org/#>

United States Durum Growers Association
1605 East Capitol Avenue
Bismarck, Nd 58501
701.214.3203
Email: office@durumgrowers.com
www.durumgrowers.com