



Ag@School

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The entire earth—every ecosystem, every living plant and animal—depends upon soil. It is a complex mixture of minerals, air, water, and organic matter (living organisms and decaying remains of once-living plants and animals). Farmers know that on average it takes 500 years to create an inch of topsoil, so they understand the importance of taking good care of the soil. After all, every day is Earth Day for agriculture!



Today's Children... **Tomorrow's Leaders**

soil, n. the top layer of earth suitable for growing plants





Agriculture Feeds the World

If you ate food today, you should thank a farmer! Producing food to feed 8.1 billion people is no small task! Farmers understand that we need to use resources to produce food today without using up those resources. We will need those same resources to produce food in the future. While countries around the world will take one day, April 22, to celebrate and appreciate 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. Soil is 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.

Farmers are able to grow more food on each acre by using science and technology. They choose improved seeds and plants and often test the soil before planting to determine the composition, pH (acidity or alkalinity), and balance of nutrients present. Results are used to determine the proper type and amount of fertilizer to apply for the specific crop they are planting. Farmers also manage pests and use better equipment and techniques to increase production.

Farmers know and appreciate their land and the advancements in science and technology which 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*



A VERY "FRUITFUL" STATE

WASHINGTON IS A TOP PRODUCER OF APPLES, PEARS, SWEET CHERRIES, RED RASPBERRIES AND CONCORD GRAPES.



TREE FRUIT

Washington produces 69% of all US apples, but accounts for 90% of all apples exported to other nations. Our slogan "The Best Apples on Earth" certainly describes Washington apples that are shipped to over 60 countries around the world. Washington produces nearly 45% of the pears grown in the US. Thanks to advancements in Controlled Atmosphere (CA) storage technology, fresh apples and pears are available to consumers nearly year-round. The three main tree fruit regions are the Wenatchee Valley, Columbia Basin and Yakima Valley. These areas are ideal because of the mild climate, dry growing season, good soils, and plentiful irrigation water from nearby rivers.



1. Because we produce over half of the U.S. crop of this fruit and ship them world wide, Washington is known as the _____ Capital of the World.

STONE FRUIT

No, they don't grow out of rocks! **Stone fruits** have a large, hard seed called a pit. Cherries, apricots, peaches, nectarines, plums and prunes are all stone fruits produced in our state. Weather is very important to a stone fruit grower. Rain and hail can damage the tender fruit and destroy an entire crop in the blink of an eye.

Even gentle rain on cherries is bad. A water drop collects in the dimple where the stem is attached and causes the cherry's skin to split open. This ruins the fruit. If it rains a grower might pay a helicopter to hover over his trees to blow the water off and dry the fruit quickly.



2. Comparing weather across the state, why would most stone fruit be grown in Eastern Washington?

A BERRY NICE PLACE

Berries are grown in many areas of our state but the major production area is the Puget Sound lowlands. The soil and climate there are great for blueberries, strawberries, raspberries and blackberries. Most cranberries are grown in the Willapa Hills region. 60% of America's red raspberries used in processing (quick frozen berries, concentrates, purees and other products) are grown in Washington, most of those in Whatcom County



3. If WA harvests 9,600 acres of red raspberries and the yield is 8,070 pounds per acre, the total harvest will be _____ pounds.

How many tons? _____

GRAPES

The grape industry has grown to become Washington's 9th most valuable crop. We lead the nation in production of Concord grapes (used for juices and jams) at 42%. We also produce 25% of the nation's Niagara grapes and are second nationally in the production of wine grapes.

Nearly all our grapes are raised east of the Cascades.



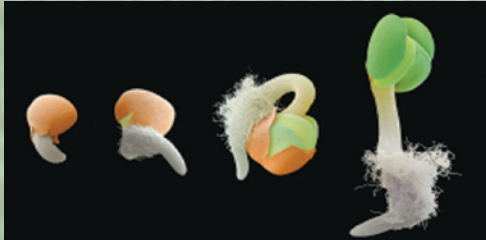
4. Which is your favorite – grape juice, grape jelly, or fresh grapes?

Which one is better nutritionally?

Seeds - Miracles of Life



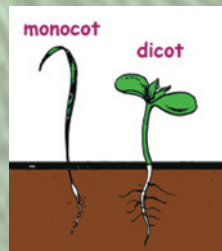
Thanks to seeds, all human, plant and animal life on earth survives. Without seeds, we would die. The life cycle of most plants begins with seeds. Seeds vary in size from nearly microscopic orchid seed to the gigantic seed of the coco de mer which could weigh over 38 pounds. A seed coat layer protects 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,



1st year carrots

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.

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 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 Laboratory for Genetic Resource Preservation in Fort Collins, CO holds more than 470,000 samples of seeds from around the world. Right here in our state in Pullman, seeds are also stored, grown out and distributed for 18 genebanks spread across the US! If natural disasters or plant diseases destroy large numbers of our seeds, we could turn to the seed bank for replacements.



National Laboratory for Genetic Resource Preservation

3 Basic Soil Particle Sizes



CAN YOU DIG IT?

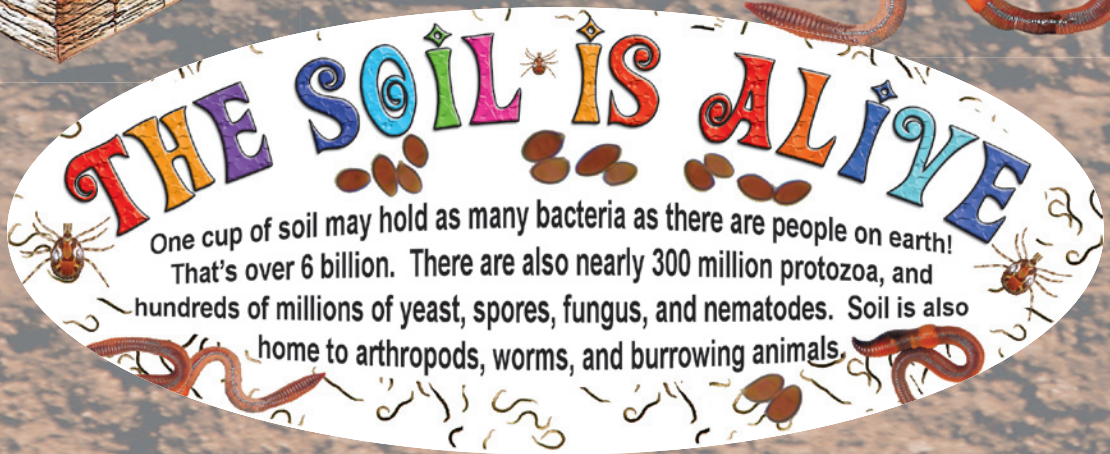
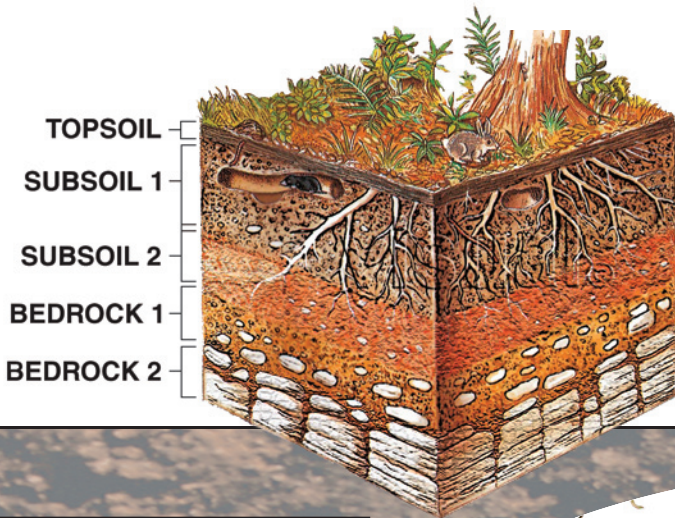
Let's talk about dirt, soil actually. There are three basic particle sizes called sand, silt, and clay. The difference in size between the three would be like comparing a basketball (sand), a golf ball (silt), and the tip of a ballpoint pen (clay). Soils from different locations vary in their amounts 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

Organic matter is usually near the surface and enriches the **topsoil** which is where we plant seeds.



SOIL CONSERVATION



With help from science, farmers have developed conservation practices that reduce soil loss. The movement of soil from one place to another by wind or water is called **erosion**. It can occur anywhere but is usually worse in places that are steep or where there are no plant roots to hold soil in place. Stopping erosion is important because it can take hundreds of years for nature to replace just one inch of good topsoil.

These practices include planting windbreaks, farming with the contour of the land and planting strips of crops across hillsides (both slow down the gravity flow of

water). Another is **reduced tillage**. When land is tilled (plowed or cultivated), soil particles are exposed to wind and water erosion. The more times a farmer disturbs the soil, the finer the particles become and the worse the erosion potential. To stop erosion many farmers now use equipment and methods that use less tillage. Following harvest, crop residue is left in the field and often the field is not disturbed until time to plant the next crop. The roots hold the soil in place. Less tilling means fewer tractor trips across the field and less air pollution from dust and burning fuel and less fuel used.

What is a Watershed?

A watershed is the land area that delivers run-off water to the area's lowest point – a stream, river or lake. Small watersheds flow into bigger ones until they eventually reach the ocean. This water travels across and under fields, forests, cities, streets and lawns.

We all live in a watershed and everything we do in our watershed affects its water. Run-off from streets, yards, farms and forests eventually ends up in our water.

- Washington has 62 main watersheds Which one do you live in?

Hint: to find the answer checkout this website:

<https://ecology.wa.gov/Water-Shorelines/Water-supply/Water-availability/In-your-watershed>

- What can you do to stop pollution in your watershed?

1. _____
2. _____



Stewards of the Forest

Foresters are farmers too and good stewardship is important in forestry. This is especially true in our state. Half of Washington is cover by forests. We have 21.3 million acres of forest! Trees mature like any other crop – it just takes decades to reach maturity, not days. Part of managing a forest is keeping the tree stand healthy by removing mature trees. Older trees can be more sensitive to insect damage, disease, and decay.

Keeping forests healthy today means we will have trees to harvest in the years ahead. Responsible forest management includes removing dead and decaying wood that could fuel a forest fire. Foresters also practice modern conservation logging. This leaves many trees uncut to provide habitat for wildlife and reduces soil erosion into streams. Trees are planted to replace those removed by logging.



Farmers Care for Livestock Too

Farmers are very concerned about the welfare of the animals they raise. Animals that are healthy, comfortable, and well fed will grow fast and produce more meat, milk, and eggs. Farmers protect animals from predators, give them vaccinations for their health, and feed them nutritious feed. In fact, farm animals may indeed eat better than you, because they are not allowed to eat “junk” food.

Fun Fact

Farmers and ranchers provide habitat for 75% of Americas wildlife. Why do you suppose wildlife prefers to live on farms and ranches? Hint: Think of the four needs for habitat.

Habitat needs are food, water, shelter and space. Farms usu-

ally have food (crops) and water. While forests may provide shelter, they may not provide food. An improtant part of shelter could be “**edge**”. This is a term describing the border between two areas, it could be between the woods and a cropped field or perhaps be the fence row between fields.



SUSTAINABLE AGRICULTURE ...

American agriculture is the most earth-friendly in the world. Our farmers know they need to be friends of the land, soil and water. Why? If they treat the earth well, it will be able to keep giving back... and not just for us today, but for future generations too.

Sustainable agriculture meets the needs of today but does not use up resources for the future. It must be:

- Environmentally friendly; taking care of the soil so it will remain productive now and in the future
- Profitable enough to keep farmers in business
- Able to improve the quality of life for farmers and all of society

Both conventional agriculture and organic agriculture can be sustainable.

Organic food is produced without using fertilizers made with synthetic ingredients, genetically engineered seeds, or synthetic pesticides (but natural pesticides and mineral salts can be used).

Organic food accounts for nearly 6% of total sales in Washington. Organic production certainly meets the first condition of sustainability, being environmentally friendly. Organic food is usually

more expensive than conventionally produced food. It needs to be, because it is often more expensive to produce organic crops because there is more labor involved. The majority of organic foods are higher cost fruits and vegetables. It is easier to farm organically on smaller farms, or with established fruit trees or vines that do not require annual planting.

Large-field crops like grains are less likely to change to organic because there is not enough profit to pay for the extra labor, while growing fewer bushels, and losing a year of production when producing green manure. Remember to be sustainable, farmers have to make enough money to stay in business.

Sustainability does not mean raising crops without the benefit of commercial fertilizers, pesticides or biotechnology.

It is true that organic production does not use synthetic (man-made) fertilizers. If we went to only organic production, we would have to produce the necessary nitrogen (the main plant nutrient) by either:

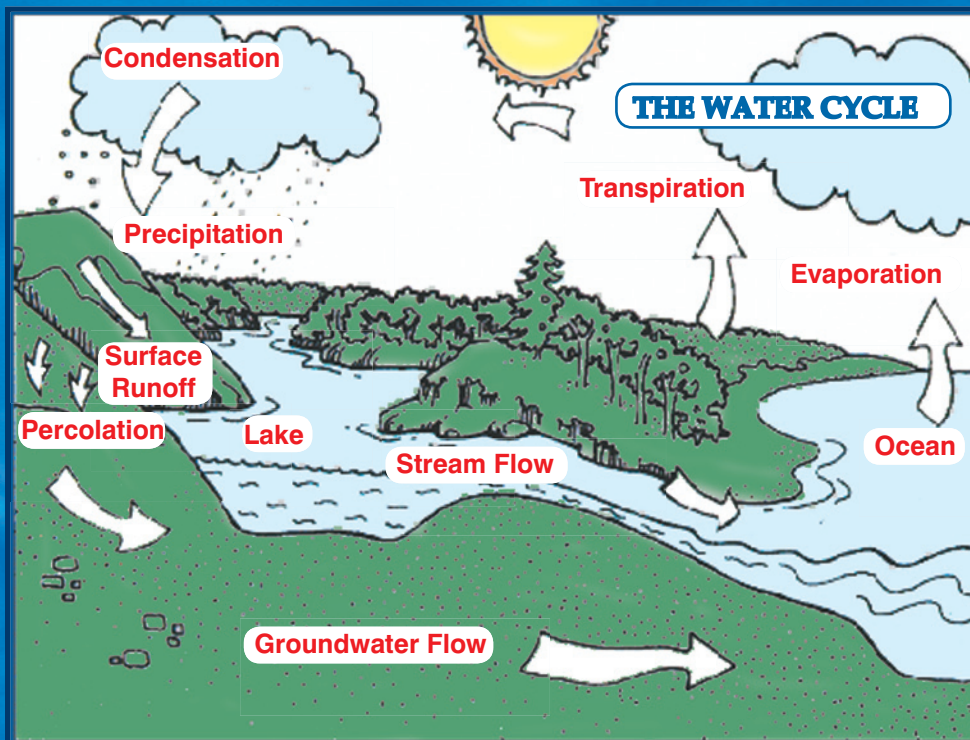
- Converting 1/3 of all crop land into green manure production (where crops are plowed down into the soil). This is a great method for improving the soil and adding nitrogen, but it takes that land out of production for that growing season (and perhaps for a second year in dryland Eastern Washington in order to build up enough soil moisture for a grain crop).
- Or increasing the number of cattle to produce the manure necessary to replace synthetic fertilizer. The US currently has 97 million head of cattle; we would need to add another billion head. Can some of them stay in your backyard?



Isn't organic food better?

The answer is more about varieties and handling than production systems. Locally grown food (whether organic or conventional) may indeed taste better. Characteristics that make fruits and vegetables ship well, process easily, or extend the shelf-life may come at the expense of flavor and texture. Buying from local growers gives you the chance to try varieties of red, juicy strawberries, flavorful tomatoes, and carrots with more vitamin A.

Water—The Most Common Material on Earth



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.

Are We Running Out Of Water?

No 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.

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**.

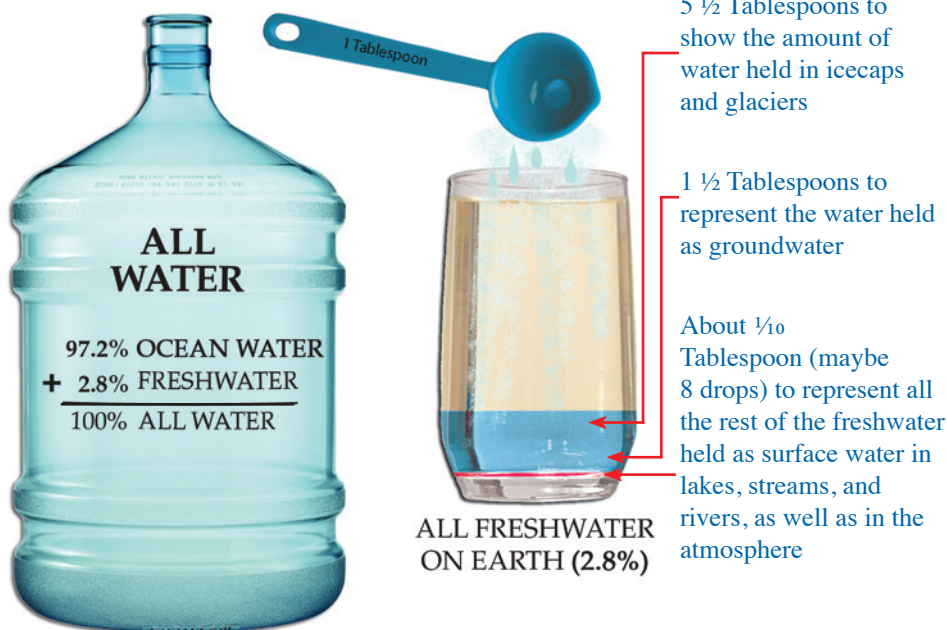
Percolation: The movement of water into soil through pores, holes and cracks.

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.

Water, water everywhere and just a drop to drink

Remember that about 70% of the earth is covered by oceans. Let's pretend that a gallon of water represents all the water on earth. Transfer the following to a small glass:



The amount of water in the glass represents the total amount of freshwater in the world (and 3/4 of that is frozen in glaciers and icecaps). The amount left in the gallon jar is ocean (salt) water. Fortunately only pure water evaporates from the ocean to fall back to land as freshwater.



Earth Day is Every Day for Farmers & Ranchers!

Earth Day was first celebrated on April 22, 1970, and has been celebrated on the 22nd of April each year since. Farmers and ranchers celebrate the earth every day by protecting and conserving the Earth's resources all year round. Farmers and ranchers know that without plants - all humans, animals, and agriculture could not exist. Caring for the environment allows the needed renewable resources to continue to be produced now and into the future.



More than 90% of US farms are operated by individuals or families. Maintaining and improving the environment is necessary to keep the family business going. Today's farmers are restoring wetlands, reducing soil erosion, protecting wildlife, and generating far less waste than ever before. Every day is Earth Day for agriculture!

What Can You Do To Conserve Water

Answers that may come to mind are: turning off the water while you brush your teeth; using a bucket, not a hose, to wash the car; deep watering the lawn once a week, instead of shallow watering daily; taking shorter showers; only running the dishwasher when it is full. You can probably think of many more. But the best answer, the one that saves the most water is:

DON'T WASTE FOOD!

Agriculture is the largest human use of water. Farmers have to supply enough food to take care of what we need and to cover out wasteful habits. Americans throw away 30% of the food grown. Think of all the food tossed out from supermarkets, restaurants, school cafeterias, and home kitchens. We also tend to overeat which is also wasteful, and leads to health problems. Throwing away food and overeating are like leaving the water tap running constantly.



Think Globally



We are very fortunate to have the climate, water, soils and space in Washington to raise an abundance of food; and the distribution system to handle it. Developing countries do not have these resources. They have poor conditions that can lead to 50% of food lost to hot, humid climates; rodents, insects, and molds; exposure to weather after harvest; lack of refrigeration and lack of storage and transportation systems. As world population increases, water will become scarce in some regions. Areas like Washington with an abundance of water will have opportunities to provide more food worldwide.

What insect helps you the most?



The honeybee. If it weren't for bees carrying pollen between the male and female flower parts, there wouldn't be any apples, almonds, or cherries. One-third of all our food - fruits and vegetables - would not exist without bees visiting plants.

Take some guesses on this "Bee Trivia" quiz:

1. How fast can a honeybee fly? _____
2. How many eggs does a queen bee lay in a day? _____
3. How many times does a honeybee need to visit an apple blossom to help create a perfect apple? _____
4. How much honey (fuel) would it take for a honeybee to fly one trip around the world?



1. 15 miles per hour 2. 800 to 1500 3. 40 to 50 4. 2 tablespoons of fuel (honey)