Ag@School TEACHER GUIDE
Volume 12, Issue 3 2012/2013

Welcome to Ag@School!

Class sets of this magazine, aimed primarily at 4th grade level, are **FREE** to subscribing Washington teachers. This is the last of three issues for 2012-2013. **Your subscription for next year will NOT be automatically renewed.** Please visit our website www.waic.net to complete a survey and re-subscribe or unsubscribe. Thank you in advance for your feedback. The first issue next year should arrive at schools the end of September.

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 CCSS, GLEs and EALR's that will help your students meet state requirements.

This issue is designed to help students understand:

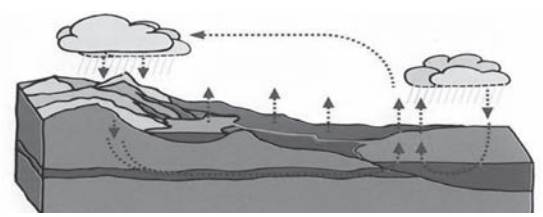
- The dependence of all living things on soil
- Sustainable agriculture uses technology to use resources today without depleting them for tomorrow
- Plant growth is affected by pH and soil chemistry
- The water cycle
- Seeds can produce new plants or be consumed by humans and animals
- Every day is Earth Day for agriculture.

Reproducible activities in the teacher guide expand on concepts covered in the magazine. Included in the guide are vocabulary words, connections to state guidelines, answers to questions in the magazine, and post tests.

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: topsoil, topography, canola, humus, pH, embryo, germinate, cotyledons, monocots, dicots, annual, perennial, biennial, legumes, precipitation, percolation, evaporation, transpiration, and condensation.



Ag@School funding

Many businesses, organizations, public agencies and individuals contribute money and time to provide this magazine for you at no cost. They are listed on Page 6 along with a suggested activity for research and writing letters of thanks. We suggest using the activity as a small group project both for internet research practice and, of course, letter writing experience.

CCSS, GLE & EALR Connections

Science:

4-5 INQF pages 3 and 7
4-5 APPG pages 2 and 8
4-5 PS2 A-C page 7
4-5 ES2 B-D-F page 3, TG
4-5 LS1E pages 2 and 6

Math:

4.1D-E page 3
4.2.D TG

Social Studies:

2.2.1 pages 2, 6, 8
4.1.2 pages 4-5, 6, 8

Integrated Environmental & Sustainability:

Std. 1 pages 1,2

Reading:

The articles and activities in the magazine are designed to develop rich content knowledge of how agriculture provides basic necessities to life, and is deeply ingrained in the history and economy of Washington State. Students will need to interpret technical words and phrases used in the text.

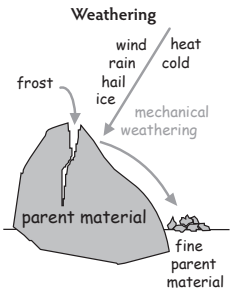
Writing:

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 – Every Day is Earth Day

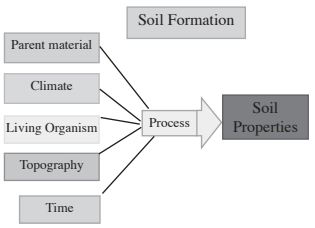
April 22 is Earth Day—a day intended to inspire awareness and appreciation for the earth's natural environment. Farmers understand that the bounty of crops they are able to produce is dependent upon the sun's energy, adequate water, and a healthy soil ecosystem. Sustainable agriculture must be environmentally friendly by taking care of the soil and using water efficiently, but it must also be profitable enough to keep farmers in business, and able to improve the quality of life for the farmer, farm workers, and all of society.

How Soil is Made



The world has thousands of different soils (70,000 just in the US). Parent rock (like lava, limestone, granite) is broken apart into finer particles by a process called weathering. Temperature and water are critical in this process. Water dissolves minerals and is important in chemical reactions. Freezing and thawing also break down rocks. Plant roots can enter cracks in the rocks and break them apart. Roots can form acids that help break down particles. When plants and animals die, they add organic matter to the weathered parent material. Bacteria, fungi, and worms enrich the soil by breaking down organic matter to form topsoil. Soil formation is very slow, taking thousands or even millions of years.

How Is Soil Made: 5 soil forming factors



1. ***Parent Material:*** Chemical and physical weathering break down rocks over time. The parent material dictates what texture the soil has, whether it is sand, silt, or clay (or a combination). Texture affects the soil's ability to store water and nutrients, and therefore affects plant growth.

2. ***Climate:*** The higher the precipitation and temperature, the greater the weathering.

3. ***Living organisms:*** the number of organisms in the soil depends upon the climate. Soils in warmer, moister climates have more microbes. The organisms break down the humus in the soil and turn it into usable nutrients for more plant production. More plant production adds more humus. This increases the soil's nutrient content and water holding capacity.

4. ***Topography:*** Soil formation on steep slopes will not be as great because the water will run off and not percolate through the soils and may also cause loss of soil through erosion.

5. ***Time:*** the more time that passes, the more intense the soil forming processes are, which usually means the soil is deeper.

The Soil is Alive

The soil is home to an incredible number of organisms, most of them so tiny we cannot see them without a microscope. They decompose organic matter, take nitrogen from the air and make it available to plants, improve soil structure, and control crop pests. There are all manner of creepy-crawlies---algae, bacteria, rotifers, fungi, protozoa, nematodes, arthropods, earthworms---all part of the soil food web. The human food system would collapse without the complicated food web that exists in the soil. We are totally dependent upon the soil web to provide and maintain the growing environment for larger plants that feed us and the animals we use for food. Farmers understand this delicate balance. They know if they treat the soil well, it will be able to keep giving back…not just for us today, but for future generations too.

If microscopes are available for your use, it is well worth the effort to examine soil samples under magnification. Observing this fascinating world may be just the impetus students need to encourage further scientific investigation. There are also short You-tube videos of soil microbes and pond water organisms.

Size Comparison

Students may have difficulty imagining how small microbes can be. For comparison's sake visit: http://www.cellsalive.com/howbig.htm

Page 2 – Canola

Students should discuss the products that can be made from canola. It is important to note that both the oil and the meal need to be used for the processing to be economically viable. Why is Warden a good place to site the plant? Not only is it centrally located in Washington, but Grant county is home to very large potato processors (chips and fries) that could use the oil, and also home to lots of dairy cows that can consume the meal. Anytime transportation costs can be reduced, net profit increases. The processor needs to be able to offer to buy seed from the farmer at a price that will induce the grower to plant canola.

Canola is a member of the brassica genus of plants. These are also known as the mustard family, cruciferous vegetables, or cole crops. This family includes many vegetable crops: cabbage, cauliflower, broccoli, collard greens, brussel sprouts, kale, radishes, turnips, rutabagas, arugula, horseradish, and water cress. Teachers may be familiar with rapid cycling brassica (RCB) or *Braccica rapa* used in teaching biology. These cultivars are related to mustard and canola, but flower in 13-18 days and complete the life cycle in 28-35 days.

Page 3 – Power of Hydrogen

Understanding pH and logarithms will come later in Junior High or High School. At his point, the subjects are merely introduced. Hydrogen is symbolized in chemistry by the letter H. It is the most abundant element in the universe. We owe most of the energy on our planet to hydrogen since the sun's nuclear fires convert hydrogen to helium releasing a large amount of energy. French scientist Antoine Lavoisier named the element hydrogen in 1783. The name comes from the Greek 'hydro' meaning water and 'genes' meaning forming. Two atoms of hydrogen plus one atom of oxygen make water (H_2O).

Soil chemistry is very complex and researchers are learning more every day. We can amend soil to meet the nutritional requirements of plants and to replace nutrients lost when the organic matter of crops is removed during harvest. Unfortunately, many years of adding nitrogen fertilizer has caused a marked decrease in pH in some of our wheat growing areas, resulting in poor plant growth and signs of aluminum toxicity. Strategies to continue production on these soils include the application of lime to raise the soil pH and the use of plant varieties that are more tolerant of acid soils.

Discuss with students the economics of different crops. Even though blueberries like acid soils we currently raise only 7000 acres in Washington. We have nearly 2.4 million acres devoted to wheat production. Wheat is grown in lower rainfall areas and sometimes on challenging terrain. Students need to understand that there are multiple factors to consider when choosing crops to raise. Finding new varieties of crops that have been successful in the past, or altering soil chemistry are more viable alternatives.

Page 4-5 Let's Plant Some Seeds

Choose a variety of vegetable seeds. Let students examine them with magnifying glasses before planting. Use clear plastic cups with some potting soil. Plant seeds against the side of the cup so students will have a window to view the germination. Plant some seeds upside down or sideways to see what happens. Be sure to keep the potting soil moist, but do not overwater---remember that soil should be 50% empty space. If you fill the empty space with water, you will drown the plant.

As plants emerge, note the roots and the sprout. How many leaves does each seed produce? Is it a monocot or a dicot? How long does each seed take to germinate? Have students record the results.

Kitchen Seed Search

Students may discover quite a few seeds in their kitchens or on grocery shelves including: anise, caraway, celery, coriander, cumin, dill, dry beans, fennel, flax, lentils, mustard, pepper, poppy, sesame, and sunflower.

Page 7 – Water Cycle

Discussion starters:

- How is water cleaned through the water cycle (evaporation---also large particle contaminants like silt are trapped in percolation process)
- What impurities might be left behind when water evaporates?
- What can people do to prevent impurities from getting into the water in the first place?

Reinforce that salt water cannot be used for drinking water or to water plants and animals. The amount of water in the world is constant although it changes location and physical form.

Total Water on Earth – Check the Math

Explain to students that the chart on page 7 is a combination of a pie chart and a bar graph. The bar graph is expanding the very thin slices of the pie chart that represent groundwater and surface water. (In fact, for visual reasons, the surface water portion of the graph is out of scale so that it can even be seen). Students should be impressed by how much of the water is contained in the oceans, and how little of the total is surface water (lakes, rivers, and the atmosphere).

The surface water category representing 0.001% of the total water breaks down to:

Lakes	0.017%
Soil	0.005%
Atmosphere	0.0001%
Rivers	0.00001%

Have students count the zeros; notice that there is 10 times more water in the atmosphere as in rivers (.0001 vs. .00001).

WSDA Poster Contest

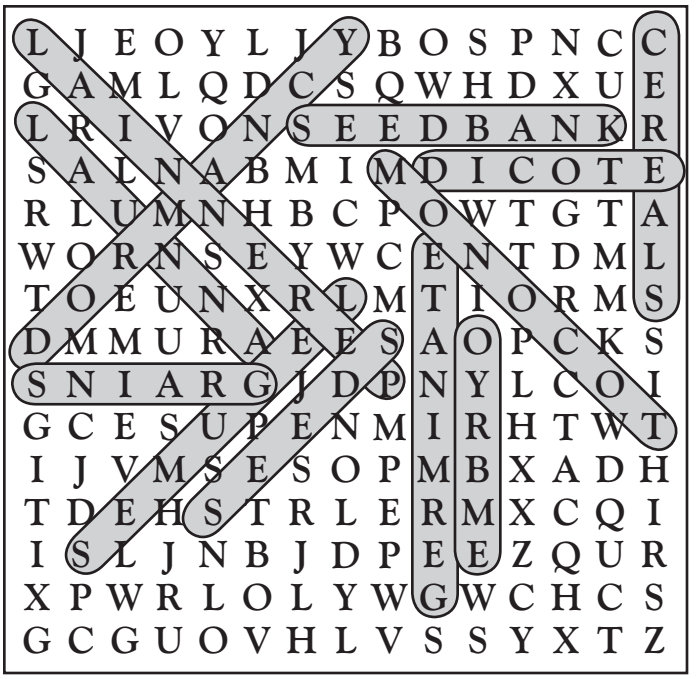
What comes to mind when you think of food, farming, energy and the environment going into the next 100 years? This is a great discussion topic and we encourage students to submit entries for this contest. Use past copies of Ag@School (on line at www.waic.net) for information and let your imaginations soar!

Answers to TG page 4

New Words: 13, 6, 10, 9, 5, 3, 14, 4, 11, 1, 7, 8, 2, 12

Answers to TG page 5

1. 2 containers; 2. 141 X 3=423; 3. 8 X 3= 24ounces; 4. 45/60= 75%; 5. 1 – ¼ = 3/4



Tip for Teachers!!

Subscribe to Dr. Watts, Science for Kids, Agricultural Research Service

Visit www.ars.usda.gov/is/kids. Especially check out the Teacher's Desk tab to find Ag-Tivities, Crosswords & More, Whiz Kids, and a really excellent page called Hot Links for Teachers—Cool Sites for Kids. You will find a wealth of information and fun activities.

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.

Graphic design by Mike Hendricks, Hendricks Design. Edited by Robyn Meenach.

WHAT NEW WORDS DID YOU LEARN?

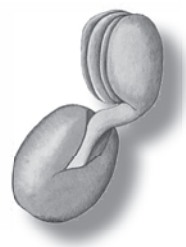
These words were used in this issue of Ag@School.
Can you match the words to the definition?

1. Precipitation
2. Topography
3. Evaporation
4. Sustainable agriculture
5. pH scale
6. Condensation
7. Cotyledons
8. Biennial
9. Percolation
10. Winter annual
11. Transpiration
12. Ground water
13. Humus
14. Canola

_____decayed organic matter in the soil
_____process of water vapor turning into liquid
_____plants that complete the life cycle in one year, with seeds germinating in the fall or winter
_____movement of water into soil through cracks, holes and pores
_____a scientific measurement of acidity or alkalinity compared to distilled water
_____changing from a liquid or solid state to a gas or vapor
_____a type of edible rapeseed
_____using technology and resources to keep farms profitable, improve human lives, yet respect the environment
_____evaporation of water from plant surfaces
_____rain, snow, hail, sleet, dew and frost
_____first seed leaves on a sprout
_____plants with a two year life cycle
_____geographical contours of the land
_____wells and aquifers tap this important resource

Seeds - Miracles of Life

Can you define these words?



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G	A	M	L	Q	D	C	S	Q	W	H	D	X	U	E
L	R	I	V	O	N	S	E	E	D	B	A	N	K	R
S	A	L	N	A	B	M	I	M	D	I	C	O	T	E
R	L	U	M	N	H	B	C	P	O	W	T	G	T	A
W	O	R	N	S	E	Y	W	C	E	N	T	D	M	L
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ANNUAL
CEREALS
DICOT
DORMANCY
EMBRYO
GERMINATE
GRAINS
LEGUMES
MONOCOT
PERENNIAL
SEEDBANK
SEEDS

Tell What You Learned

1. Explain why a farmer might choose to grow canola.
2. Describe what happens to a seed as it germinates.
3. Persuade the reader of the importance of the Washington Department of Agriculture. Tell what responsibilities WSDA has to the public.
4. Write a narrative tracing a drop of water through the water cycle, beginning when the drop fell from the leaf of a plant. Include details such as where it landed, where it traveled, and the different forms it became as it passed through the cycle.

Chase the Blues Smoothie

Read the recipe and answer the questions below.

2 cups fresh or frozen blueberries

1 6-ounce container vanilla flavored low-fat yogurt

1 cup fruit juice (orange, pineapple or apple)

In the container of an electric blender, place blueberries, yogurt and fruit juice; whirl until smooth. Serve immediately.
YIELD: 3 cups (3 servings) 141 calories per serving

1. How many 6-ounce containers of low-fat yogurt would you need to make 6 servings? _____
2. How many calories are in the whole recipe? _____
3. There are 8 fluid ounces in 1 cup. How many ounces does this blueberry smoothie recipe yield? _____
4. If there are 45 mg. of Vit C in each serving and you need 60 milligrams of vitamin C daily, what percentage of your vitamin C requirement will one serving provide? _____
5. Lisa has 1/4 cup of orange juice in her measuring cup. How much more juice does she need to make this smoothie?_____

THANK YOU TO ALL OUR DONORS

Many people and groups provide the financial support necessary to print and distribute *Ag@School* at no cost to requesting classrooms. All of the following individuals, businesses and organizations have contributed funds within the last year.

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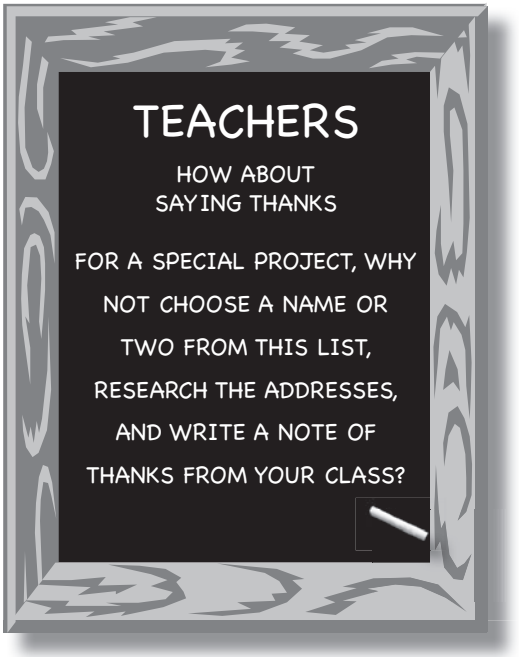

Organizations

Adams County Wheat Growers

American Egg Board

Asotin County Cattlewomen

Benton County Cattlemen

Benton Franklin County Farm Fair

Cattle Producers of WA

Columbia Co. Crop Improvement Assoc

Douglas County Wheat Growers

Edgewood Grange

Elk Plain Grange

Franklin County Cattlemen

Franklin County Farm Bureau

Grant County Farm Bureau

Grays Harbor Dairy Women

Kenova Grange

King-Pierce Farm Bureau

Kittitas County Cattlewomen

Kittitas County Sheep Producers

Lewis County Farm Bureau

Lincoln County Farm Bureau

Little Skookum Shellfish Growers

McMillan Grange

Okanogan County Cattle Women

Pacific Coast Shellfish Growers

PNW Aerial Applicators

PNW Vegetable Assoc.

Pierce County Pomona Grange

Pleasant Hill Grange

Riverside Valley Grange

Skagit County Farm Bureau

Snake River Pomona Grange

Snohomish County Dairy Women

Spokane County Farm Bureau

Stevens County Cattle Women

WA Hay Growers Association

WA Dairy Federation

WA Farm Bureau

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