Ag@School TEACHER GUIDE
Volume 18, Issue 2 2018/2019

Welcome to Ag@School!

Class sets of this magazine, aimed primarily at the 4th grade level, are FREE to subscribing Washington teachers. Instructions for subscribing are on page 5. Back issues are available at www.waic.net.

This is the second of three issues for 2018-2019. Delivery of the next issue will be in 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.

This issue is designed to help students understand:

- High-yield agriculture has allowed us to feed the world without bringing more land into production
- Washington's location on the Pacific Rim is advantageous for international trade which fuels our state's economy
- Technology is using scientific knowledge to find a better way of doing a job

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.

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 agriculture production (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.

Why Agriculture?

Teaching about agriculture is an ideal way for students to make real-life connections to science, math, and social studies concepts. Agriculture is relevant because students encounter it daily. Who doesn't enjoy talking about food? Nearly everything we eat, wear, use- even some fuel that powers cars and buses, comes from plants and animals grown on farms. Agriculture provides perfect real-world connections to STEM and makes learning relevant to students.

Helping students understand the farm-to-table connection is important in our consumer-driven society. Teaching students to be agriculturally literate connects their learning to everyday life.

Browse the Matrix!

Visit our website at http://www.waic.net and browse the National Ag in the Classroom link to the Curriculum Matrix

The Agricultural Literacy Curriculum Matrix is an online, searchable, and standards-based curriculum map for K-12 teachers. The Matrix contextualizes national education standards in science, social studies, and nutrition education with relevant instructional resources linked to Common Core Standards.

Search our instructional, classroom-ready resources now! After you find what you need, consider storing them in your personal binder — MyBinder! Create a MyBinder profile now, or login.

Vocabulary

There are words and concepts throughout the magazine (some are **bolded**) that can be used in variety of ways to enhance learning and expansion of concepts.

Agrarian, urban, high-yield agriculture, technology, Pacific Rim, tariffs, Free Trade Agreements, precision farming, GPS, GIS, drones (unmanned aerial system), direct-seeding, irrigation, genes, GMO, tissue culture, micropropagation, controlled atmosphere storage, industrial revolution, mechanical revolution, chemical revolution, green revolution, electronic revolution, biotechnology, electronic revolution, ethanol.

Standards Alignment

This publication is aligned with 4th grade standards for Washington state students

Social Studies EARLS (Essential Academic Learning Requirement) –
Economics 2.1.1, 2.2.1, 2.2.2, 2.4.1
Geography 3.3.1
History 4.3.1

Common Core State Standards (CCSS)

Reading –

Questioning, Inference, and Interpretation - RI.4.1, Themes and Central Ideas –RI.4.2

Connections - - RI.4.3 , Academic Vocabulary – RI.4.4, Points of View/Purpose – RI.4.6

Visual/auditory Media and Information Sources – RI.4.7, Argument and Reasoning – RI.4.8, Fluency – RI.4.4a

Writing –

Argumentative- W.4.1b, Informative/Explanatory – W.4.2, Narrative – W.4.3,Task, Purpose and Audience –W.4.4 , Technology –W.4.6, Research – W.4.7, Access and Organize Information – W.4.8.Access and Organize information – W.4.8

Speaking and Listening –

Collaborative discussions – SL.4.1, Evaluate Presented Information – SL.4.2; SL.4.3

Language –

Language conventions – L.4.3

Reference materials – L.4.5c

Math –

Multiplication and Division - 4.NBT.B.5, Measurement – 4.MD.A.2

Science **(Next Generation Science Standards -NGSS):**

Energy 4-ESS3-1, Structure, Function and Information Processing – 4-LS1-1, Earth and Human Activity 4-ESS3, Engineering Design 3-5-ETS1-1.

Cover

Statistic is cited from American Farm Bureau Federation, Food and Farm Facts booklet. Booklet and lesson plans and much more available at http://farmfacts.fb.org/ or http://www.agfoundation.org/

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.

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

We suggest that teachers do the "Earth as an Apple" (page 6 in this guide) prior to handing out this issue. Please read the background information prior to presenting the activity.

Page 2 - Name the Big Four

Potatoes, wheat, corn and rice

Why does Idaho produce more potatoes than Washington? There are 320,000 acres of potatoes planted in Idaho, only 164,000 acres Washington.

To learn more about Washington diversity and our top commodities visit:

Washington Department of Agriculture at http://agr.wa.gov/AgInWA/

USDA National Agricultural Statistical Service at https://www.nass.usda.gov/Statistics_by_State/Washington/

For more on my plate nutrition and the USDA go to:

https://www.choosemyplate.gov/ and https://www.choosemyplate.gov/washington

Page 3 - Washington Trade is Boosted by the Pacific Rim

Washington sits on the Pacific Rim. Thanks to this geographical location, we have a favorable international trade advantage. By ship, our ports are about two days closer to Asian markets than California's. 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?

Don't Miss This!

Visit: www.myamericanfarm.org to play on-line games and explore fun family activities.

It's all about agriculture!

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	WHEAT
CORN	POTATOES

PLANTS NEED FOOD TOO!

Just as we need vitamins and minerals from our bodies 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.

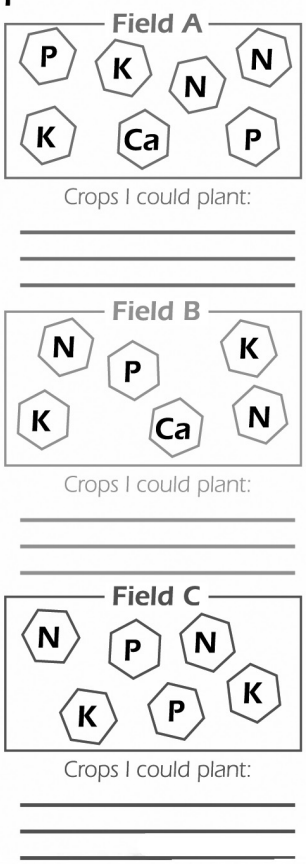
Using the key decide which crops you could plant in each field.

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

Corn needs:
2 N's
1 P
1 K

Potatoes need:
2 P's
2 N's
1 Ca
2 K's

Wheat needs:
1 N
1K
1-1/2 P



Page 4/5 - Technology has Improved Production Agriculture

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

1. 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.)
2. How else is GPS used? (hikers use hand-held models, cars employ GPS in navigation systems to guide the driver to a specific destination). Precision farming results in less productive land receiving fewer inputs (seed, fertilizer, etc)
3. 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).

GMO Additional Information:

The only GMOs commercially available in the U.S. are the following ten crops: soybeans, corn (field and sweet), papaya, canola, cotton, alfalfa, sugar beets, potatos, apples and summer squash.

As a result, most of the products in the produce aisle of your grocery store are not GM, but 70 to 80 percent of the food on grocery store shelves likely contain processed ingredients from GM plants.

GREAT lesson plans on the matrix (located on our website) on GMOs

Please visit these websites for more information:gmoanswers.com, ag.purdue.edu.com, biofortified.org fieldtomarket.org, geneticliteracyproject.org, kfolta.blogspot.com

Plants Need Food Too answers

Field A: Corn, Potatoes, Wheat
Field B: Corn
Field C: Corn, Wheat

Page 7 - Agriculture in a Changing World

Discussion starters:

1. Using the time line across the top of the page discuss how the US population has grown and how our society has shifted from agrarian to urban. In 1790, the US had a total population of 4 million. 90% of the population (3.6 million people) lived on farms, so our society was based on agriculture (agrarian society). In 2017, total US population was 325.7 million , but less than 1% live on farms. The majority live in cities, thus we are now an urban society. Have students calculate the population statistics for the information given for 1850 and 1950. Which countries in the world today are considered agrarian? (Use a World Almanac—Nations section, to find the answers)
2. Discuss the definition of revolution (a sudden or complete change) and how each of the revolutions listed changed the world. Introduce the phrase, "necessity is the mother of invention". What did society "need" that prompted all these inventions? What other definitions of 'revolution' do students know? (rotation of planets, or political upheaval)

Additional background information:

Students should note that the original John Deere plow pictured on the cover was pulled by two animals and the farmer had to walk behind to steady and guide the plow. Even the first tractors were tremendous labor savers (both in time and muscle power). As farm draft animals were replaced by machines, farmers no longer had to spend time caring for them, and could now farm the remaining fourth of farm acres that had been devoted to growing feed for the work animals.

Fertilizer bags have 3 numbers on the front, like 32-10-10. These numbers describe the percentage of Nitrogen, Phosphorus, and Potassium (in that order) contained in the bag. In this case, the 3 numbers only total 52%; the balance will be inert ingredients. Sometimes there is a fourth number given; it is usually sulphur, possibly iron; you have to read the small print to be sure. If a farmer wanted to put 20#/acre of nitrogen on his crop, how much 32-10-10 fertilizer would he need? Every pound of fertilizer would contain .32 # of nitrogen. 20#/.32 = 62.5# of 32-10-10 fertilizer.

Insulin is a protein produced in the pancreas that is essential for carbohydrate metabolism. Diabetics must inject additional insulin in order to live. Prior to biotech-bacteria producing human insulin, beef and pig pancreases were collected for insulin extraction.

All the advances in farming can be traced to developments in scientific knowledge. Individual scientists build upon the work of others, and often seemingly tiny, even unrelated discoveries can provide the "missing puzzle piece" to lead to major advancements.

Discussion starters:

1. Thinking globally, why is it important for farmers to use high-yield agriculture methods? (prevents starvation in countries with poorer ground and less technology; protects rain forests, wetlands, and wild-life habitat; abundant food costs consumers less; can students list others?)
2. **Note that "green revolution" has nothing to do with environmental activism.** Dr. Borlaug introduced high yielding varieties of wheat and rice that increased the amount of food produced in poor countries. What other technological improvements do we have in the US that poor countries cannot afford? (Poor farmers in developing countries cannot afford the machines we have, thus much of farming still relies on hand labor. Nor can they afford man-made fertilizers and chemicals. Diets of the people are limited in variety, quantity, and quality.)

Technology is the Key

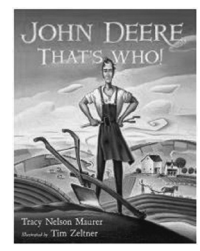
There are five outstanding technological developments in the last 90 years that have led US agriculture to its current production levels:

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.

Page 8 -Grain corn vs Sweet corn

Grain corn (or field corn) is the predominant corn type grown for human consumption (corn meal, corn flakes, tortillas, etc), animal feed, ethanol, and many other by products (see the chart at http://www.ncga.com/upload/files/documents/pdf/cornuses-poster.pdf). Sweet corn that we eat as a vegetable and popcorn are different types of corn and are not processed like grain corn.

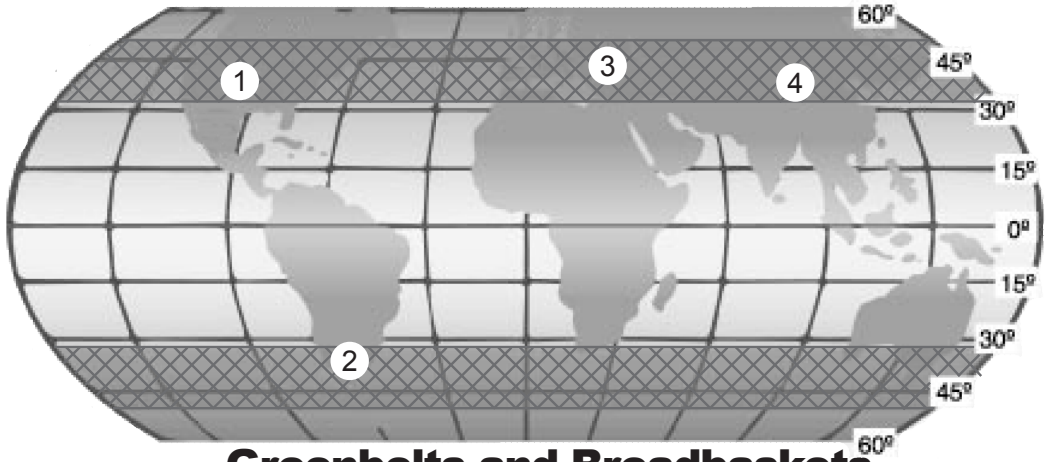
Library corner



Check out this book in the curriculum matrix for lessons associated with this resource! (include picture of book) www.waic.net click on curriculum matrix, click on search of companion resources, click books and type in title – John Deere, That's Who!

Grange

For more information about the Washington State Grange or any of the mentioned Grange Programs, you may go to www.wa-grange.com. To find a local Grange near you, go to wa-grange.com/LocalGrange.aspx.



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 conditions are best for growing. 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. _____

Why do plants not grow as well between the two belts? _____

Why do plants not grow well above and below the belts? _____

There are many areas within the greenbelts where crops do not grow well. Can you think of any reasons why this is true?

Answers: 1. US, 2. South American Pampas, 3. Ukraine, 4. North China Plain
Why plants don't grow well between belts? Too hot
Why plants don't grow well above/below? Too cold
Some areas are too rocky, too wet, too dry and too cold. There's are also areas where the soil is just too poor to grow crops.

(Post-Test) TELL WHAT YOU LEARNED!

1. How has technology changed or improved production for farmers? Give two examples. Which innovation do you think is the most valuable? Why?
2. Persuade the reader that export trade is important to Washington. Give reasons to support your point of view.
3. Choose a job that agriculture depends upon and explain why science is an important subject to include in studies for that career.

Subscribe to Ag@School

Class sets of Ag@School are **FREE** to Washington teachers.
To subscribe send an email from your **own** email address (do not use someone else's mailbox) to **info@waic.net**. In the subject line type "Subscribe". In the body of the message state the following:

- Your name, grade you teach, and number of students in your class
- Your school's full name (no abbreviations please)
- School mailing address (for postal delivery)
- The county in which your school is located
- School phone number including area code

You may also subscribe via postal mail by sending the above information to:
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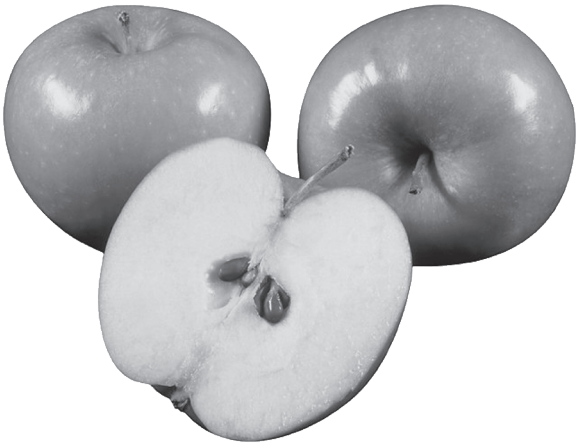
Thank you in advance for your feedback. Sorry, subscriptions are not accepted by phone

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 like 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

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Celebrate National Ag Day March 14th, 2019 during National Ag Week March 10-16, 2019. This day recognizes and celebrates the abundance provided by agriculture. Every year, producers, agriculture associations, corporations, universities, government agencies and countless others across America join together to recognize the contributions of agriculture. Ag Day is about recognizing and celebrating the contribution of agriculture in our everyday lives. The National Ag Day program encourages every American to:

- Understand how food and fiber products are produced
- Value the essential role of agriculture in maintaining a strong economy.
- Appreciate the role agriculture plays in providing safe, abundant and affordable products.

We encourage you to visit the National Ag Day website at www.agday.org and see what you could do within your classroom to celebrate and recognize agriculture! Feel free to contact us as well for additional ideas and/or help in finding a guest speaker who could come visit your classroom!

The Perpetual Farm - Growing Sustainable agriculture in Washington

Can we farm forever? Come explore this question and more!
http://www.agforestry.org/perpetual-farm
Also available online: a Teacher's Guide, aligned to the Common Core State Standards for English Language Arts and Literacy in History, Social Studies, Science and Technical subjects for grades 9 through 12. Help teach the next generation about critical thinking, the future of agriculture and sustainability.

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 this mission. Teachers may reproduce any pages for use.

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