Ag@School

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Earthday is Everyday for Farmers!

Caring for soil and water resources allows farmers to produce food now, and in the future.




Today's Children...Tomorrow's Leaders

Sustainable Agriculture: Using technology and resources to keep farms profitable, improve human lives, yet respect the environment.

Agriculture Feeds the World

If you ate food today, you should thank a farmer! Producing food to feed 7 billion people is no small task! Farmers understand that we need to use resources to produce food today without using up those resources, because we will need them to produce food in the future. While countries around the world will take one day, April 22, to celebrate an appreciation of our environment, **everyday is Earth Day for farmers**.

This issue of Ag@School touches on two of the most important resources, soil and water. Every ecosystem on earth relies on soil. It is a complex layer teeming with life, where the atmosphere, water, sunlight, and the earth's crust mix and interact. Almost all the biological activity in the soil takes place in the top one or two inches (called the **topsoil**). Water is essential for all life. To produce food for you to eat, farmers need water, either rain or water stored for irrigation.

Remember that every farm is different and a farmer must consider his individual growing conditions. We have more than 1600 soil types in Washington, our rainfall averages could be as much as 120" or as low as 7". Rainfall and humidity during the growing season dictate crops that can be raised. Some farms have irrigation, most do not. The length of the growing season and the date of the last frost are often dependent on elevation. **Topography** runs from flat, to rolling hills, to mountainsides.

Farmers know and appreciate their land and advancements in science and technology have allowed farmers to be more efficient at using critical resources.

"Treat the earth well; we do not inherit the Earth from our Ancestors, we borrow it from our Children."
- Ancient Indian Proverb

Wow! What's Growing There!

You can't help but notice the intense yellow color amid the green fields in the spring and early summer.

These are fields of canola and mustard. Canola is a type of rapeseed originally developed by Canadian plant breeders for its low level of saturated fat. (It is an acronym; **can**adian **o**il **l**ow **a**cid = **canola**). Mustard is used to produce the condiment you might like to put on your hot dog.

Both of these plants produce bright yellow flowers. Each flower produces a pod, similar in shape to pea pods, but about 1/5th the size. Within the pods are tiny round seeds that are harvested by a combine. They can be crushed to make canola oil, or ground to make mustard. You might also recognize canola seeds as the very small round dark seeds in a bird seed mix.

each flower produces a pod

Each canola seed contains approximately 40 per cent oil. One bushel of seed makes about 2.2 gallons of edible oil. Many people prefer the light color and mild taste of canola oil over olive oil, the other readily available oil high in monounsaturated fat. Canola oil could also be used to produce biofuel, but cooking oil is more profitable.

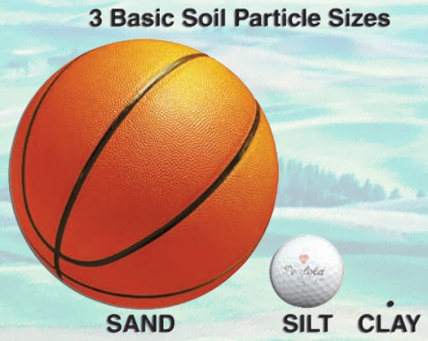
The remainder of the seed is processed into canola meal, which is used as a high protein livestock feed containing up to 34% protein. It is an excellent feed for dairy cattle.

For many years, Washington farmers had to ship their canola to Lethbridge, Canada to be processed. Recently a new plant opened in Warden, WA. Why would that be a good location for a canola processing plant? (think of what else is in the Moses Lake area)

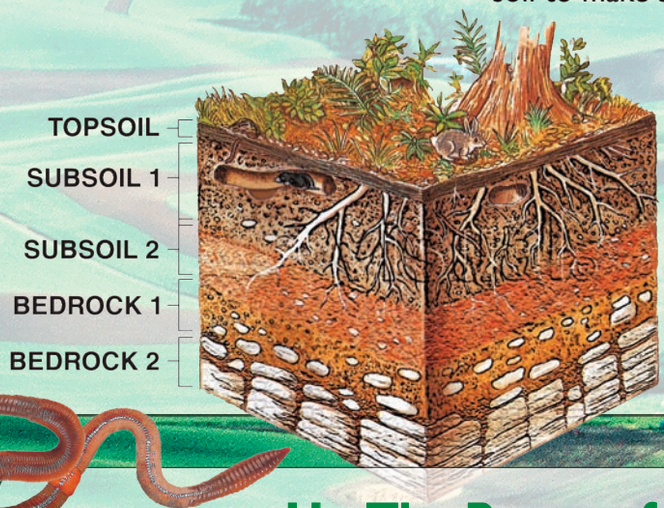
canola meal

Farmers choose to raise canola as a crop for many reasons. Rotation with canola can break up pest cycles, giving wheat growers a way to control crop disease and grassy weed problems. A canola crop can increase yields in wheat planted the next year. Winter canola is harvested before winter wheat so harvest is extended over more days. The price for canola is connected to the oil-seed market not the grain market.

CAN YOU DIG IT?



Soils are made of three basic particles called sand, silt, and clay. The difference in size between the three would be like comparing a basketball (sand), a golf ball (silt), and the tip of a ballpoint pen (clay). Soils from different locations vary in their amounts of each of the three particles. The amount of each type of particle is important because that determines the capacity of the soil to hold water and air. In the Columbia Basin soil can be very sandy whereas near Mica, WA the soil is nearly all clay, in fact there is a business there that uses the soil to make bricks.



Ideally soil is:

- 45% particles (sand, silt, and clay)
- 5% organic matter (dead plants and animals)
- 50% empty space (pores) with half filled with air, and half filled with water

Without decayed organic matter (**humus**), the soil loses its capacity to retain the water and air that soil organisms need.

pH – The Power of Hydrogen

A very important trait in soil is its pH measurement. The soil pH value directly affects how available nutrients are to plant roots. Blueberries and conifers thrive best in acid soils (pH 4.5 to 5.2). Vegetables and grasses do best in slightly acidic soils (pH 5.8 to 6.5). Soil pH values above or below these ranges may result in poor plant growth and nutrient deficiencies.

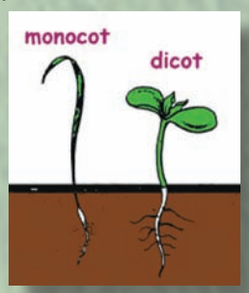
pH is a scientific scale that runs from 0 (highly acidic) to 14 (highly alkaline) with distilled water being neutral at pH 7. Each one-unit change in the pH scale corresponds to a ten-fold change in hydrogen ion concentration. For example, pH 8 is 10 times more alkaline than pH 7 and pH 9 is 100 times (10 times 10) more alkaline than pH 7.

Concentration of hydrogen ions compared to distilled water		Examples of solutions at this pH
10,000,000	pH = 0	Battery acid
1,000,000	pH = 1	Hydrochloric acid secreted by stomach lining
100,000	pH = 2	Lemon Juice, Vinegar
10,000	pH = 3	Grapefruit, Orange Juice, Soda
1,000	pH = 4	Tomato Juice, Acid Rain
100	pH = 5	Soft drinking water, Black Coffee
10	pH = 6	Urine, Saliva
1	pH = 7	"Pure" water
1/10	pH = 8	Sea water
1/100	pH = 9	Baking soda
1/1,000	pH = 10	Great Salt Lake, Milk of Magnesia
1/10,000	pH = 11	Ammonia solution
1/100,000	pH = 12	Soapy water
1/1,000,000	pH = 13	Bleaches, Oven cleaner
1/10,000,000	pH = 14	Liquid drain cleaner

A strongly acidic solution can have one hundred million million (100,000,000,000,000) times more hydrogen ions than a strongly basic solution! (10 million X 10 million). It's a lot easier to use this scale with a range of 0 to 14 instead of writing all those zeros!

Thanks to seeds, all human, plant and animal life on earth survives. Without seeds, we would die. The life cycle of most plants begins with seeds. Seeds vary in size from nearly microscopic orchid seed to the gigantic seed of the coco de mer which could weigh over 38 pounds. A seed coat layer protects the tiny baby plant (**embryo**) inside. Most seeds also contain a supply of stored food (starch, oil, protein) to start the embryo on its way.

Seeds sprout, or **germinate**, when there is a certain amount of warmth and moisture. Most seeds need a period of rest or **dormancy** before they start to grow. When germination occurs, the seed coat splits, a rootlet starts downward, and a sprout bearing seed leaves called **cotyledons**, makes its way to the soil surface.



Grasses (including corn, wheat, and other grains) have only one cotyledon and are called "**monocots**". Other plants including many vegetables have two cotyledons and are called "**dicots**".

As living things, seeds are perishable, particularly if not kept cool and dry. The ability to germinate varies between plants from a year to the extreme example of wheat seed found in Egyptian tombs that still sprouted after thousands of years.

Plants are also classified by the length of their life cycle. **Annual** plants complete their life cycle within a year, while **perennial** plants live for over two years. A third classification, **biennial** plants, refers to plants with a two-year life cycle. Carrots are biennials. We can choose to harvest carrots as a root vegetable in the first year. Carrots for seed are not harvested for their roots. Harvest occurs after the leafy carrot top sets seed in the second year, completing the life cycle.

1st year carrots

Annuals are planted and harvested in less than a year, so new seeds must be planted every year to produce a crop. **Winter annuals** have seeds that germinate in autumn or winter. The small plants live through the winter, establishing a good root system, then bloom in winter or spring and set seed before fall. Important crops in Washington would be winter wheat and winter canola.

Winter annuals develop root systems that hold the soil and prevent erosion during winter and early spring and they usually yield better than spring varieties.

carrots for seed

Summer annuals are planted in the spring, sprout, flower, and produce seed in the summer.

Development of cultures traced to seeds

Early people were hunter/gatherers. They moved from place to place gathering seeds to eat. When groups of people wanted to stay in the same place, they planted seeds to produce crops that they could harvest.

Native Americans gathered corn, squash, pumpkin, and sunflower seeds and safely stored some to eat, and some to save for planting the next year. Settlers coming to the United States brought seeds with them. They guarded and protected the seeds on ocean journeys, wagon trains and travel on foot. Their seeds were treasures that could make the difference between life or starvation in the new land.

Today, most of the world's food supply depends on seeds that farmers plant, especially **cereals**, **legumes** (peas and beans), and nuts.

One grain of wheat can produce a plant that will produce 100-200 more seeds.

Seeds are also used to feed livestock. Some seeds are used to make most cooking oils as well as spices that flavor our foods.

How many seeds can you find in your mom's kitchen? How about at the store? Make a list to see how many you can identify.

Banking on Seeds

People put money in a bank for safekeeping. Did you know the US government does the same thing with seeds? The National Seed Storage Laboratory in Fort Collins, CO holds more than 261,000 samples of seeds from around the world. If natural disasters or plant diseases destroy large numbers of our seeds, we could turn to the seed bank for replacements.

National Seed Storage Laboratory

Lovin' Those Blues!

Blueberries are one of the fruits that are native to North America. In recent years, they have grown in popularity because besides being tasty, they are very nutritious. They contain Vitamin C, fiber, and more antioxidants than most other fruits or vegetables. Antioxidants help protect the cells in our body from damage that can lead to cancer, heart disease and other diseases.

Native Americans once called them "star berries", because the five points of blueberry blossoms make a star shape. They held blueberries in high regard, believing that the "Great Sprit" created the berries to feed their hungry children during famine.

Lewis and Clark shared meals with the Indians that included smoked blueberries and venison that had wild blueberries pounded into the meat and then smoked and dried (pemmican).

Wild lowbush blueberries (6-18" high) continue to thrive in Maine and Canada and can be commercially harvested. There are also wild highbush varieties. Scientists crossed wild lowbush plants with wild highbush plants to create our hybrid highbush varieties. These hybrids have plump, juicy, sweet berries that are easy to pick. Blueberries need an acid soil (pH 4.5-5.2), plentiful water, and an adequate temperature range that includes a seasonal cold period. Northern varieties need as much as 1000 hours a year below 45° Fahrenheit to flourish the following spring. Native Southern species ("rabbiteye") are more resistant to heat and drought, and need only a short cold weather dormant period of 500 hours. All varieties need to be frost-free while blooming. Full sun exposure is required to develop good fruit flavor and maintain high yields.

Blueberries are used fresh or processed as jams, syrups, fruit leathers, and pastries. They are easy to freeze and retain quality when frozen.

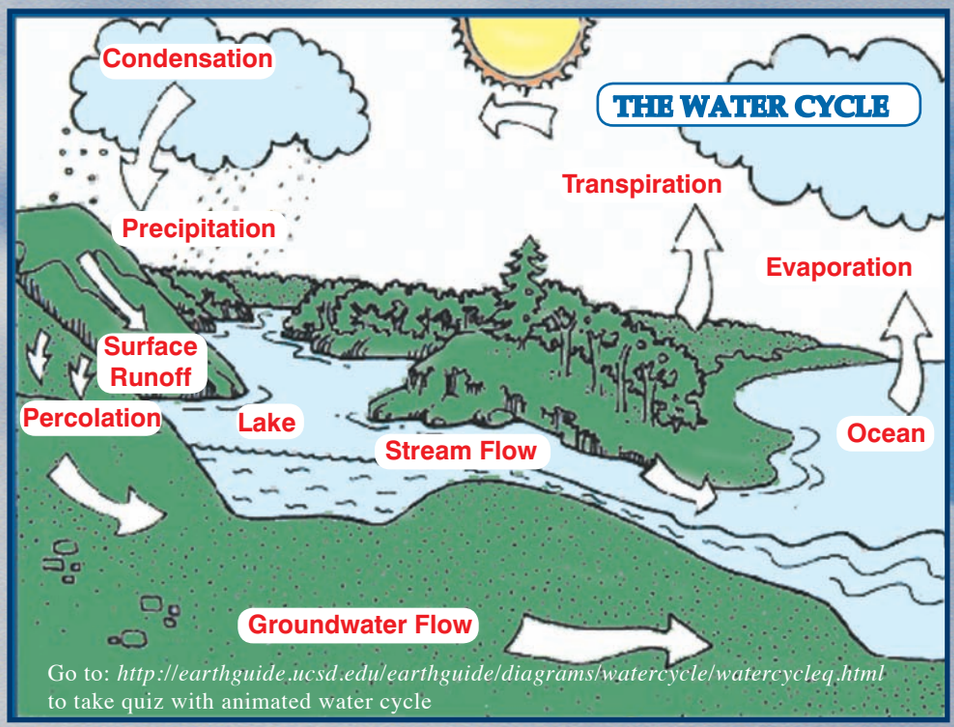
Blueberry crops can be harvested two to three years after planting and reach maximum production in six to eight years. Cultivated blueberries grow in clusters and do not all ripen at once. Berries are often picked by hand to gather the first fruit. Later a harvesting machine travels along rows gently shaking each plant so only the ripe berries fall into the catching frame.

Blueberry Fun Facts

Visit www.suberblues.net

- America's favorite muffin is, of course, blueberry.
- Blueberries are one of the natural foods that are truly blue in color.
- July is national blueberry month because that is the peak of the harvest season.
- The pale, powder-like protective coating on the skin of blueberries is called "bloom".
- Washington produced 14.1% of all US blueberries in 2011

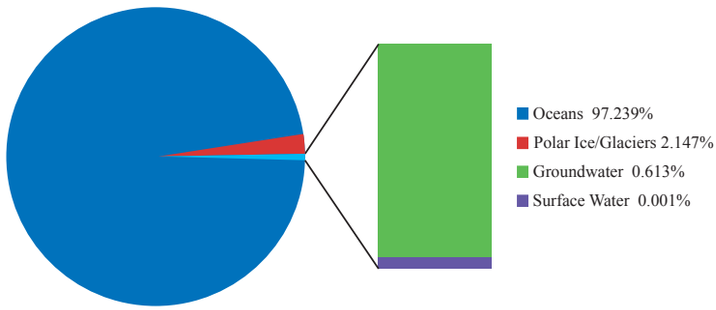
Water–The Most Common Material on Earth



Go to: *http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/watercycleq.html* to take quiz with animated water cycle

Total Water on Earth

Remember that about 70% of the earth is covered by oceans and those oceans hold more than 97% of all the water. Just over 2% of the water is frozen in glaciers. That means that less than 1% of the earth's water is available for drinking, and most of that is groundwater. The very thin purple line at the bottom of the bar to the right of the pie chart represents all the combined water in lakes (0.017%), the atmosphere (0.001%) and rivers (0.00001%)



How Much Water is Enough? There's An 'App' for That!

Farmers can use their smart phones or computers to operate center pivot irrigation systems. They can also use a new irrigation scheduling program that will calculate how much water to use based on soil types, weather (rain, wind, heat), crop being grown, how much water has already been applied, etc. The goal is to keep crops growing at an optimum without wasting water. WSU researchers at Prosser developed the program.

The water cycle is the circulation of the earth's water in a never-ending process. The heat from the sun causes (1) water from the ocean, streams, lakes, and even plants to evaporate. As the water vapor rises, it is cooled by the upper air. Cold air cannot hold as much water vapor as warm air so (2) water vapor condenses into water droplets and creates clouds. The wind carries clouds over the land and (3) water falls back to earth as precipitation.

Water is Life!

All living things (plants, animals, humans) must have water to survive. **The amount of water on earth stays the same. It is never 'used up', but continues to move through the water cycle**. However, the water in a specific location can change in amount or form, sometimes we have a drought and sometimes we have extra snow or rain. A growing human population puts pressure on available water.

Condensation: The process of water vapor in the air turning into liquid. As water vapor rises it cools and becomes liquid again. These droplets form around dust particles in the air and become clouds.

Evaporation: Changing from a liquid or solid state to a vapor or gas. Only pure water evaporates. Substances like salt and minerals are left behind when water evaporates.

Groundwater: Water which has seeped below the earth's surface and is held there in the underlying sand and gravel. Water bearing layers are called **aquifers**. In Washington, 2/3 of the people get their drinking water from aquifers.

Percolation: The movement of water into soil through pores, holes and cracks.

Precipitation: Rain, snow, hail, sleet, dew, and frost.

Transpiration: Water that is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface through leaf pores.

Washington State Department of Agriculture (WSDA) 1913 - 2013

This year WSDA celebrates a century of supporting the agricultural community and promoting consumer and environmental protection.

Washington became a state in 1889, and by 1913 state legislators decided to form an official state agency to handle responsibilities related to agriculture. This included nine programs covering animal health, dairies and food, horticulture, oil, bakeries, fairs, feed, fertilizer, and stallions and jacks

(male horses and male donkeys).

In 1913, Washington had more than 56,000 farms (a ratio of 5.1 farms for every 100 residents). More than 80% of the state's farms owned horses, because for the most part horses still pulled the equipment and often provided the transportation.

Today, a hundred years later, WSDA operates 26 programs that:

- Assure the safety of the state's food supply.
- Ensure the safe use of pesticides and fertilizers.
- Protect all of Washington from selected plant and animal pests and diseases.
- Facilitate the movement of Washington agricultural products in domestic and international markets.
- Provide funding for 450 food banks, shelters and meal providers.

Washington currently has 39,500 farms (a ratio of 0.5 farms for every 100 residents). Some 300 commodities are produced commercially. Washington's $46 billion food and agriculture industry employs about 160,000 people and accounts for 13% of the state's economy (2011). More than $15 billion in food and agricultural products were exported through Washington ports in 2011, the third largest total in the U.S. (This includes grains and agricultural products from other states.)

Important dates to remember for this Centennial Celebration:

- 4/11/13 WSDA Centennial Day at the Capitol
- 4/15/13 Deadline for poster contest entries
- 6/10/13 WSDA Anniversary; poster contest winner announced
- 9/25/13 Taste Washington Day

Learn more about these events and other WSDA activities at: www.agr.wa.gov

Poster Contest:

The Next 100 Years of Agriculture in Washington

Farming and agriculture has changed quite a bit over the past 100 years, and also much of it remains the same. Show us what you see when you think about Washington Agriculture over the next 100 years. What comes to mind when you think of food, farming, energy and the environment going into the future? Make a poster to show us what you think Washington farming and agriculture will look like. Your design could become the image used for Washington food and farming celebrations all year long!

Complete rules at:

http://agr.wa.gov/AboutWSDA/DirectorsOffice/Centennial/docs/WSDAPosterContestFinal.pdf

Submissions are due by Monday, April 15th to centennial@agr.wa.gov

Learn More About Agriculture

Check out the Ag Research Service website, Dr. Watts, Science for kids

www.ars.usda.gov/is/kids

If you need an idea for a science fair project, think agriculture.

www.ars.usda.gov/is/kids/AgSciProjects/agscitoc.htm