FUN FACES OF WISCONSIN AGRICULTURE
CORNY'S CORN FAST FACTS

Production Information

Iowa, Illinois, Nebraska and Minnesota account for over 50 percent of the corn grown in the U.S. Other major growing states are Indiana, Wisconsin, South Dakota, Michigan, Missouri, Kansas, Ohio and Kentucky. This area is known as the "Corn Belt."

Corn is an annual plant that grows seven to ten feet tall. The scientific name for corn is Zea Mays L. Corn is well adapted, high yielding, and can grow under various conditions. Corn requires proper fertilization of the soil. Hybrid seeds, made by crossing two or more corn plants, are planted in the spring with a corn planter. The corn plant has a strong root system including brace roots that help support the corn stalk. The tassel develops on the top of the corn plant. It has hundreds of small flowers that produce pollen. The leaves of a corn plant are long, narrow and pointed on the end. Ears of corn grow where the leaf joins the stalk. A corn plant will normally have 1 ear. The ear of corn is covered with husks or specialized leaves. There are rows of kernels that make up the corncob; each has a silk-like thread that runs from the kernel out through the end of the husk. During pollination, each silk needs to be pollinated in order to produce a kernel of corn. Dent corn will be harvested in the fall. The amount of moisture will help a producer determine the use of the corn. High moisture corn is put in silos, bags and bunkers. Corn that is harvested and dried down is stored in bins and used for various purposes.

Wisconsin Production

In 2004, Wisconsin planted 3.60 million acres of corn and 38% of the total crop. Corn is used for corn silage (the whole plant is chopped and fermented) or harvested as grain for livestock feed, ethanol and other uses. WI often leads the nation in the acres harvested for silage (950,000). Grain yield will vary but the 2005 average was 148 bushels per acre. Leading counties of corn harvested for grain include Dane, Rock, Grant, LaFayette and Columbia. Counties harvesting corn for silage include Dane, Marathon and Manitowoc.

Career Information

Researchers develop the new uses for corn including plastics, ethanol, and human food uses. Growers depend on crop scouts to help monitor weeds, pests and diseases. Plant geneticists help develop new hybrids. Processors take the corn and create ethanol, livestock feed and human foods, and all the other products. Shipping via truck, rail and boat is important for corn. Marketing specialists help farmers and cooperatives with corn prices.

Trivia

- There are over 3500 uses for corn products.
- An ear of corn averages 800 kernels in 16 rows. A pound of corn consists of approximately 1,300 kernels. An acre of corn yielding 100 bushels produces approximately 7,280,000 kernels.
- A bushel equals 56 pounds and is about 72,800 kernels of corn.

Other Information

There are six different types of corn- sweet, dent, flint, pod, flour and popcorn. Popcorn is the only type that pops. Corn-on-the-cob and canned or frozen corn at the grocery store come from sweet corn. Dent (field corn) is the type most grown in America. Almost all of the corn you see in farm fields is dent corn. Unlike sweet corn, dent corn has a hard outer portion about the thickness of your fingernail. The inner portion of the corn kernel is soft and floury. Dent corn is used to make starches, oils, livestock feed, ethanol fuel and many other products like crayons, paints and paper. Dent corn also is used to make corn syrup sweeteners and other ingredients that appear in all kinds of foods from soft drinks to baked goods. Corn serves as a livestock feed source with 50% of the crop being used for feed. A 56 lb. bushel of corn fed to livestock produces 5.6 lbs. of retail beef, 13 lbs. of retail pork, 19.6 lbs. of chicken or 28 lbs. of catfish.

FUN FACES OF WISCONSIN AGRICULTURE
MATH - CORN LESSON PLAN

STUDENT'S NAME:

Answer the questions below. Show your work.

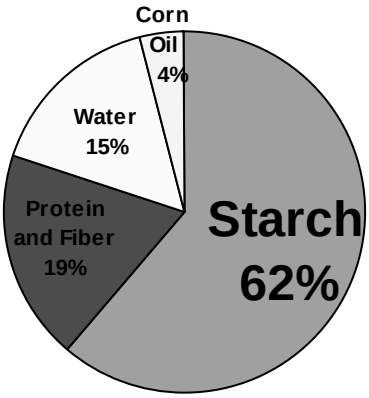
1. If the average corn plant has one ear of corn, how many ears would there be in a field of 400 plants?

2. If each ear of corn has 576 kernels, how many kernels would be in the field from Question #1?

3. In 2005 in Wisconsin, 2,900,000 acres of corn were planted and 429,200,000 bushels were harvested. How many bushels were harvested per acre?

4. If one cow eats 25 lbs of corn each day, and one pig eats 4 lbs of corn each day, how many pounds of corn would the farmer need to grow to feed 65 cows and 250 pigs?

5. Ethanol is made from the starch in corn. If one bushel of corn weighs 56 pounds, how many pounds will be ethanol?



Components of Corn

6. If the farmer harvests 350 acres of corn and has committed 25% to the local ethanol plant, how many acres are left for feeding animals?

7. If the farmer's average yield per acre is 129 bushels in 2005 and there is a drought in 2006 that reduces production by 25%, what will the average yield be in 2006?

ANSWER KEY

1. If the average corn plant has one ear of corn, how many ears would there be in a field of 400 plants?

1 ears X 400 plants = 400 ears in the field

2. If each ear of corn has 576 kernels, how many kernels would be in the field from number one?

576 kernels X 400 ears = 230,400 kernels in the field

3. In 2005 in Wisconsin, 2,900,000 Acres of Corn were planted and 429,200,000 bushels were harvested. How many bushels were harvested per acre?

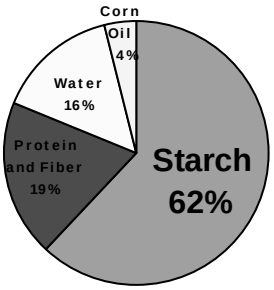
429,200,000 bushels / 2,900,000 acres = 148 bushels/ acre

4. If one cow eats 25 lbs of corn each day, and one pig eats 4 lbs of corn each day, how many pounds of corn would the farmer need to grow to feed 65 cows and 250 pigs for one year?

25 pounds X 65 cows = 1,625 pounds of corn for cows
4 pounds X 250 pigs = 1,000 pounds of corn for pigs
1,000 for pigs + 1,625 for cows = 2,625 pounds of corn each day
2,625 pounds/day X 365 days in a year = 958,125 pounds of corn

5. Ethanol is made from the starch in corn. If one bushel of corn weighs 56 pounds, how many pounds will be ethanol?

56 pounds X .62 starch = 34.72 pounds of starch



Components of Corn

6. If the farmer harvests 350 acres of corn and has committed 25% to the local ethanol plant, how many acres are left for feeding animals?

350 acres X .25 percent ethanol = 87.5 acres to ethanol

350 acres – 87.5 = 262.5 acres to feed the animals

or 350 acres X .75 percent to animals = 262.5 acres to feed animals

7. If the farmer's average yield per acre is 129 bushels in 2005 and there is a drought in 2006 that reduces production by 25%, what will the average yield be in 2006?

129 bushels X .25 percent reduced = 32.25 less production

129 – 32.25 = 96.75 average yield in 2006

or 129 bushels X .75 remaining production = 96.75 average yield in 2006

FUN FACES OF WISCONSIN AGRICULTURE
DIVERSITY OF GRAIN PRODUCTION AND USE

Activity Length:
Match the by-product – 20 minutes
Technology Discussion – 15 minutes
Town Meeting On Building an Ethanol Plant – 2 class periods or One hour on two consecutive days
Create a collage – 30 minutes
Corn Math Lesson – 30 minutes

Student Objectives:
1. Identify commercial items as products of corn or soybeans
2. Discuss production of various products and how changes in technology have allowed these things to happen
3. Create a collage to remember the various products used in our daily lives that come from grain
4. Utilize their research skills and resources to gain information about a specific side of a topic
5. Develop speaking skills to share their side of the issue
6. Research the sides of a relevant issue to today

Wisconsin Model Academic Standards:

English	A.4.1	A.4.2	A.4.4	B.4.2	B.4.3	C.4.1	C.4.2	C.4.3	E.4.1
Math	A.4.3	D.4.1							
Science	A.4.5								
Social Studies	B.4.3								

Introduction: Corny's Corn Fast Facts

Additional Information available at:
Ethanol Promotion and Information Council (www.epicinfo.org/)
National Corn Grower's Association (http://www.ncga.com/education/main/index.html)
Renewable Fuels Association (www.ethanolrfa.org)
American Coalition for Ethanol (www.ethanol.org)
Wisconsin Ethanol Coalition (www.wisconsinethanol.com/)

Important Terms:
- By-product: a secondary product left from the production of a primary commodity.
- Corn: Most important field crop grown in the United States. Major types are dent, popcorn and sweet corn.
- Soybean: A small, round bean used for food, fertilizer, animal feed, medicines and oils
- Processing: Turning raw agricultural products into consumable foods.

- Biodiesel: Vehicle fuel made from vegetable oils or animal fats which reduces pollution and makes the air cleaner. It is commonly made from soybean oil.
- Ethanol: Vehicle fuel made from sugars found in plants such as corn or grain sorghum. It Is cleaner than gasoline and makes the air healthier and cleaner to breathe.
- Renewable Energy Source: A source of energy that we are able to grow more of to replace what is used.
- Bio-diesel: Use of agricultural crops as feed stocks for fuels
- E10: 10% ethanol and 90% unleaded gasoline, a fuel blend covered under warranty by every automobile manufacturer that sells vehicles in the U.S. for every make and every model of automobile.
- E 85: A blend of 85% ethanol and 15% gasoline that is mean for use in Flexible Fuel Vehicles (FFVs).
- Flexible Fuel Vehicles (FFVs): Can operate on gasoline or any blend of ethanol up to 85%.

Materials for this activity:

- Commodity Product Cards
- Magazines or catalogs to cut pictures from
- Grain seeds and other products
- Construction Paper
- Glue
- Scissors
- Corn and Soybeans Products List
- Ethanol Fact Sheet
- Town Hall Meeting Materials

Lesson Outline:

Match the byproduct

Students will identify commercial items as products of corn or soybeans

1. Begin by defining the words corn and soybeans so students have an understanding of each crop. Give brief background of each crop and answer any questions students may have. Don't go too in depth, as this activity is designed for students to raise questions about the production and processing of these crops into other products.

2. Explore United Soybean Board's website for uses of soybeans: (http://www.unitedsoybean.org/newuses/)

3. Explore National Corn Grower's Association for related curriculum items. (http://www.ncga.com/education/main/index.html)

4. Review the Corn and Soybean Products handout.

5. Break students into groups of 7-10 students.

6. Distribute one set of Commodity Product Cards to each group.

7. Spread the cards out onto the table face up, and separate them into the following groups: Soybeans, Corn, None regarding the origin of each product.

8. Give groups enough time to complete the activity.

9. With the same headings (Corn, Soybean, None) written on the board, take suggestions from students as where to correctly place each item.

Answer Key:

- Soybean Products: Tofu, Nestle's Quick® Cocoa, Soy Ink, Soy Sauce, Biodiesel
- Corn Products: Ethanol, Corn Flakes, Chewing Gum, Paint, Photographic Films, Marshmallows
- None: (these are all none because they are animal by-products): Glue, Make-up, Bandages, Leather Boots, Footballs
- Any Space: Soap (soap can go in any category because it uses corn, soybeans, and animal by-products to create it)

Technology Discussion

As a class, raise the following questions to further explore the origin of these products and how they have come to be a part of our marketplace.

- Of the products in the last activity, how many were available to the Native Americans and Pilgrims? Your great-great-grandparents? Grandparents? Parents?

- Why are these products available to use today?

- Give examples of products that are brand new today.

- What has caused these products to be available to us now?

- Why is it more important now to develop alternative sources for products than it was to our early ancestors?

- What products do you see available for your grandkids that are not available to us today?

Town Meeting On Building an Ethanol Plant

Before beginning this activity, inform students that this is only an in-class activity. Students are not expected to adopt the opinions of their group, or are they to allow their own personal opinions to impede on their research. This activity encourages them to see both sides of an issue and to listen to the opinions of others.

1. Review the Ethanol Fact Sheet. Discuss dependence on foreign oils, renewable resources and how ethanol plant placement can impact local communities.

2. Divide the class in half (depending upon class size, may need to divide further) so that there is an even number of groups.

3. Distribute scenario cards to each group with half of the class receiving that they are in favor of the building of an ethanol plant in the community while the other half is against it.

4. Conduct your research.

<u>Option 1</u>

This activity may be done independently or as a group. To ensure that each student participates, an additional requirement may be that each group turn in their resources with one from each group member included. This may be a great time to orient students to the different resources that are available for them in researching

- Through a trip to the library and/or computer lab, give students time to research their side of the scenario.

- Or assign this as homework to be done outside of class.

- After research is completed, allow students time to work together and develop their side to be presented at the "town meeting".

- Encourage students to use statistics and examples to back up their points.

<u>Option 2</u>

- Instead of allowing students time to research on their own, provide them with an informational packet utilizing the following resources to draw information from the National Corn Growers Association (www.ncga.com)

- Give groups time to read through the information and formulate their reasons for being on the side that they are on.

5. Hold a "Town Meeting"

Before beginning this activity, set rules to ensure students are treated fair and respected when they are speaking.

- To make this more realistic, post a flier on the door of the room as students return from a break or return to school so that they have been 'notified' of the pending meeting.

- Introduce the pending issue, and give each group a set amount of time to tell their side of the topic.

- Depending on how the class was split up, arrange the discussion so that each group is allowed to present one item of importance their group researched.

6. Follow-up Discussion

- Do we see similar things happening today? Examples?

- Why is it important to be able to grow our own fuel?

- After researching, what did you learn about those that were against this topic?

- What do you think needs to be done to ensure that people are receptive to new things like Ethanol?

Create a collage

This activity will help students combine what has been discovered in the past activities into their individual interests and make it more personal for them.

- Distribute construction paper to each student and make available magazines and sample grains for them to use.

- Encourage students to be creative and come up with not only current products, but some of those discussed for in the future.

- If the list from activity one is still left on the board, this may help to remind students of options they have for their collages.

- Once finished, display them around the room.

Corn Math Lesson

1. Distribute Corn Math Lesson for classroom activity or homework assignment

Suggested Reading Materials:

- 2006 World of Corn – available from National Corn Growers Website (http://www.ncga.com/), under Media and Information Center
- Popcorn Website (www.popcorn.org)
- Wisconsin Fresh Market Vegetable Grower's Association (www.wisconsinfreshproduce.org) and then link to Vegetable Facts, Sweet Corn

Additional Worksheets:

- *Amazing Corn Activity Booklets*- sponsored by Wisconsin Corn Promotion Board
- Careers Guide related to corn
- Ag Statistics Lesson Plan related to corn

Related activities:

- Give students one corn product to research and present to the class as a poster
- Corn Plastic activity
- Using the websites listed in the suggested reading materials, students can study other types of corn – sweet corn, popcorn, flint corn, or broom corn and create a poster with the following points
    - How many acres are raised in Wisconsin (if any)
    - How does this type of corn differ from dent corn?
    - How is corn processed so people or animals can use it?
    - How does this product appear to the consumer? Where can they buy it?

Commodity Product Cards

Corn	**Soybean**	**None**	Footballs
Ethanol	Bandages	Leather Boots	Paint
Marshmallows	Soap	Glue	Make-up
Biodiesel	Chewing Gum	Soy Sauce	Corn Flakes
Tofu	Photographic Films	Soy Ink	Nestle's Quick® Cocoa

FUN FACES OF WISCONSIN AGRICULTURE
CORN AND SOYBEAN PRODUCTS

THE FOLLOWING IS JUST A PARTIAL LIST OF CORN AND SOYBEAN PRODUCTS!

Corn Products

- Many baby foods
- Bakery products
- Brewed beverages (bourbon, beer, ale)
- Carbonated beverages (high fructose corn syrup)
- Prepared cereals
- Tartar sauce
- Salad dressings
- Chewing gum
- Baking powder
- Prepared mixes (pancake, waffle, biscuit, cake flour, puddings)
- Gravies and sauces
- Canned soups and dehydrated soup mixes
- Coffee "creamers" and designer coffee drinks
- Sweetened condensed milk
- Cordials and liqueurs
- Most commercially prepared desserts Fruits (commercially canned, candied, frozen, pie fillings, jams, jellies, marmalades, preserves)
- Fruit "drinks" and some fruit juices are sweetened with corn by-products
- Frostings and icings
- Oriental foods typically contain cornstarch as a thickener
- Cornmeal
- Powdered sugar
- Tortillas
- Distilled vinegar
- Grits
- Some shortenings
- Many distilled products-gin, vodka, whiskey
- Instant coffee
- Infant formulas
- Many fried foods are fried in corn oil
- Candy
- Ice cream, sherbets, and sorbets
- Marshmallows
- Meats (cured meats, luncheon meats, sausages, bologna, bacon, ham, wieners)
- Pickles, if sweetened
- Peanut butter
- Instant iced tea mixes
- Sweetened ice tea
- Low calorie sweeteners
- Most snack foods
- Caramel coloring
- Flavoring extracts
- Canned vegetables
- Gelatin desserts
- Some nutritional supplements, unless labeled otherwise
- Fruit pectin
- Popcorn
- Corn oil
- Cornstarch
- Prepared mustards
- Hominy
- Margarine
- Wine coolers
- Adhesives-stamps, envelopes, stickers, tape
- Aspirin
- Talcum powder (talc, baby powders, powder inside medical latex gloves)
- Paper cups
- Toothpaste (substitute baking soda)
- Medicines (syrups, ointments, lozenges, tablets)
- Laundry starch
- Chalk

- **Livestock and poultry feed.**

Soybean Products

- **Mayonnaise**
- **Milk substitutes**
- **Infant formulas**
- **Blended seasoning powders**
- **Soups-canned or dehydrated**
- **Soy nuts**
- **Soy oil**
- **Tofu**
- **Tempeh**
- **Miso**
- **Shortening, margarine**
- **Soy sauces**
- **Teriyaki sauce, shoyu sauce**
- **Condiments (ketchup, Worcestershire sauce, steak sauce, salad dressings)**
- **Baked goods (breads, pancake mixes, pastry, crackers, croutons, chow mein noodles, doughnuts, pizza)**
- **Many processed foods (granola bars, non-dairy creamers, coffee whiteners, frozen fish sticks and fillets, most canned tuna, most frozen prepared dinners, frozen prepared French fries, prepared spaghetti sauce, etc.)**
- **Snack foods (potato chips, corn chips)**
- **Instant powdered beverages (hot cocoa)**
- **Nutritional supplements unless otherwise labeled free of soy**
- **Luncheon meats (sausages, wieners**
- **Cereals (boxed, dry)**
- **Ice creams and sherbets**
- **Peanut butters**
- **Paints and inks**
- **Cosmetics-make-up and lotions**
- **Glycerine**
- **Paper and textile finishes**
- **Soaps**
- **Adhesives**

Town Hall Meeting Materials

Name of the Plant	Location of the Plant	Number of jobs it will create
Amount of corn it will use/year	Where will waste products go?	Opinion of adjacent landowners
Opinion of neighbors	Town Board's Feelings	Closest City Council's Feelings
Financial Impact on the area	Suggestions to make the project successful	Disadvantages of the project

Other items to consider	New facts that were brought up	Who should be notified of the public meeting
Where will the meeting be held? Date? Time?	Other items of information	

Ethanol Fact Sheet

<u>The information below was taken from the following websites:</u>

Renewable Fuels Association (www.ethanolrfa.org*)*
American Coalition for Ethanol (www.ethanol.org)
Wisconsin Ethanol Coalition (www.wisconsinethanol.com/)
Ethanol Promotion and Information Council (www.epicinfo.org/)

If time and resources allow, give students the opportunity to further research these websites to gain even more information and do a more indepth research on these issues before conducting the "Town Board Meeting"

In 2005, the use of ethanol reduced the U.S. trade deficit by $8.7 billion by eliminating the need to import 170 million barrels of oil.

- 10% ethanol-enriched fuel reduces carbon monoxide *better than any other reformulated gasoline* — by as much as 30%.
- Choosing even a 10% ethanol-enriched fuel results in a 35 – 46% reduction in greenhouse gas emissions.

According to a 2004 USDA study, the production of ethanol creates more than 67 percent more energy than it takes to make it. And other studies have come to similar conclusions.

PERFORMANCE

- Auto manufacturers approve and recommend, fuel enriched with up to 10% ethanol for all cars.
- Flexible fuel vehicles are designed to run on E85 (85% ethanol and 15% gasoline) — the cleanest-burning renewable fuel available today.
- By looking at your vehicle's fuel cap, you can tell if it's a flexible fuel vehicle — meaning it can run on regular gasoline with 10% ethanol-enriched fuel or E85.
- Fuel enriched with 10% ethanol is manufacturer-approved for use in small engines, including power equipment, motorcycles, snowmobile and outboard motors.
- Ethanol is the highest-performance fuel on the market, with an octane rating of 113.
- Ethanol-enriched fuel contains more oxygen — so it burns cleaner.
- Enriching fuel with 10% ethanol helps it to burn cleaner and at a cooler temperature, which can add to engine longevity.

ENVIRONMENT

- Ethanol is a clean-burning, renewable fuel.
- E85 is the cleanest-burning fuel available on the market today.

- 10% ethanol-enriched fuel reduces carbon monoxide better than straight gasoline — by as much as 30%.
- The use of 10% ethanol-enriched fuel reduces greenhouse gas emissions by 12 – 19% compared with conventional gasoline, according to Argonne National Laboratory.
- Ethanol reduces tailpipe fine particulate matter emissions by 50%. These emissions pose a threat to those with respiratory ailments.
- Ethanol is biodegradable, meaning it won't harm groundwater in the event of a spill.

AMERICA

- Ethanol-enriched fuels account for approximately 30% of all fuel sold in the United States.
- Ethanol is made from crops grown in America, primarily corn and milo.
- Today there are more than 100 ethanol plants across the country.
- Ethanol replaces gasoline that would require the use of 600,000 barrels of oil a day.
- Last year, the United States produced more than 4.3 billion gallons of ethanol.
- The U.S. ethanol industry supported the creation of nearly 153,725 jobs in all sectors of the economy in 2005, boosting household income by $5.7 billion.

Another fact: Source: Wisconsin Corn Growers Association

If corn averages 148 bushels/acres. There are 80,000 seeds/bag and a producer uses about 30,000 seeds/acre. One bag of seed corn produces around 1,103 gallons of ethanol fuel. If the vehicle gets 20 miles per gallon, that would be 22,060 miles per bag of seed corn.

The math: 148 bu/acre x $\frac{\text{80,000 seeds/bag}}{\text{30,000 seeds/acre}}$ = 394 bu. X 2.8 gal/bu = 1103 gal.

1103 gal x 20 mpg = 22,060 miles/bag of seed

Corn Plastic
Make Plastic Using Corn Oil and Corn Starch

Native Americans first began growing corn in North America at least 3,000 years ago. Corn is now America's #1 feed grain crop. The top corn producing states are Iowa, Illinois, Nebraska, and Minnesota. Other states in America's "corn belt" include Indiana, Wisconsin, South Dakota, Michigan, Missouri, Kansas, Ohio, and Kentucky.

Corn is an important renewable resource. There are thousands of uses for this valuable crop, not only as food for humans and livestock, but for many other products as well. These uses include:

1. **Ethanol** - an environmentally-friendly fuel that, when blended with gasoline, reduces carbon-monoxide emissions from vehicles by 25-30%. Using ethanol-blend fuels helps reduce our dependence on foreign oil imports. One acre of corn produces 414 gallons of ethanol (148 bushel X 2.8 gal/bushel).
2. **Printing Ink** - Corn-based ink can be used in place of regular printer's ink, which is made from petroleum products - another way to reduce dependence on imported oil!
3. **Corn Starch** - Corn starch is a key ingredient in thousands of corn products. It is found in camera film, candles, shoestrings, charcoal briquettes, crayons, detergents, wood products, adhesives, fireworks, medicines, paper, cardboard, and biodegradable plastics.

Materials Needed :

- cornstarch
- measuring spoons
- corn oil
- water
- medicine dropper
- food coloring
- microwave
- sandwich-size resealable plastic bag

Procedure:

1. Place a tablespoon of cornstarch in a resealable plastic bag.
2. Add two drops of corn oil to the corn starch.
3. Add one and a half tablespoons of water to the oil and cornstarch.
4. Stir the mixture.
5. Add two drops of food coloring to the mixture and stir well.

Scientific Observations:

- What do you notice about your biodegradable plastic?
- Is your biodegradable plastic the same as other students' plastic?
- What could you make with this biodegradable plastic if you let it harden?

Next, microwave your biodegradable plastic for 20-25 seconds on high.

- What happens to your plastic?
- Form your plastic into a ball and describe what it will do.

Wisconsin Ag in the Classroom – www.wisagclassroom.org – 608-828-5719
Thanks to Illinois Agriculture in the Classroom.

FUN FACES OF WISCONSIN AGRICULTURE
NUTRIENTS AND FERTILIZERS

Activity Length:
What is an element? – 30 minutes
Corn Baby Activity- 10 minutes to make the Corn Baby. Follow-up activities will vary in length.
Real World Application- 45 minutes
Corn Math Lesson – 30 minutes

Student Objectives:
1. Familiarize students with scientific properties and the use of the Periodic Table of Elements
2. Understand the importance of minerals in the soil for plant production
3. Apply these minerals to real-life decisions of fertilizing flowers and gardens
4. Demonstrate how to take a soil sample and understand the information on a soil report

Wisconsin Model Academic Standards:

English	C.4.1			
Math	E.4.1			
Science	A.4.2	A.4.3	B.4.1	D.4.1

Introduction: Corny's Corn Fast Facts

Additional Information available at:
International Plant Nutrition Institute (www.ipni.net)
Iowa Testing Labs (www.iowatestinglabs.com/brochures)
Natural Resources Conservation Service at (www.wi.nrcs.usda.gov) Click on soils

Important Terms:
- Nutrient: substances necessary for the functioning of an organism.
- Fertilizer: Material that supplies nutrients for plants.
- Nitrogen: Element that exists in the air and is needed by plants to produce proteins, chlorophyll, DNA, RNA and other things. Helps the plants growth and helps keep them green. Symbol is N
- Phosphorus: Essential element required by plants and animals. The phosphate in phosphate rock ore is very insoluble and not available for use by plants. During processing, the ore is treated with acids to make the Phosphorus more available. Helps the plant trap and use the sun's energy for photosynthesis and other plant functions. Also important for developing healthy roots and fighting off diseases. Symbol is P.
- Potassium: Mined from ancient deposits formed as seas and oceans evaporated. Essential nutrient for plants and people. Doesn't mix well with other nutrients. Potassium protects our plants against diseases and helps them stay healthy when it is

cold or dry. Nearly 90% of body potassium is found in major organs and tissues, including muscles, skin and digestive tract. Symbol is K.

- Mineral: A mixture of naturally occurring inorganic compounds often mined for the useful substances they contain.
- Deficiency- Less available than needed for optimum growth.

Materials for this activity:

- Plant Nutrient Team book published by the Potash Institute (www.ppi-ppic.org)
- Wisconsin DATCP Fertilizer Labeling Requirements handout
- Samples of fertilizer bags (be sure the bag is clean) or ask a garden center or supply cooperative to give you a label from a bag
- Magazines or catalogs to cut pictures from
- Construction Paper
- Glue
- Scissors
- Jewelry sized bag
- Crystal Soil (found at garden centers) or a cotton ball
- Hole punch
- Corn seed
- Yarn or string
- Water
- Soil probe or shovel

Lesson Outline:

What is an element?

This activity may begin as part of a science class and utilize various science books and resources in addition to the Plant Nutrient Team book. You can also find element information at (www.ipni.net)*, (*www.iowatestinglabs.com/brochures) or (www.wi.nrcs.usda.gov)

1. Break students up either into pairs or small groups.

2. Assign each group one of the following elements: Nitrogen, Phosphorus, or Potassium.

3. Give them access to a Periodic Table and explain the different groups of elements.

4. Assign them to come up with three important things that their nutrient/element provides to plants and soil.

5. Discuss situations why it is necessary for these plants to receive all three nutrients.

6. Optional exercise: As students give reasons to the importance of each of the nutrients, write them down on a bulletin board.

7. After the first activity is complete, give students the opportunity to create visual representation of the importance of these nutrients.

8. Each student can be given a piece of paper and the opportunity to draw, write or choose from magazines something to represent each of the elements of importance of the nutrients.

Corn Baby Activity

1. Discuss the parts of a corn seed. Download the cross-section of a corn kernel from the National Corn Growers Association (http://www.ncga.com/WorldOfCorn/main/kernel.asp) or make a copy of Corn Kernel.

2. Complete the Corn Baby Activity.

3. During the weeks that the corn kernels germinate, use the results in the following ways:
    a. Have students measure the growth each day and create a graph or chart
    b. Have some students take their kernels out of the bag after it has germinated and plant in potting soil and watch the growth. Students can try various types of soils: potting soil, soil from a garden or sand.
    c. Have some students leave their corn baby in the bag and see how long it can exist without rotting.

Real World Application

This activity will show students the real world application of nutrients even when they are not living on farms.

1. Utilizing sample fertilizer bag labels, or the Wisconsin DATCP Fertilizer Labeling Requirements handout, ask what the significance of each number may be. Encourage students to review what they learned about the various elements.

2. Discuss the importance of different fertilizer products.

3. Discuss how consumers would know what their soil fertility levels are?

4. Refer to the University of Wisconsin Extension Bulletin website (http://learningstore.uwex.edu/). Go to Lawn and Garden Section, Lawn and Turf, Care, and then download the activity sheet on Sampling Lawn and Garden Soils for Soil Sampling.

5. If you have equipment to conduct a soil sample, the students could take soil samples from the school grounds and send them in to be tested. You might also work with your school's grounds staff for assistance or the local agriculture education instructor.

6. When the results come back, discuss the results of the soil tests and determine what should be given to improve the soil fertility.

7. Using the information on the board created in the "What is an Element" lesson, ask what a fertilizer high in Nitrogen would do to a plant—what kind of plants would need that? A fertilizer high in Phosphorus? Potassium?

8. Challenge students to look around their home or stores to see where they see these fertilizer products.

Corn Math Lesson

1. Distribute Corn Math Worksheet as a classroom activity or homework assignment

Suggested Reading Materials:

- *Corn Belt Harvest.* By Raymond Bial

Additional Worksheets:

- *Amazing Corn Activity Booklet.* Sponsored by Wisconsin Corn Promotion Board
- Careers Guide related to corn
- Ag Statistics Lesson Plan related to corn

Related activities:

- Explore these nutrients roles in food and foods that are high in them.
- Soil Sammy activity
- Slice of Soil activity
- Edible Soil activity

Periodic Table of the Elements

Period \ Group**	1 IA 1A	2 IIA 2A	3 IIIB 3B	4 IVB 4B	5 VB 5B	6 VIB 6B	7 VIIB 7B	8 -------	9 VIII ----	10 ---	11 IB 1B	12 IIB 2B	13 IIIA 3A	14 IVA 4A	15 VA 5A	16 VIA 6A	17 VIIA 7A	18 vIIIA 8A
									-------- 8 --------									
1	1 H 1.008																	2 He 4.003
2	3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
3	11 Na 22.99	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.07	17 Cl 35.45	18 Ar 39.95
4	19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.88	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.47	28 Ni 58.69	29 Cu 63.55	30 Zn 65.39	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
5	37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
6	55 Cs 132.9	56 Ba 137.3	57 La* 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 190.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.5	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (210)	85 At (210)	86 Rn (222)
7	87 Fr (223)	88 Ra (226)	89 Ac~ (227)	104 Rf (257)	105 Db (260)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 --- ()	111 --- ()	112 --- ()		114 --- ()		116 --- ()		118 --- ()

Lanthanide Series*	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (147)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
Actinide Series~	90 Th 232.0	91 Pa (231)	92 U (238)	93 Np (237)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (249)	99 Es (254)	100 Fm (253)	101 Md (256)	102 No (254)	103 Lr (257)

CORN BABY ACTIVITY
START CORN IN A PLASTIC BAG

Background Information:

Most corn grown in the U.S. is used to feed livestock or for human consumption. Poultry, beef, pork and dairy producers use more than 55% of all the corn grown in the U.S. The rest is exported or sold to other countries and maybe used to feed livestock. For more info, visit **www.ncga.com**

Materials Needed:

- Jewelry size resealable bag (found in craft stores)
- Crystal soil (found at most garden centers)
- Hole punch
- Water
- Measuring spoons
- Corn plant
- Seeds of corn- (packaged)
- Yarn or string

Procedure:

1. Show stalks of corn (or corn plants) to the class and pass around a bag of cob or shelled corn. Explain that corn is a "renewable resource," which means they are never "all used up" because more can always be grown.

2. Explain that corn is a valuable source of many nutrients that our bodies need every day. Corn is found in many different products that we use each day that have been processed into such things as: starch (examples: baby food, baking powder, salad dressing, bookbinders, glue); syrup (examples: soda pop, chewing gum, dessert icing, fireworks, adhesives); ethanol fuel (examples: popular additive to reduce reliance on foreign oil and improve air quality in polluted U.S. cities), dextrose (bakery goods, fruit juices, peanut butter, antibiotics, citric acid, lysine) and oil (examples: margarine, potato chips, soup, soap, paint, rust preventative).

3. Complete Corn Baby Activity with class.

Activity Directions:

1. Punch a hole in the top of your bag (above the seal).
2. Place ¼ teaspoon of crystal soil into the bag.
3. Add one tablespoon of water.
4. Gently push in two seeds of corn.
5. Seal your bag firmly.
6. Insert the yarn to make a necklace.
7. Wear your Corn Baby around your neck and under your shirt to keep it in a warm, dark place.
8. Check your Corn Baby each day for germination and record the growth.

Corn Kernel

One of America's greatest strengths is our ability to grow our own food. We also help others by exporting corn.

The endosperm accounts for about 82 percent of the kernel's dry weight and is the source of energy (starch) and protein for the germinating seed. Starch is the most widely used part of the kernel and is used as a starch in foods—or as the key component in fuel, sweeteners, bioplastics and other products.

The pericarp is the outer covering that protects the kernel and preserves the nutrient value inside. It resists water and water vapor—and is undesirable to insects and microorganisms.

The germ is the only living part of the corn kernel. The germ contains the essential genetic information, enzymes, vitamins and minerals for the kernel to grow into a corn plant. About 25 percent of the germ is corn oil—the most valuable part of the kernel, which is high in polyunsaturated fats and has a mild taste.

The tip cap is the attachment point of the kernel to the cob, through which water and nutrients flow—and is the only area of the kernel not covered by the pericarp.

Source: 2006 World of Corn. Published by the National Corn Growers Association.
http://www.ncga.com/WorldOfCorn/main/kernel.asp

FUN FACES OF WISCONSIN AGRICULTURE

WISCONSIN DATCP FERTILIZER LABELING REQUIREMENTS

Source: Wisconsin Department of Agriculture, Trade and Consumer Protection Website. October 24, 2006

http://www.datcp.state.wi.us/arm/agriculture/pest-fert/fertilizers/lab_reg_fert.jsp

Wisconsin requires that bagged fertilizer products meet state labeling requirements. Common labeling problems include bagged products listing only a product grade with no guaranteed analysis or fertilizer grades with guarantees for secondary nutrients or micronutrients.

Requirements

To comply with Wisconsin's fertilizer regulations, all bagged fertilizers, including packaged custom mixed fertilizers, must be conspicuously labeled with the following information:

1. Brand or product name
2. N-P-K grade
3. Net weight
4. Name and address of the licensed manufacturer/distributor

Fertilizer Grades

The Wisconsin Fertilizer Law defines "grade" as the percentage guarantee of total nitrogen, available phosphorus (or available phosphate), and soluble potassium (or soluble potash). A more common way is to refer to the percentage of N-P-K.

Example: 9-23-30 means 9% nitrogen, 23% available phosphate and 30% soluble potash.

Guaranteed Analysis

The guaranteed analysis tells the user the guaranteed percentage of the nitrogen, phosphate and potash within the product. The product cannot contain more or less of a listed guarantee. To ensure the guaranteed analysis is correct, the Wisconsin Department of Agriculture, Trade and Consumer Protection randomly samples and tests fertilizers each year.

Label Example

SUPERGRO SUPREME	
19-19-19	
Guaranteed Analysis	
Total Nitrogen (N)	19%
Available Phosphate (P2O5)	19%
Soluble Potash (K2O)	19%
Net Wt. 50 lbs.	
Manufactured by: The Fertilizer Company Anywhere, USA	

Secondary Nutrients and Micronutrients
Bagged fertilizers can contain secondary or micronutrients such as zinc, copper or calcium. However, these secondary or micronutrients must be properly listed on the product label.

You cannot list additional plant nutrient guarantees within the grade statement. For example, a bagged fertilizer contains 5% zinc. The label cannot state "9-23-30-5Zn."

What is acceptable is to follow the grade statement with the secondary or micronutrient percentage. The secondary or micronutrient can also be part of the product or brand name such as "9-23-30 with 5% Zinc" or "SupremeGro 19-19-19 with 5% Zinc."

If secondary and/or micronutrients are claimed to be present in bagged fertilizer, the percent claimed must appear in the guaranteed analysis and meet the minimum amount as required by law. The table below lists the minimum amounts for each secondary and micronutrient. Secondary and micronutrients must appear using the elemental form and the format as listed in the table. These requirements are also outlined in ATCP 40, our fertilizer rules.

Element	Percent
Calcium (Ca)	1.00
Magnesium (Mg)	0.50
Sulfur (S)	1.0
Boron (B)	0.02
Chlorine (Cl)	0.1
Cobalt (Co)	0.0005
Copper (Cu))	0.05
Iron (Fe)	0.10
Manganese (Mn)	0.05
Molybdenum (Mo)	0.0005
Sodium (Na)	0.10
Zinc (Zn)	0.05

These labeling requirements promote uniformity in labeling of bagged fertilizers, as well as informing consumers of the plant nutrient values claimed to be present in the fertilizer. Bagged fertilizers that are found to be in violation of Wisconsin's fertilizer regulations are subject to warning notices and fertilizer stop sales.

For more information about labeling requirements for bagged fertilizers, contact the fertilizer program at (608) 224-4541 or send an email agriculture@datcp.state.wi.us.

Soil Sammy

This activity is a good supplement to a lesson on soil and seed germination.

Soil is an important natural resource. Farmers must take good care of the soil so it will continue to grow food. Farmers must check the soil to make sure it has the right nutrients in the right amounts. If the soil doesn't have adequate nutrients, farmers need to adjust the balance of nutrients to grow healthy crops. Farmers may grow crops that add nutrients such as nitrogen to the soil, or they may add fertilizers containing nitrogen and other nutrients.

Materials Needed:

- Knee-high stocking
- Grass seed, 1 tablespoon each
- Potting soil
- Baby food jar
- Water
- Jiggle eyes
- Scissors and fabric
- Glue (quick drying craft glue is best)

Procedure:

1. Using knee-high hose, place some grass seeds in the toe where you want them to grow. The toe end of the hose is the head of Soil Sammy and the grass looks like hair when it grows.
2. Pack a handful of soil in the end of the hose on top of the seeds. Make sure the ball of soil is slightly larger than the opening of the baby food jar.
3. Tie a knot in the hose under the ball of soil.
4. Completely wet the head of the Soil Sammy. Place the top of the hose (which is the bottom of Soil Sammy) in baby food jar filled with water, making sure the head is above the mouth of the jar. The end of the hose will absorb water to feed the grass seed, which will germinate through the hose (you may have to cut a few small holes in the hose to help).
5. Now you can decorate! Suggestions include a round piece of fabric to fit over the mouth of the jar for a shirt, buttons glued to the shirt, jiggle eyes for the face, felt cut-out for the mouth, etc.
6. Water as needed and be sure to cut the grass "hair" and style as desired.

For Discussion:

Will the grass hair grow better or faster with fertilizer? Try it and find out. Add different fertilizers to the soil and water and see which grows best.

Add to the water:
Store-bought liquid fertilizer
Soda pop (it has phosphorus)
Apple juice (it has citric acid)
Lemon scented liquid soap (it has citric acid)
Ammonia (it has nitrogen)

Add to the soil:
Store-bought fertilizer stick
Coffee grounds (caffeine has nitrogen)
Baking soda (it has nitrogen)
Epsom salt (it has magnesium sulfate)
Cream of tarter (it has potassium)

Farmers must be careful to add just the right amount of fertilizer. Too much fertilizer can be harmful, and too little fertilizer can result in plants that don't grow well due to lack of nutrients. Farmers attend special classes and use math problems to figure out the right amount to use. You shouldn't use too much fertilizer either, but you can experiment with different amounts.

Wisconsin Soil Facts:

- In Wisconsin, 16.2 million acres of land is used for agricultural purposes.
- There are 560 different soils mapped in Wisconsin.
- Wisconsin's state soil is Antigo Silt Loam.

Edible Soil Profile

An **Edible Soil Profile** is something that looks like what you would find if you dug deep into the ground. But you can eat your soil profile, that's why we call it "edible". If you were to take a big machine, like an excavator, and dig a big hole in the earth, you would be able to see the different soil layers.

Bedrock (Reese's Pieces) – Bedrock is the deepest and a very hard layer of rock. It is usually very thick. If you dug many, many feet into the earth, do you think any animals or bugs could live in this layer? What kinds? There aren't any living animals or insects in this rock because it is too hard and animals can't dig through it. There isn't any sunlight or oxygen that far into the earth. Our groundwater is found in the bedrock because the rock can hold the water, like a big tank.

Shale (Organic Blue Corn Flakes or blue frosting) – It is also a type of rock, but appears more as layers on top of layers. If you lay your hand on top of your other hand, and then another hand on top of that hand, that gives you an idea of what this kind of rock looks like. Water can run through shale, but very slowly.

Clay (Crushed Nutter Butter Cookies) – Does anyone know what clay feels like? Is it hard or soft? Clay is very hard when it is dry, but if you get it wet, it feels softer and almost greasy. Clay is often used in the bottom of ponds to make the water stay in the pond because good clay will hold water. If the clay is mixed with soil or sand, it won't hold water as well. Maybe you use clay at home or school for art projects.

Coarse Sand (Roughly crushed Rice Krispies) – is made up of rock that has broken down into small pieces. If you took a handful of sand and threw it into a pond, the coarse sand would fall to the bottom faster than the fine sand because the pieces are bigger and heavier. Sand doesn't stick together like clay, so water will run through it.

Fine Sand (Graham Crackers crushed to powder) – is above the coarse sand. This kind of sand is tiny, like you would find on a shoreline. Sometimes it has tiny pieces of dirt, called silt, mixed in it. Insects and animals can move around in the fine sand, but there isn't any food there, so they move to the upper layers to find the food they need.

Subsoil (Vanilla & Chocolate Sandwich Cookies; crushed together, filling removed) – is just below the topsoil. What would you find living in the subsoil? Insects, worms, ants, groundhogs, chipmunks. The subsoil is usually gray or brown.

Topsoil (Chocolate Sandwich Cookie, with filling, crushed) – is the very top layer of soil and is what you usually walk on. When farmers are working in their fields and the wind is blowing, often you will see the topsoil blowing away. The topsoil is washed away if there is a heavy rain and there isn't any grass or crops to hold the soil in place. When you play in the yard and dig with your toys, you dig in the topsoil.

Conservation Layer (Oatmeal Crisp Raisin Cereal, gummy worms, M & M's) – covers the topsoil. This layer is made up of leaves, grass, sticks, bugs, worms, ants, rocks, and anything else that might fall to the ground. When the leaves, grass, and plants die, they form a layer on top of the soil to make it rich and nice for the animals and bugs.

A Slice of Soil

One of the most important natural resources that covers much of the earth's land surface is soil. All living things depend on it as a source of food, either directly or indirectly.

Our food producing land remains the same and yet the world population continues to grow. As a result, each person's food portion becomes smaller and smaller. It is the responsibility of each generation to use the soil wisely to insure the future. The following demonstration shows how little of the earth's surface is actually used for food production as compared with growing populations.

Materials:

- Large apple (softer apples work better)
- Paring knife (or heavy plastic knife)

Procedure:

1. Cut the apple into four equal parts. Three parts represent the oceans of the world. The fourth part represents the land area.
2. Cut the land section in half lengthwise. Now you have two one-eighth pieces. One section represents land such as deserts, swamps, Antarctic, arctic, and mountain regions. The other one-eighth section represents land where people can live but may or may not grow food.
3. Slice this one-eighth section crosswise into four equal parts. Three of these one thirty-second sections represent areas of the world which are too rocky, too wet, too hot, or where soils are too poor for production, as well as developed areas.
4. Carefully peel the last one thirty-second section. This small bit of peeling represents the soil of our earth upon which mankind depends for food production.