



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 4. Back issues are available at www.waic.net.

This is the first of three issues for 2013-2014. Delivery of the next two issues will be in January and April.

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 activities to specific GLEs and EALR's that will help your students meet state requirements.

This issue is designed to help students understand:

- The economic importance and diversity of Washington agriculture
- The importance of agriculture to their lives
- Washington geography and climate and how these influence agriculture
- The benefits of dams and how locks enable river transportation
- Genetic engineering is an important tool in improving crops and ag products
- Cheese is an important milk product and is often made with GE enzymes
- Wheat grown in Washington is mostly exported

Reproducible activities in the teacher guide expand on concepts covered in the magazine. Included in the guide are vocabulary activities and post tests.

Why Agricultural Literacy?

Agriculture is society's lifeline and an integral part of our heritage. Unfortunately as our country moved from agrarian to urban, people lost contact with the main industry necessary for survival—food production. America's largest industry has dropped from public discourse except for the occasional media splash. Yet we all eat, and it is important that we have an understanding of where our food is produced and who we depend upon to deliver it to our tables.

Less than 2% of the US population is involved in production agriculture (farming) yet 24 million American jobs are dependent upon it. Agriculture is more than working the land and tending the animals. This huge industry—production, processing, transportation, and marketing—generates billions of dollars each year. Agriculture is vital to national security, a stable economy, and the US trade balance.

Vocabulary Words

- Each issue will introduce 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: Pacific Rim, precipitation, latitude, irrigation, locks, enzyme, gene, GMO, curds, and whey.

GLE, EALR & CCSS Connections

Science:

SYSC, APPA, APPG

Math:

CCSS Math 4.MD.A.1

Health & Fitness:

1.5.1 and 1.5.2 pages 3,7 TG page 6

Social Studies:

EALR 2.2.1, 2.2.2, 2.4.1, and 3.1.2

Reading:

CSS ELA RI.4.7, RI 4.1

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.

Cover - Agriculture—From Field to Table

Background:

Washington is full of agriculture. It is everywhere! Yet, agriculture is different in each part of the state due to our diverse geography and climate. Agriculture is much more than farming. The industry includes producing raw products, transforming them into things people use, distributing them around the state, nation, and world, and marketing them to consumers. These steps employ thousands of people in hundreds of different jobs.

Discussion starters:

1. Discuss reading maps and finding towns on a map. Go to the Tacoma Public Library website: www.tpl.lib.wa.us/SiteMap.aspx and click on Washington Place Names to research the history of how our cities and counties got their names.
2. Which of the crops or products around the edges of the cover have you seen growing? What crops and animals are raised where you live?
3. Have students draw the 117th Longitude line through Washington State (basically the eastern border with Idaho) and 124th Longitude line (basically the western edge where Columbia river enters Pacific Ocean)

Answers to questions on the cover:

1. 5, 30
2. 2, 125
3. 195, 75
4. 195, 26, 395, 135
5. 82, 120
6. 90, 110
7. About 755
8. 9
9. 7

Page 2 – Ag is Science & Technology

Agriculture is responsible for the food we eat. Food comes from farms; it doesn't just magically appear in grocery stores or restaurants. Farmers and ranchers depend on a wide variety of ag-related careers. Have students brainstorm jobs that are needed to bring food to their tables. Have them research related ag careers like agronomist, entomologist, mechanic, irrigation manager, satellite guidance technician, or food photographer.

Think

If we had no farmers, how would your life be different? Would your parents have the same jobs as today? Would you have different chores? If we didn't have semi-trucks would your diet be the same? Would the foods you eat change with the seasons?

What is a GMO?

Creating a GMO can be simplified into 5 steps:

1. Identify the gene that codes for the protein of interest e.g. insulin
2. Remove gene from the donor e.g. human cell
3. Insert gene into a host e.g. a bacterium
4. Grow the altered bacteria on a large scale to make the protein product
5. Isolate the protein

Genetic modification involves the mutation, insertion, or deletion of genes, but not all genetic modification is considered GE or GMO. Although by definition we do not have GE wheat, we do have a variety, named "Clearfield" that will tolerate the herbicide Imazamox (brand name Beyond).

Clearfield wheat is non-GMO, unlike Roundup-resistant corn and soy. This genetic variant was created by a process called chemical mutagenesis. Scientists exposed wheat seeds to the chemical, sodium azide, to induce mutations.

In addition to chemical mutagenesis, gamma and x-ray radiation are also used on seeds and plant embryos to induce mutations. This all falls under the umbrella of "traditional breeding methods" and "hybridization", and are considered non-GMO

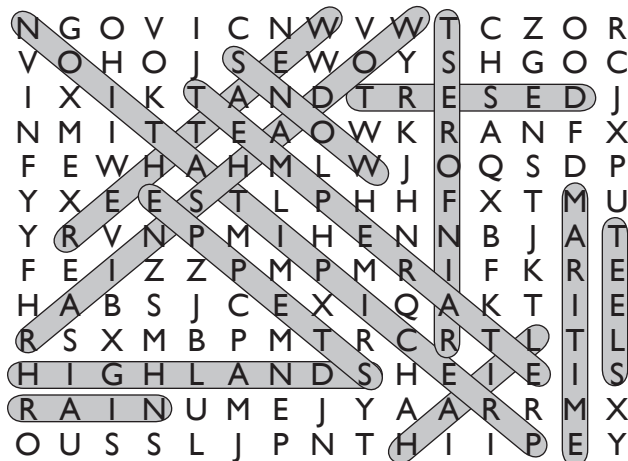
Page 3 – Climate

Discussion starters:

1. Why are different crops and animals raised in different regions of Washington? (They all have unique requirements for climate, rainfall, terrain, and soil to thrive)

2. What is meant by a "rain shadow"? (as clouds rise they lose moisture causing a dry region east of the Cascades) How does it affect the types of crops grown east of the Cascades? (With irrigation, anything can be grown, without irrigation farmers are limited to grain, grass seed, legumes, and some oil seed crops) Using the precipitation map, have students find rain shadow areas caused by the Olympic Mountains.
3. Track the fruit growing areas in Washington. They follow the banks of major rivers and lakes and the Columbia Basin irrigation project. There is enough water in these areas to make "micro-climates" that are warmer in the winter and cooler in the summer.

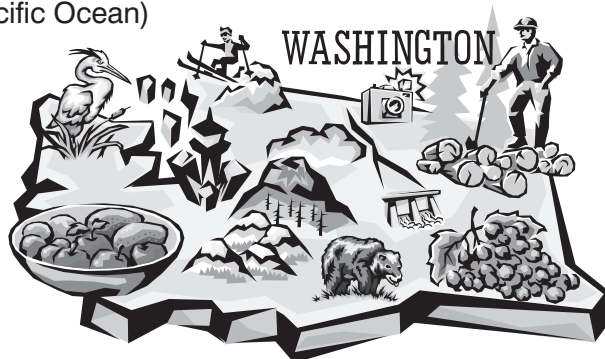
Climate Word Search



Page 4/5 – Grown in Washington

Discussion starters:

1. What geographical features make WA such a diversified agricultural state? (Next to the Pacific Ocean; deep-water ports in Puget Sound; Columbia River for navigation, irrigation and power generation; Cascades split the state; volcanoes have provided the rich ash component of our soils; elevation goes from sea level to the top of Mt. Ranier)
2. Discuss individual growing regions and what factors make each an ideal place to grow specific crops or products (have students refer to the boxes on pages 4-5)
3. Why is a location on the Pacific Rim so important? (Closer to trading partners, especially around the Pacific Ocean)



Page 6 – Rivers, Dams and Locks

Remind students that **technology involves changing the natural world to meet human needs or wants**. Our rivers are excellent examples of this. With our system of dams and locks, we provide water for irrigation, electricity production, recreation, cities and industry. We have flood control, transportation, and still provide for the needs of salmon. Discuss how engineers found solutions to many problems to better serve our citizens and our economy. This in turn has improved the quality and quantity of crops we can raise.

Background:

1. Rock Island dam was the first large dam on the Columbia (1933). Bonneville Dam was second, built in 1938 for electricity generation. Grand Coulee was authorized as one of the many projects to put men back to work after the depression and was built to supply irrigation water for the Columbia Basin Project, using the sale of electricity generated by the dam to pay for the construction of the dam and the irrigation delivery system. In 1948 the Snake and Columbia Rivers crested simultaneously and created a flood that wiped out a section of Portland. River-use planners turned their attention to flood control (as well as navigation and power generation) as the remaining dams were completed on the two rivers.
2. Deep water ports are those capable of handling a fully laden Panamax ship. That is a ship that is the maximum size that can still fit through the Panama Canal. As the Panama Canal undergoes its current expansion, the list of ports will change. It is also important that we dredge the Columbia River channel to keep the necessary depth clear for these huge ships to reach the largest Columbia ports. Other ports like Bellingham and Olympia are not equipped to handle Panamax ships. Bremerton is a large port for the US Navy.
3. Discuss the different ways people use and depend upon the Columbia and Snake Rivers (recreation, irrigation, water supply, power generation, flood control, wildlife habitat, transportation and commerce. Can the students think of more?)

Think & Discuss:

Have students name three renewable energy sources. (hydro-electric power, wind power, and solar power). Why is hydroelectric energy the most reliable?



Discussion starters:

Hydroelectric power is the most reliable because water behind the dams can be released through the generators at

3

any time to supply electricity. If the sun is not shining or the wind is not blowing, solar and wind energy do not produce electricity. In fact, hydroelectric power is called upon to deliver electricity when these other power sources wane.

Hydro-electric power is possible on the Snake-Columbia system because of the drop in altitude between the source of these rivers and the ocean. A large river like the Mississippi is unable to use hydro-electric generators because it is relatively flat along its' length.

Fossil fuels are sources of energy derived from plants and animals that lived long ago, such as coal, oil, and natural gas. They are carbon based and release carbon dioxide into the atmosphere when burned. Our clean, renewable hydropower keeps the Northwest's carbon footprint at half that of the rest of the nation. Removal of the Snake River dams would add 5.4 million tons of carbon dioxide to the atmosphere each year. Replacing the energy capacity lost by Snake River dam removal would take at least three nuclear power plants or six coal-fired or fourteen natural gas-fired plants.

It would also take an additional 120,000 rail cars or more than 700,000 semi-trucks annually to move the cargo that now travels by barge on the Snake-Columbia river system. That traffic would stress already overtaxed bridges and highways.

Sensible solutions have been found and implemented to benefit fish and yet protect the value of the Columbia-Snake River system to Northwest families and businesses. Additional hydropower generation would seem to be logical.



More info at:

www.nwriverpartners.org/issues-river-benefits

That's a Lot of Wheat

10,072,800,00# divided by 2000#/ton= 5,036,400 tons

Page 7 – Cheese

Curds are coagulated milk solids and whey is the remaining liquid portion of milk in the cheese-making process. Students might think of cottage cheese, but although that is a curd cheese, it is rinsed to remove acidity, to make a sweet curd cheese, and then has cream and salt added back to it. Whey is drained out of the curds when making cottage cheese. Whey is primarily water, but also contains lactose (milk sugar) and protein. Whey has an acidic tang, sort of like drinking really watery, unsweetened, plain yogurt. There is a large demand for whey protein as a food additive and nutritional supplement. Chances are, students would not enjoy Miss Muffet's curds and whey. (A tuffet by the way, is a grassy mound.)

The favorite cheese in the US is mozzarella (think pizza), followed by cheddar. We make cheese to help preserve milk. The main preservatives are salt and acids.



Pasteurization is the process of heating milk to a specific temperature for a specific period of time in order to kill microorganisms that could cause disease, spoilage, or undesired fermentation.

Because of the limited availability of mammalian stomachs for rennet production, cheese makers have looked for other ways to coagulate the milk. There are many sources of enzymes, ranging from plants, fungi, and microbial sources, that can substitute for animal rennet. Most hard cheeses contain an enzyme produced by GM microorganisms.

Page 8 - Wheat

Wheat has consistently been in the top six ag products in Washington State. In 2011, Apples were the top value, followed by dairy products, wheat, potatoes, hay, and cattle & calves (beef). These top six accounted for 69% of the value of all ag commodities raised in 2011 in Washington.

Washington's Top Six Crops (2011)

TG page 5 activities

Answers are apples, milk, wheat, potatoes, cattle, hay



Apples are in the fruit group, potatoes in the vegetable group, wheat in the grains group, cattle in the protein group, and milk in the milk or dairy group.

Students should be reminded that the directions ask for favorite foods produced in Washington (citrus fruits, bananas, sweet potatoes, jicama, etc. are not commercially produced in our climate). Eggs, despite being found in the "dairy case" are part of the protein group, not the milk group.

Writing Prompts

1. Create a narrative about making cheese. Who might have discovered that enzymes in a calf's stomach would turn milk to curds?
2. Tell why weather and climate are important to farmers. For instance, which fruits can we raise in Washington, and which ones will not survive here?
3. What is your favorite food grown in Washington? Describe how it looks, smells, and tastes. What color and texture does it have?
4. Some people believe that the lock and dam system on the Snake and Columbia Rivers should be removed. Do you agree or disagree? Write to persuade a friend of your opinion. Give reasons to support your position.)

Learn More About Nutrition

Excellent materials are available at the dairy council website www.eatsmart.org Check it out: WA teachers can receive **\$20.00 FREE materials** each calendar year.

Get the Facts

www.nass.usda.gov/wa/ - WA State agricultural statistics

Become a Washivore

Check out the brand new website www.washivore.org for fun facts and profiles of Washington Ag products.

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, agri-businesses and individuals, support the mission. Teachers may reproduce any pages for use.

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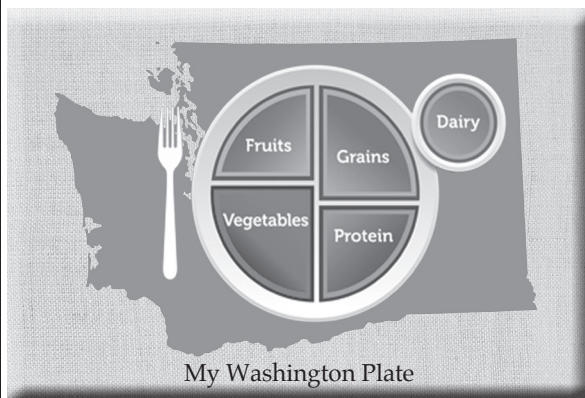
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Thank you in advance for your feedback. Sorry, subscriptions are not accepted by phone

Washington's Top Crops (2011)



Hints:

- Roundish, crispy fruit, red, green or yellow
- Beverage produced by cows
- Grain most often consumed by humans
- Root vegetable, mashed, fried, baked, or chipped
- Animals that produce steaks and burgers
- Humans don't eat it; cattle do

E M O B C K L P
 A L V O L A O T
 Z M T I O T K A
 T R M T A P R E
 H A Y T A E U H
 C R O W W C Q W
 S E L P P A C U
 S U Z X C Z P Z

Draw a line from the hint to the food group on My Washington Plate where it belongs. **WOW** – five of the six top crops are represented in a food group! These top six crops accounted for 69% of the value of all ag commodities raised in 2011 in Washington.

List your favorite Washington grown foods from each of the categories.



FRUITS



VEGETABLES



GRAINS



MILK



PROTEIN

_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Make Wise Choices...Be Healthy



- ✓ Make half your plate fruits and vegetables
- ✓ Make at least half your grains whole grains
- ✓ Know how big a "serving" is
- ✓ Avoid oversized portions
- ✓ Drink water instead of sugary drinks

- ✓ Avoid "empty calories" (excess fat & sugar with few nutrients)
- ✓ Get at least 60 minutes of physical activity each day
- ✓ Read nutritional info on label

Get more ideas and find activities at www.choosemyplate.gov

Name _____ Date _____

Tell Me About It!

Choose one article from this issue of Ag@School

Title _____ Topic _____

Why did you choose this article? _____

List two interesting facts you learned.

1. _____

2. _____

What's That Mean?

Choose two words that you want to share from this issue of Ag@School

Word: _____ Page Number: _____

Copy the sentence this word was used in. _____

Definition of the word: _____

Word: _____ Page Number: _____

Copy the sentence this word was used in. _____

Definition of the word: _____