



## Welcome to Ag@School!

Class sets of this magazine, aimed primarily at 4th grade level, are FREE to subscribing Washington teachers. Instructions for subscribing are on page 3. This is the second of three issues for 2011-2012.

Produced by Washington Ag in the Classroom, Ag@School is designed to help teachers meet student educational goals as well as develop agricultural literacy. The teacher guide connects information to specific GLEs and EALR's that will help your students meet state requirements.

This issue is designed to help students understand:

- High-yield agriculture has allowed us to feed the world without bringing more land into production
- How Washington's location on the Pacific Rim relates to international trade
- Life on earth depends on plants, especially rice, wheat, corn and potatoes
- Technology is using scientific knowledge to find a better way of doing a job
- Agriculture is very dependent on many areas of science and engineering.

Reproducible activities in the teacher guide expand on concepts covered in the magazine. Included in the guide are instructions for a visual activity (The Earth as an Apple), vocabulary activities, answers to questions in the magazine, and post tests.

## The Earth as an Apple

### Environmental benefits of high-yield agriculture

Agriculture's relationship to the economy and our standard of living is important. But, equally important is the environmental impact of modern agriculture. Food production impacts the global environment more than any other human activity.

World population, land-use, food demand and how extensively high-yield agriculture methods are embraced will determine what happens in the future to the remaining wild lands on the planet.

We suggest the teacher do the "Earth as an Apple" (page 5 in this guide) prior to handing out this issue. Please read the background information prior to presenting the activity. The land conservation benefits of high-yield agriculture are too important to be overlooked.

## Vocabulary Words

Each issue introduces several words or word combinations that may be unfamiliar to students. These will appear in bold type the first time they are used. Words in this issue include: technology, high-yield agriculture, staple food, tuber, rootstock, scion, Pacific Rim, export, import, heredity, DNA, genome, hybrid vigor, tassel, husks, kernels, corn silk, prop roots, tubers and cereals.

### Scientists – Engineers – Specialists:

Farmers depend upon scientists of all sorts to do research adding to our knowledge of the world around us, engineers to translate that knowledge into new equipment and processes, and specialists that assist farmers with problems in the field. These men and women do not necessarily have farm backgrounds, nor do they live on farms. They are employed by universities and industry and are a huge part of the success of American agriculture.

Watch for clues in this issue of Ag@School identifying a few of the dozens of science-based careers beyond that of farmer or rancher. Get more information at:

[www.ars.usda.gov/is/kids/scientists/scientistsframe2.htm](http://www.ars.usda.gov/is/kids/scientists/scientistsframe2.htm)

## Technology is the Key

### Background:

There are five outstanding technological developments in the last 60 years that have led US agriculture to its current production levels:

1)Mechanized equipment (tractors and combines rather than horses and mules); 2)widespread use of man-made fertilizers; 3) chemical pesticides; 4) computers and Global Positioning technology; and 5) advances in genetics of crops and animals either through cross breeding or biotechnology.

## GLE & EALR Connections

### Science:

APPA & APPG pages 2,4,5,6,7, TG  
LS1B page 7 LS1E page 8, TG LS3B pages 2,5

### Math:

4.1.E TG

### Health & Fitness

1.5.1 page 8 TG

### Social Studies:

2.2.2 and 3.3.1 page 3

### Reading:

The articles and activities throughout the magazine link to most reading standards. They can be used to build skills in outlining, vocabulary, comprehending important ideas, reading factual material, or reading to learn new information.

### Writing:

The post test is designed to help prepare students to write. The prompts include the four modes of writing: expository, narrative, descriptive and persuasive.

## Page 3 – Washington and Trade

Ask students to describe the “Pacific Rim”. Put an ‘X’ on the map to show Washington State.

### Discussion starters:

1. Discuss imports and exports. How are our lives changed by trade? Examine your classroom for things that were imported (look at clothing labels too). Find the countries on a globe. How does trade with other countries (and states) benefit both partners? (More than 95% of the world’s population lives outside the US, but we have enormous resources. Trade is a way of meeting consumer needs and wants not satisfied domestically.)
2. Think of food products that we cannot grow in WA (bananas, coffee, oranges, spices). Why can’t we grow these here? (climate, length of growing season, soil type). What about seasonal products (lettuce, grapes) that are grown here during summer but not in winter. How can they be offered in stores all year around? Where do they come from? Why are seasons reversed between the Northern and Southern hemispheres?

### Answers to Page 3 - Pacific Rim Wheat Markets:

Japan, Philippines, South Korea, Indonesia, Thailand, Taiwan, and Chile are Pacific Rim countries (Yemen, Nigeria, and Iran are not)

## Pages 4/5 – Technology and Apples

Technological change has dramatically affected agriculture, perhaps more so than any other industry. The benefits to the American consumer have been tremendous. Not only is our food less expensive, it is safe and abundant. It is produced on less land, with much less environmental impact than the subsistence farming practiced in much of the world.

### Discussion starters - page 4

1. What are pesticides? Pesticides are chemicals that control or eliminate pests. Examples of pests include germs, weeds, harmful insects, or rodents. A rose growing in a wheat field is a pest. We use pesticides in hospitals, schools, homes, restaurants, as well as on farms. Without pesticides food production would drop by half and we would have to farm more than twice as much land to produce the same amount of food. Pesticides can save lives, save land, save wildlife, save water, and generally make our lives more comfortable. Examples are chlorine to control algae in a swimming pool (algaecide); a pet’s flea collar (insecticide); germicides in hospitals; fungicides to control mold in showers; and herbicides to control weeds (79% of all agricultural pesticides used in the US are herbicides).
2. Part of technology is improving what machines can do. What is the most important reason for creating improved ag machinery? (To reduce the amount of labor involved resulting in lowered costs). Why are some crops still harvested by hand? (flowers and some fruits are fragile and machines might damage them, also smaller farms may be unable to afford technology.) Check out how a combine works at <http://dsc.discovery.com/videos/how-stuff-works-corn-combine.html>

## Page 5 – Genetics – DNA – Genomes

### Genetic Science in Agriculture

Farmers have been improving plants and animals since agriculture began by selecting the best individuals to use as parents for the next generation. Careful selection has resulted in leaner meats, faster growing trees, larger and tastier fruit and thousands of other improved products. Traditional plant breeding involved the crossing of hundreds of genes with the hope of randomly passing on desirable traits. Using new technology, scientists can now identify the genes that carry a certain trait, and pass that single trait on. New crops are being developed that contain less fat, stay fresh longer, require less water, and even have built-in resistance to diseases and pests. This more precise science also eliminates passing along undesirable traits that might result in inferior products.

### What is DNA?

The scientific name is deoxyribonucleic acid. DNA is found in every cell and carries the genetic information, or genes. If you could somehow untangle the DNA in your cells, it would stretch from the earth to the sun and back 30 times. Students are probably familiar with DNA as it relates to crime solving and know that each person’s DNA is unique. Let your students isolate DNA: [www.csulb.edu/~bruss/documents/DNAIsolationfromOnion.doc](http://www.csulb.edu/~bruss/documents/DNAIsolationfromOnion.doc)

### Genes and Genomes

Genes are distinct portions of a cell’s DNA. They are hereditary units passed down from parents. Genes are coded instructions that determine a particular characteristic, like red hair or blue eyes. Plants and animals also pass genetic traits to their offspring. Genes are packaged in coiled bundles called chromosomes. An organism’s complete set of chromosomes is called a genome. It is a map of where all the thousands of genes appear in each chromosome. Size or intelligence of a species does not determine the number of genes or chromosomes.

## Name the Big Four

### Potatoes, wheat, corn, rice

Why does Idaho produce more potatoes than Washington? There were 294,000 acres of potatoes planted in Idaho, and only 134,000 acres in Washington (2010).



## Cereal Grains---Staples

Cereal grains are annual grasses. Think what a technological advance it will be when scientists develop perennial cereal grain varieties! Crops will not have to be seeded annually which would be a huge savings of labor and resources. Staple foods are those regularly consumed in a community, from which people obtain a significant proportion of their caloric requirements.

## Make Your Own Biodegradable Plastic Stuff

Students may be familiar with corn starch packing peanuts that dissolve in water, as contrasted with Styrofoam peanuts that do not decompose easily. It's easy to get the basic idea of making biodegradable plastic by thoroughly mixing 1 tablespoon corn starch, 2 drops of vegetable oil, and 1 tablespoon cold water. Microwave on high for 20 seconds. When cool, you can form the mixture into a ball. It is very plastic and will even bounce. Mix it in warm water and it falls apart.

## Page 8--My Washington Plate

Draw students attention to how the Washington products discussed in this issue of Ag@School fit into the 'my plate' concept. Reinforce the concept of imports from page 3 by discussing which fruits and food products are found on the plate, but not raised in Washington. Encourage students to select healthy snacks (fruits and veggies) and reduce junk food. **Check out the website [www.freemyplate.com](http://www.freemyplate.com) for great activities and downloads for teaching nutrition.** Also [www.choosemyplate.gov](http://www.choosemyplate.gov)

## Count Comparisons

Have students write the numbers and compare the values of each digit using place value: 24 million ducks, 270 million turkeys, 9 billion chickens, and 90 billion eggs.

## TG Page 4--Answers to Label Sleuth

Milk is the most nutrient dense, followed by fruit juice. Soda is empty calories. Fruit juice should also be limited as it concentrates the sugar and eliminates the fiber. Eating a piece of fruit would be wiser.

## Answers to Plants Need Food Too TG Page 6

Field A will grow corn, potatoes, or wheat; Field B will grow only corn; Field C will grow corn or wheat. Humans also have a nitrogen requirement. We can't utilize elemental nitrogen, Instead we eat proteins (all contain nitrogen).

## Answers to Crossword TG Page 6

Across: 1. Genetics 4. Hybrid vigor 9. Genome 12. Staple 13. Kernels 14. Scion 15. Silk 16. Potato 17. Washington

Down: 2. Ethanol 3. Graft 5. DNA 6. Red Delicious 7. Cereals 8. Coddling moth 10. Tassel 11. CA

## Teachers—FYI

Don't forget to check out the rules for the next art contest [www.waic.net](http://www.waic.net)

Teachers can ask Bingo questions too—What question do you have about agriculture?

**Visit**  
**[www.waic.net](http://www.waic.net)**

FOR LINKS TO:

- Lessons • Activities • Information
- Student Websites • and more!

**Washington Ag in the Classroom**  
**is your launch pad for information and**  
**activities about all fields of agriculture!**

## Publication and Credits

Ag@School is a publication of Washington Agriculture in the Classroom, a non-profit entity created in 1981 to encourage and help teachers increase agricultural literacy in their students. Both public and private groups including the WA Dept. of Agriculture, WSU, commodity commissions, farm organizations, agribusinesses and individuals, support the mission. Teachers may reproduce any pages for use.

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**(Post-Test) TELL WHAT YOU LEARNED!**

1. TELL THE READER HOW GROWING APPLES HAS CHANGED FROM WHEN JOHN CHAPMAN (JOHNNY APPLESEED) GREW TREES TO GROWING APPLES TODAY. DO WE NOW HAVE MORE CONTROL OVER THE TRAITS OF APPLES?
2. PERSUADE THE READER THAT EXPORT TRADE IS IMPORTANT TO WASHINGTON. GIVE REASONS TO SUPPORT YOUR POINT OF VIEW.
3. DESCRIBE THE FIVE SECTIONS OF MY WASHINGTON PLATE. WHY IS IT IMPORTANT TO EAT ACCORDING TO THIS PLAN?
4. CHOOSE A JOB THAT AGRICULTURE DEPENDS UPON AND EXPLAIN WHY SCIENCE IS AN IMPORTANT SUBJECT TO INCLUDE IN STUDIES FOR THAT CAREER.

Export Trade



Agricultural Technology

**Label Sleuth**

Collect nutritional information from a carton of milk, a can of soda, and a box of fruit juice. Compare the total calories and the amounts of vitamins and minerals in each. Which one is the most nutrient dense (gives the highest amounts of vitamins, minerals, and protein for the amount of calories per serving)?

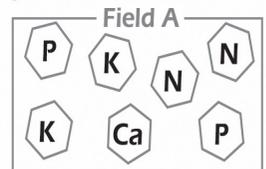
Nutrition Facts	
Serving Size 198g (198 g)	
Servings Per Serving 1	
Total Fat 64g	99%
Saturated Fat 16g	80%
Trans Fat	0%
Cholesterol 0mg	0%
Sodium 1485mg	32%
Sugars	

**PLANTS NEED FOOD TOO!**

Just as we need vitamins and minerals from our food to grow, plants need nutrients from the soil to grow. Nitrogen, phosphorus, potassium and calcium are some of the nutrients that food crops need. About 50 years ago scientists learned how to test soil to see what was missing. Farmers could then apply the missing nutrients in fertilizer. This increased yields.

Using the key decide what crops you could plant in each field.

**Key:**  
**Ca** = Calcium  
**N** = Nitrogen  
**P** = Phosphorus  
**K** = Potassium



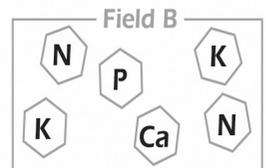
Crops I could plant:

\_\_\_\_\_

\_\_\_\_\_

**Corn needs:**

- 2 Ns
- 1 P
- 1 K



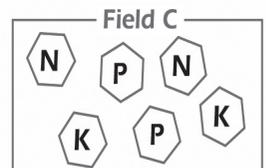
Crops I could plant:

\_\_\_\_\_

\_\_\_\_\_

**Potatoes need:**

- 2 P's
- 2 N's
- 1 Ca
- 2 K's



Crops I could plant:

\_\_\_\_\_

\_\_\_\_\_

**Wheat needs:**

- 1 N
- 1K
- 1-1/2 P

**FEEDING PEOPLE – THE BIG FOUR**

List foods you've seen or eaten this week. Which of them - plain or processed - came from THE BIG FOUR?

**RICE**

\_\_\_\_\_

\_\_\_\_\_

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**WHEAT**

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**CORN**

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**POTATOES**

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# Earth as an Apple

**MATERIALS REQUIRED:** Large apple and paring knife

**OVERVIEW:** Cut an apple into smaller and smaller fractions to visually demonstrate how the earth's surface is used. All the people on earth, nearly 7 billion, live on 1/8th of the surface. Only 1/32 of the surface is now used for growing food.

**OBJECTIVE:** Understanding why high-yield agriculture (growing more on less land) is necessary to avoid plowing more land to feed a growing population demanding better food.

## Explain that the apple represents the earth

### Cut apple into four quarters:

- Three of those represent the oceans. Set those 3 quarters aside
- Remaining quarter represents total land area of planet.

### Cut the land quarter into two pieces:

- One piece (1/8) is inhospitable to people. People can't live there. It includes polar regions, deserts, swamps, and very high or rocky mountains. Set it aside.
- Remaining 1/8 is land where all the people live, nearly 7 billion.

### Cut the 1/8 where people live into four pieces (4/32nds):

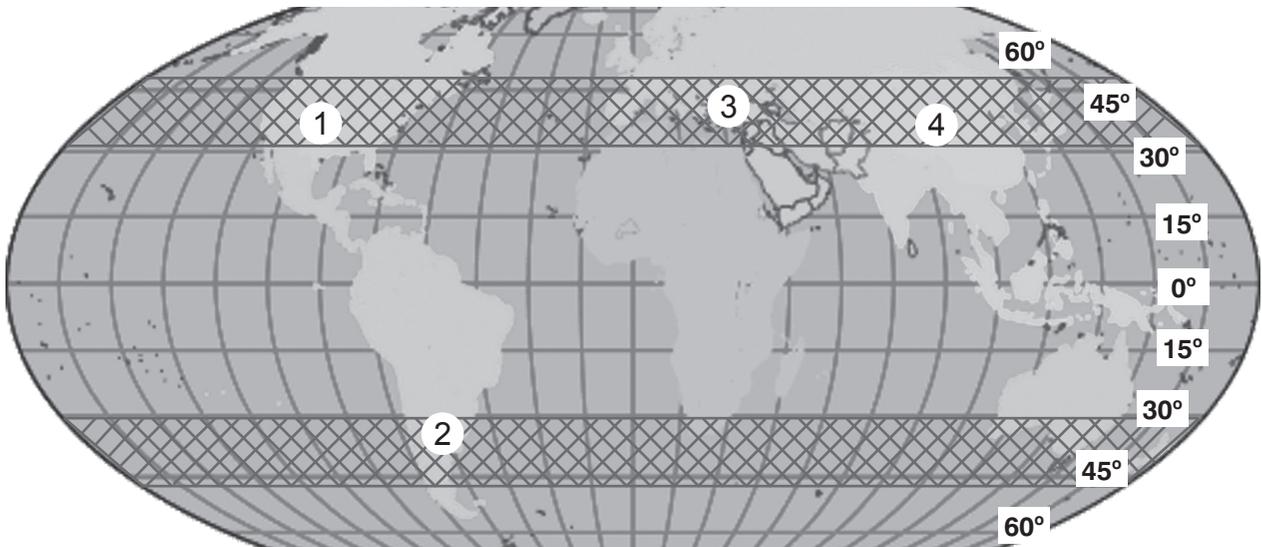
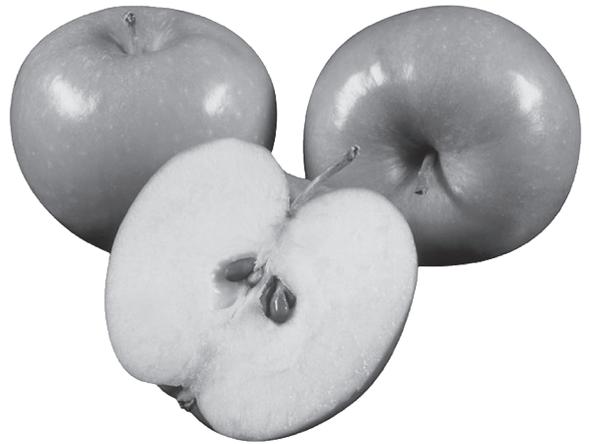
Three of these are land that does not grow food.

- Land that is too wet, too dry, too cold, too steep, or the soil is too poor.
- Land covered by cities, shopping centers, freeways, and all the things we have built on the earth.
- Land now used for other things – parks, rainforest, wildlife habitat, wetlands and recreation areas.

Set those 3 sections aside.

### Carefully peel the last 1/32 slice:

- This tiny bit of peeling represents the topsoil, the thin skin of the earth's crust upon which man depends.
- Less than 5 feet thick, it is a very fixed amount of food-producing land



## **Greenbelts and Breadbaskets**

In addition to the latest technology, US farmers have something else going for them... good land! The best land grows more food on less acres. That leaves more land for wildlife, parks and forests.

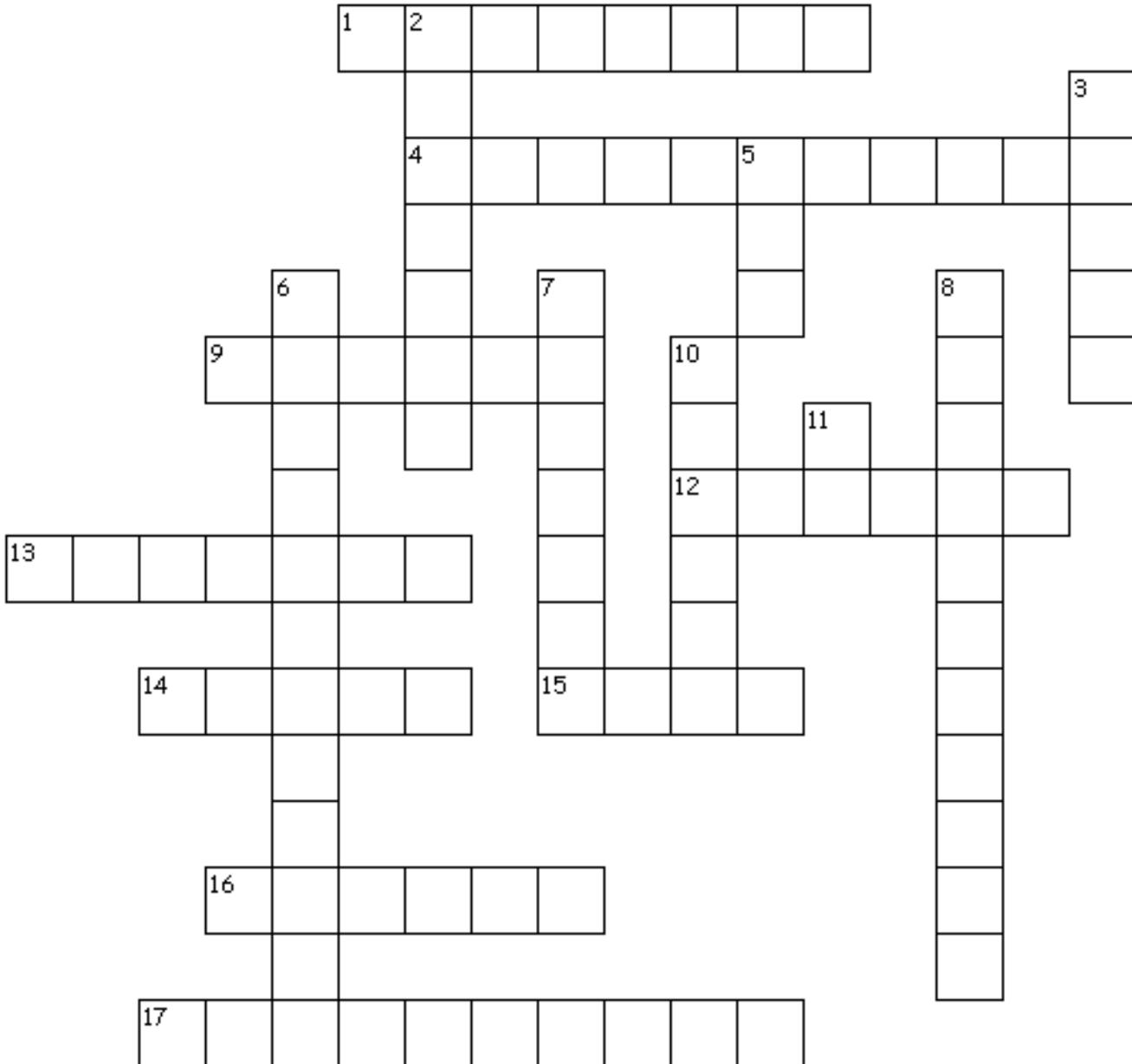
Look at the map above. There are two "greenbelts" that run around the earth midway between the equator and the poles where growing conditions are best. These include soil type, rainfall, temperature, frost-free days, daylight hours and length of growing season.

Within these two greenbelts are four regions that are perfect for growing cereal crops. These regions are called the "breadbaskets" of the world. They are the US, the Ukraine, the North China Plain, and the pampas of South America.

Fill in the 'breadbasket' that corresponds to that number on the map.

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_

# Apples - Corn - Potatoes



## Across

1. special branch of biology (heredity)
4. stronger plant by crossing strains (2 wds)
9. DNA map of genes
12. major food commodity
13. corn seeds
14. living shoot or bud for grafting
15. corn "thread" carrying pollen
16. Big Four tuber
17. top apple producing state

## Down

2. corn fuel for cars
3. unite rootstock and scion
5. genetic information carrier
6. leading apple export variety (2 wds)
7. six true grains
8. biggest apple pest (2 wds)
10. flowers of corn plant
11. storage syst. for apples