



# STEMsational Ag: The Virtual Farm

MIDDLE TENNESSEE STATE UNIVERSITY



## Module 11: My Own Garden UNIT 4: FROM SEED TO SPROUT Grades 6 – 8



National Institute of Food and Agriculture  
U.S. DEPARTMENT OF AGRICULTURE

**MIDDLE TENNESSEE**  
STATE UNIVERSITY.  
CENTER FOR HEALTH AND HUMAN SERVICES

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SCHOOL OF AGRICULTURE

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I AM *true*  
**BLUE**  
MIDDLE TENNESSEE STATE UNIVERSITY

**MT**  
Fermentation Science

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Module 11: My Own Garden  
UNIT 4: FROM SEED TO SPROUT  
Grades 6 – 8



## 6th – 8th Grade:

**Introduction to the Unit:** In this unit, students will learn the basics of germination, nutrient density, the foundations of a healthy diet, how to sprout at home, and what food does to our bodies based on the quality of what we choose to eat. Students will also learn about food deserts, scarcity, and how they can help alleviate the problem of food scarcity in their communities through sprouting.

### Pre-assessment:

Write down your answers to the following questions.

1. How do plants grow from a seed?
2. Describe the environment required for a seed to grow.
3. At what stage of growth does a plant contain the most nutrients?
4. What is required for a healthy diet?
5. \_\_\_\_\_ helps our gut function properly.
6. What is a food desert?
7. How can we improve the problem of food scarcity?
8. Why is it important to purchase organic produce when possible?



### Purpose:

- ▶ To educate students about sprouting, foundations of a healthy diet, biotechnology in sprouting seed production, food scarcity and how to improve nutrient accessibility in their communities.

### National Agricultural Literacy Outcomes:

#### Food, Health, and Lifestyle Outcomes

- ▶ T3. 6-8 G. Identify agricultural products (foods) that provide valuable nutrients for a balanced diet

### Student Learning Outcomes for the Unit:

- ▶ Students will learn about the basic germination process.
- ▶ Students will explore how to structure a healthy meal.
- ▶ Students will practice how to sprout at home.
- ▶ Students will address the impact of food on our body and organs.
- ▶ Students will explore why food deserts exist and how to address them with sprouting.
- ▶ Students will learn about clinical applications of active compounds from broccoli sprouts.

### Vocabulary Words:

- ▶ **Germination:** refers to the process by which an organism grows from a seed or a spore after a period of dormancy
- ▶ **Sprouting:** the process whereby seeds or spores sprout and begin to grow, and while synonymous with germination, typically refers to a sprouted seed or legume for food preparation
- ▶ **Photosynthesis:** the chemical process in which carbon dioxide and water combine using energy from the sun to make sugar and oxygen
- ▶ **Primary root:** the primary root, or radicle, is the first organ to appear when a seed germinates. It grows downward into the soil, anchoring the seedling.
- ▶ **Fiber:** a type of carbohydrate that humans can not digest. The human gut microbiome made of bacteria, fungi, and viruses can break down fiber into useful molecules that our body needs for things such as proper gut cell function, improving our immune system, and lowering the risk of heart disease, diabetes, and cancer.
- ▶ **GMO:** Genetically Modified Organism is a plant, animal, microorganism, or other organism whose genetic makeup has been modified in a laboratory using genetic engineering or transgenic technology. This creates combinations of plant, animal, bacterial, and virus genes that do not occur in nature or through traditional crossbreeding methods. Many crops such



as wheat, soy, cotton, and rice are genetically modified to be pesticide-resistant which allows harsh pesticides to be used to dry out crops before harvest; however these pesticides have been shown to cause cancer such as Monsanto-Bayer Round-Up which contains glyphosate, directly linked to non-Hodgkin Lymphoma.

- ▶ **Organic:** USDA certified organic foods are grown and processed according to federal guidelines addressing, among many factors, soil quality, animal raising practices, pest and weed control, and use of additives. Organic producers rely on natural substances and physical, mechanical, or biologically based farming methods to the fullest extent possible. Produce can be called organic if it's certified to have grown on soil that had no prohibited substances applied for three years prior to harvest. Prohibited substances include most synthetic fertilizers and pesticides. In instances when a grower has to use a synthetic substance to achieve a specific purpose, the substance must first be approved according to criteria that examine its effects on human health and the environment.
- ▶ **Food Desert:** The United States Department of Agriculture (USDA) defines a food desert as when a census tract meets the following two criteria (USDA, 2014):
  - ▶ **Low-income community:** poverty rate of 20 percent or higher, or a median family income at or below 80 percent of the statewide median family income
  - ▶ **Low-access community:** urban census tracts with more than 33 percent living more than one mile from a supermarket or large grocery store or rural census tracts (geographical region containing 1,000 to 8,000 people) that are more than 10 miles from a supermarket or large grocery store.

### Materials Needed:

- ▶ 1 Mason jar
- ▶ Cheesecloth or galvanized stainless steel screen
- ▶ Rubber band
- ▶ Bowl or dish rack (to set jar at angle)
- ▶ 2-3 tablespoons of organic sprouting seeds

## Activity 1:

Read the handouts and exercises for this lesson on the following pages.

- ▶ Seed to Sprout
- ▶ Sprouting Guide for hands-on experience with gardening in the kitchen.
- ▶ How to Sprout EASILY for 25 cents a Day!

# SEED TO SPROUT

ADDRESSING FOOD INSECURITY

## SPROUTING FOR CHANGE

RESTORING NUTRITION

HEALING THE GUT

PRACTICAL AND SUSTAINABLE



# IN THIS LESSON

- 05** GERMINATION
- 06** PHOTOSYNTHESIS
- 08** SUGAR:FAT TRIGGER
- 09** HEALTHY CHOICES
- 10** FOOD SCARCITY

**SOMETIMES THE  
SOLUTION TO OUR  
PROBLEMS IS  
CLOSER TO THE  
GROUND THAN WE  
REALIZE.**



# Pre-Assessment

1. How do plants grow from a seed?
2. Describe the environment required for a seed to grow.
3. What is produced by photosynthesis?
4. At what stage of growth does a plant contain the most nutrients?
5. What is required for a healthy diet?
6. \_\_\_\_\_ helps our gut function properly.
7. What is a food desert?
8. How can we improve the problem of food scarcity?
9. Why is it important to purchase organic produce when possible?



# GERMINATION

## FROM SEED TO SPROUT

Every plant begins its life when seed reaches water. With the right environment, this capsule of nutrients is unlocked to begin the process of producing roots and shoots.



When the seed is exposed to moisture and the right temperature, it begins to absorb water and the outer shell of the seed softens as the seed expands. A dark, warm environment is optimal for most seeds to begin their journey to becoming a full-grown plant.

As you can see in the picture to the left, the process of **germination** goes from seed to radicle, then a primary root develops before a plumule emerges from the ground and leaves are produced to begin the process of photosynthesis.

The beauty of sprouting is that it only takes 3-5 days for the sprout to be ready for consumption.

Sprouting seeds are unique in that they go through a screening process using technology to examine the germination rates for specific seed strains. They are also screened for cross-contamination with animal products that may leave behind types of E. Coli or other harmful bacteria. Organic sprouting seeds ensure that the seeds are free from harmful pesticides that can damage our brain cells and our reproductive and hormone systems.

# PHOTOSYNTHESIS

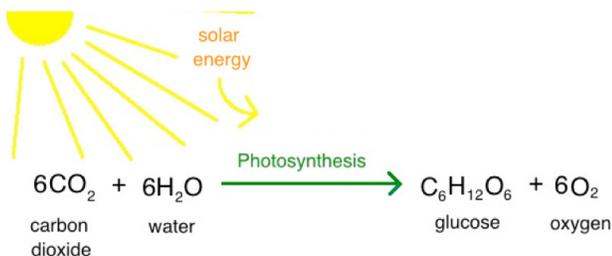
## ENERGY CYCLING



All producers use **photosynthesis** to create their own energy. Using the sun, carbon dioxide and water, they harness this energy in little structures known as **chloroplasts** which are similar to the mitochondria within our cells.



Through the process of photosynthesis, producers such as broccoli sprouts convert six molecules of carbon dioxide and six molecules of water into one molecule of glucose and six molecules of oxygen.



Other organisms receive oxygen to breathe and energy from consuming producers like plants and animals. It takes many producers to feed one consumer, and this is why global organizations for climate change recommend lowering intake of meat and animal products to reduce the strain on our ecosystems.

Plants also help to filter the underground water supply and prevent soil erosion and nutrient depletion when grown in complimentary and diverse groupings. Soil erosion, made famous in the dust bowl era, occurs when land is overfarmed and not allowed to rest properly between harvests. Monocropping is also a huge concern, and can lead to nutrient depletion of the soil and food we consume.

# CO-EVOLUTION

why our gut health relies on diversity of plant fibers

Vegetable fiber in particular is essential for our epithelial cells in our gut to function properly. Our gut cells evolved with our microbiome, the bacteria, fungi, and viruses that live in our intestines. The cells responsible for moving food through our gut for proper digestion rely on the microbiome to break down this vegetable fiber so that they can use these products for energy.

In order to have an efficient and anti-inflammatory microbiome, we need to consume a variety of vegetables and fruits to provide different types of fiber for a balanced community of microbes. The inflammatory colonies that are present in small amounts within our microbiome do not consume vegetable fiber. In fact, they feed off of sugars and fats.



## OPTIMAL GUT HEALTH IS FOUND IN DIVERSITY OF PLANT FIBERS

When we eat too many ultra-processed foods, such as candy bars, chips, processed red meats and fried foods, we are encouraging the bad, inflammatory bacteria in our gut to multiply in numbers while our good, anti-inflammatory bacteria is starved off because they have no vegetable fiber to feed on. As a result, we are more prone to constipation, because now our gut cells are not able to function optimally due to a lack of the by-products of vegetable fiber broken down by our microbes.

Even the small spaces between our gut cells can become wider as tight junction proteins lose their ability to keep food particles and proteins from entering the bloodstream, whereby autoimmune conditions arise as antibodies are made against these particles.

Needless to say, the food that we choose to eat has a MASSIVE impact on how good we feel, how much energy we have, how well our body can eliminate toxins and waste, our immunity, and the quality of our gut health.



# THE SUGAR:FAT TRIGGER

why our food choices matter

Have you ever thought about why candy bars are so addicting? We certainly all love the rush of energy from eating sugar, but there is actually a certain ratio of fat to sugar that our brains are addicted to consuming. Companies such as donut shops and candy bar companies have made sure to include this level of fats and sugars in their products to make bigger sales.

So why are our brains addicted to sugar and fats? In part, it is due to our survival instincts developed from the evolutionary process. Long before the industrial age, food supplies were scarce. Knowing how to hunt and scavenge for food was essential to survival. Our brain prioritized high fat and high starch foods because these contained the most energy to fuel long hunts and the hours or days inbetween the next meal.

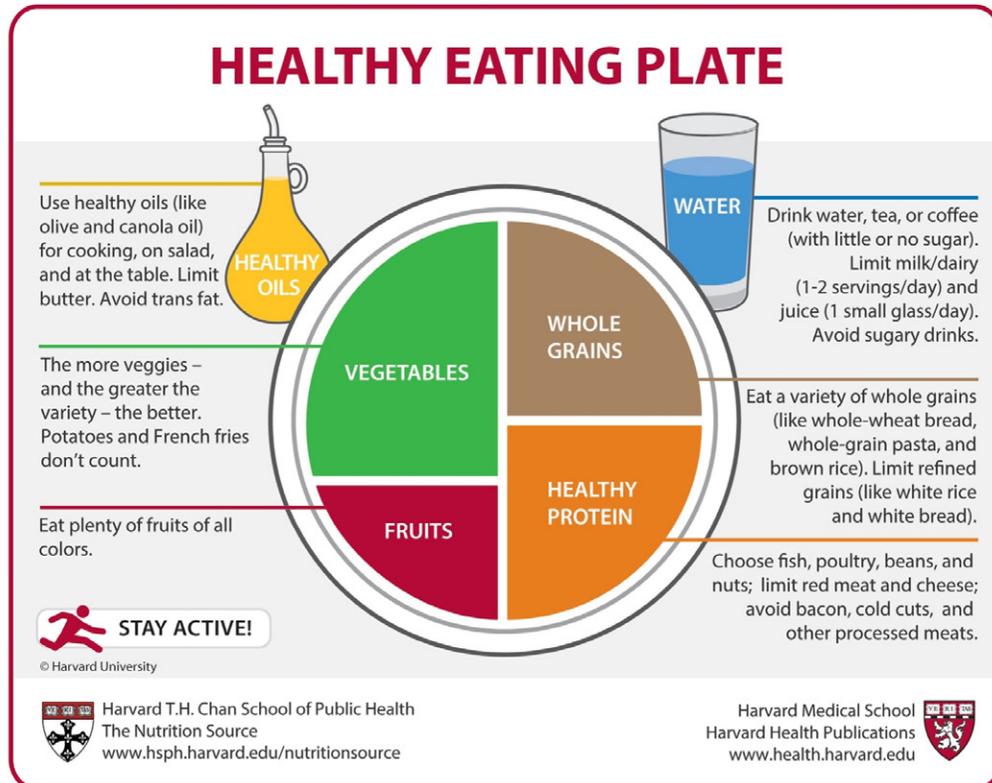
We now live in the age of convenience and industrialization where food is always available to grab off a shelf, drive-through, or gas station. This early survival adaptation no longer serves us, and it is used by food corporations to sell their products.

Whole, organic foods do not share this brain excitation pathway; however, they are essential for our gut health, brain health, energy, and lowering inflammation in the body. With this in mind, we can make informed choices about what we choose to eat each day.

# HEALTHY CHOICES

## Fundamentals of nutrient density

As scientists learn more about how food affects our health and the quality of our mood and energy, these findings influence recommendations for how to structure our plate. An easy way to reach the goals for nutrient density, or achieve multiple types of vegetable fiber, vitamins, and minerals is to start the meal with vegetables or fruits as the base and build up from there with healthy protein sources, whole grains, and omega-3 rich fats like avocado.



A good rule of thumb is to start with two fistfuls of fruits and/or vegetables, then one fist of protein, one fist of complex carbohydrates like whole grains or potatoes, and one thumb-sized serving of fats. Always remember to switch up the types of whole foods you consume, and eat the rainbow!

Eating whole sunflower seeds can be a healthy snack, but when converted to an oil, we lose a lot of the benefits from the rest of the seed and the energy content becomes highly concentrated.

The closer to the ground that we eat, the better. When food is processed, fiber and nutrients are lost and many have an excessive amount of omega-6 rich oils such as sunflower, palm, vegetable, and rapeseed oil, which promote inflammation in the body.

Thankfully, sprouts are rich with nutrients, flavor, and fiber. When sprouting beans, we get all the benefits of complex carbohydrates and proteins and with broccoli sprouts we receive antioxidants.



# FOOD SCARCITY

## barriers to healthy food

When it comes to finding food to eat, America is one of the top countries for fast food and quick, junk food snacks. However, many of us live in food deserts, and we may not even know it.

What is a **food desert**? It is an area (community, neighborhood, etc.) that is surrounded by fast food restaurants and gas station markets, in which there is a lack of stores selling affordable and fresh, whole foods and groceries. Often food deserts encompass neighborhoods and communities where the nearest grocery store is over a 30-minute drive away. For many without transportation, accessing healthy lifestyle behaviours like eating fresh vegetables and even small amounts of meat can be nearly impossible. For many reasons, these community members often have higher rates of disease risk than their counterparts who have easy access to healthy choices.

It is hard to imagine why there are still so many barriers to accessing healthy food in the age of industrialism and technology. Thankfully, there are many ways to improve community access to fresh produce. Can you think of some ways to help your neighbors get fresh food?

A few ways to improve access to fresh food include sprouting, community gardens, and farmers markets. Sprouting is an easy way to access healthy choices without needing garden space, dirt, or sunlight. Community gardens can easily be organized and seasonal; local produce can produce an astounding harvest. Farmers markets exist in many communities and provide wonderful, affordable options for communities.

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Image: "Copyright © 2011 Harvard University. For more information about The Healthy Eating Plate, please see The Nutrition Source, Department of Nutrition, Harvard T.H. Chan School of Public Health, <http://www.thenutritionsource.org> and Harvard Health Publications, [health.harvard.edu](http://health.harvard.edu)."



# SPROUTING GUIDE



This guide will help you learn how to sprout in a few simple steps!

## Materials Needed:

Mason Jar

Cheesecloth and rubber band or Screw on sprout lid ([link](#))

OR

Sprouting jar ([link](#))

Organic sprouting seeds ([link](#))

## Instructions:

1. Pour 2-3 tbs. of sprouting seeds in your glass jar along with 2 cups of water.
2. Cover the jar with cheesecloth and secure with a rubber band, or place sprouting lid on jar and allow seeds to soak overnight.
3. In the morning, drain out the water with the cheesecloth/lid still on. Place the sprouting jar upside down tilted in a bowl to allow air flow and water drainage.
4. Rinse seeds every morning and evening (think of it as giving them a shower and draining out the water).
5. Within 1-2 days, you will see the seeds opening up and little shoots sprouting.
6. By day four or five of the rinsing process, you are ready to harvest!
7. Enjoy your sprouts with tahini and liquid aminos/soy sauce, sprinkle on a salad, or blend in a smoothie! Store in the fridge tucked in a paper towel or keep in your jar. Can freeze for adding to soups or smoothies.



Soaking Set up  
(overnight)



Sprouting Set Up  
(Prop up in a bowl next  
day)



Root hairs on  
broccoli  
sprouts are  
not mold!



## Review this Exercise on Jar Growing Methods for Beginners.

Sprouting does not require soil or sunlight and can be an easy and fun way to help students engage with the plant growth process and cooking at home.

# How to Sprout EASILY for 25 Cents a Day!

Also available online at: [www.youtube.com/watch?v=qynti1u9ywE](http://www.youtube.com/watch?v=qynti1u9ywE)



Hey you guys!

It's Kristina. I am so happy to have you back in the kitchen today, because we're going to be sprouting and talking all things sprouts.



Sprouts are quick and easy to do. Anyone can sprout. It's super affordable, and you don't need much equipment to do it - just a jar or a sprouting tray.



You can sprout seeds, beans, legumes, or grains; and the nutritional value is increased when you sprout a seed. And because it releases enzyme inhibitors, it also helps to make the digestion process a little easier for you.



Because the sprouting process also increases nutrient levels, you're able to consume plants that are even richer in protein, folates, magnesium, phosphorus, manganese, and vitamins C and K.



For instance, there have been several studies released that showed that sprouting helps to actually increase the protein content of those plants. I thought that was pretty cool.



Sprouts are a great food to consume, especially for vegans because they're high in protein.



And so, when anyone ever asks you (if you're a vegan) where you get your protein... you can say sprouts, because it is a great source of protein.



And, because sprouts do not require any sunlight to grow, sprouts are amazing to grow any time of the year - especially during winter when less is available.



There's more interest now than ever to grow one's own food, and to practice more sustainability. So, I'm really happy to share with you what I've been sprouting at home; and I'm really excited to share my tips with you!



So, I'm gonna take you through the process today and we are going to have a lot of fun sprouting.



We're gonna have a little sprout party...



a little sprout party!!



So today is day 1, and usually, sprouting is a ...



four-day process from beginning to end.



What you will need is a sprouting tray or a jar. I have both, and I prefer sprouting via jars because not only is it easier, but also, there's less risk of your sprouts getting moldy. So I have some jars that I'll be sharing with you today.



Other than a jar or a sprouting tray, you will need to get some high quality seeds.

The quality of your seed matters. I cannot stress this enough.



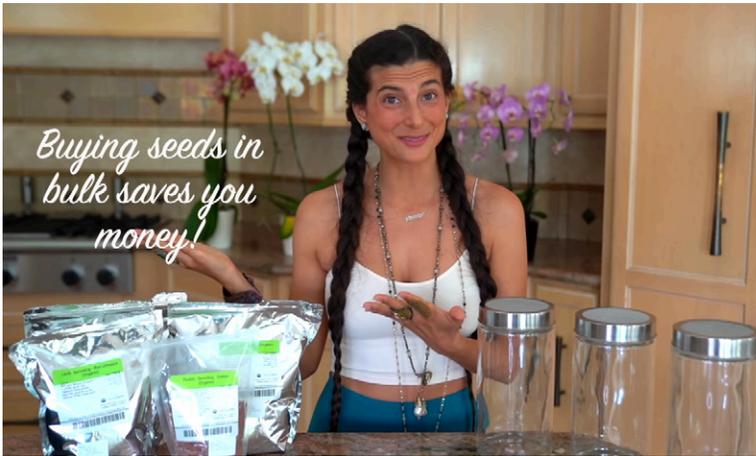
You want to get organic non-gmo seeds. I got my seeds from True Leaf Market. (This is not sponsored; I'm just sharing what's in my kitchen.)



And, I got the 12 pound pack - which is my favorite one to get - because it's an amazing variety for beginners and for medium to advanced sprouters.



For those of you who are interested in their beginners set, I have it linked at the end for you. You can check it out. It's amazing. It has everything from mung beans, alfalfa, broccoli sprouts, salad mixes, protein mixes, and more. It's just a great variety to begin with.



I also love this 12 pound set because it can last you for up to a year. That's right, I said a year!

And it will save you a lot of money.



I did the math on this 12 pound seed set and each bag (each one of these bags) will yield you 8 half cups servings of seeds.



1/2 cup of seeds will yield you approximately 4 cups of grown sprouts at a minimum. Some will yield up to 7 cups.



This means that you will get approximately thirty two cups of fully grown sprouts per each pound bag.



That's three hundred and eighty four cups of sprouts total, which is enough to feed you at least one cup of sprouts [a day] for an entire year.



That breaks down to twenty-five cents a day for 1 cup of grown sprouts. For a year this is a huge savings, considering you can pay up to...



\$5 at the grocery store for...



a container of sprouts. (I've been guilty of it.)



These are the seeds that I'm using. Of course, you can find whatever seeds that you feel most comfortable with. I just highly recommend that you find the highest quality seeds organic and non-gmo. I love this set because of the variety, because it saves you so much money. If you're interested in it, it's linked below. No, it's not sponsored. I'm simply sharing what I use, and love; and I hope that you love it too.



So, when I'm sharing with people the importance and the nutritional value of consuming sprouts most people will roll their eyes at me and say, "Oh, one cup? That's not very much!"

Well, guess what? One cup of sprouts is filled with **so many** nutrients!



*Protein  
(17 amino acids)  
Magnesium  
Iron  
Vitamin A  
Vitamin B-6  
Vitamin C  
Vitamin K*

*Folate  
Phosphorus  
Manganese  
Fiber  
Zinc  
Copper  
Selenium  
...and much more!*

Imagine if everyone consumed just one cup of sprouts in their daily routine how much more nutrients they would get into their diet!



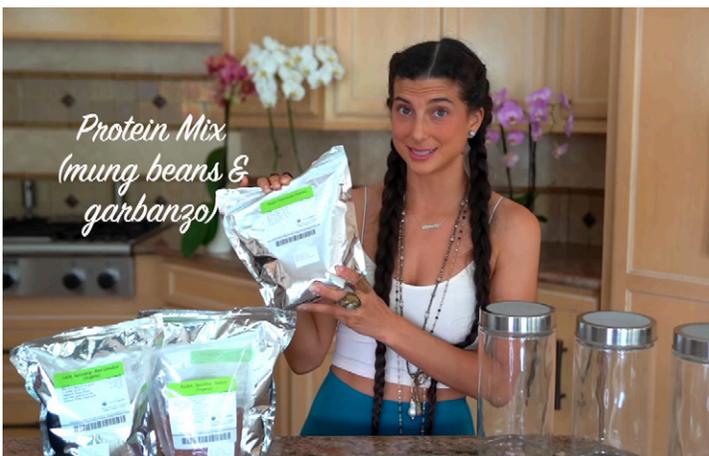
And usually one cup depending on what kind of sprout you're using can be very filling. I typically won't do more than two cups of sprouts on my salad, because they are very satiating.



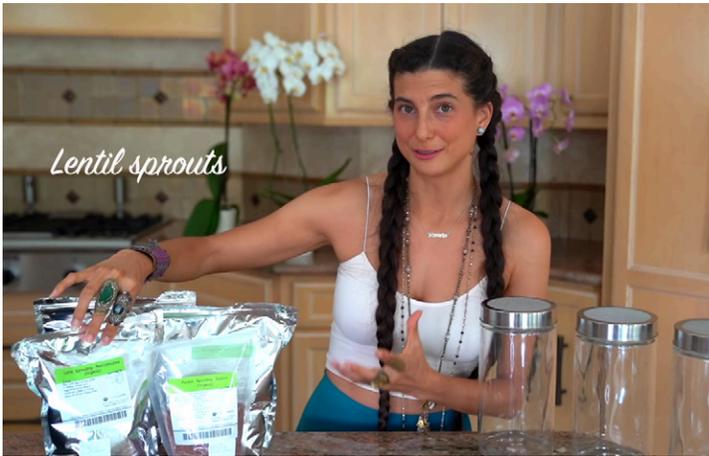
They're very, very filling, and you can get a lot in that little amount of sprouts. Sprouts are a great way to increase your nutritional intake. You get so much for so little. And, it's so easy to do at home!



So today, I'm gonna show you how I sprout three kinds of seeds from beginning to end.



I've got here a Protein Powerhouse Pack. It has mung beans and garbanzo beans. These are really easy to sprout for beginners.



I've also got lentil sprouts which are very hardy for a salad and some other recipes that I'm gonna be sharing with you at the end of this video.



I've also got broccoli sprouts. These are said to be one of the most nutritionally dense sprouts, and they taste amazing pretty much on anything you put them on.



So, I'm going to be showing you these three sprouts today.



So, as you can see here, I have three sprouting jars in front of me. Each of these is a half-gallon jar that I bought online.



I will also link these at the end for you if you're interested in buying some quality sprouting jars.



So into each of these (3) jars, I'm gonna add 1/2 a cup of each of the seeds that I want to sprout.



After your seeds are in your jar, you will fill up each jar with 3 cups of purified water, and then screw on the lid.



Purified water is really important here because the sprouts are soaking up your water - so you don't want to use non-filtered water.



You'll see that this lid has a sieve on it which allows water and air to come through. If you don't have one of these, you can also use a cheesecloth and tie it over with a rubber band. You can also use the top of a regular strainer throughout your daily process.



Ok, so this is it for day 1. After this, all you have to do is place them on your countertop somewhere away from the direct sunlight, and let them soak for about 12 hours.



I usually start this process at night, so when I wake up the next morning, I can begin the phase 2 component. I'll see you in the morning!



So it's day 2, and the seeds and beans have been soaking overnight.



And as you can see, they have soaked up a significant amount of water.



All we need to do today is rinse and drain them, and I will do this once in the morning and once in the evening.



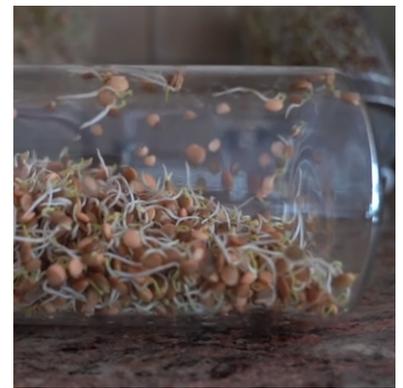
So I rinse and drain them twice a day, and I usually repeat the rinse and drain process twice.



Once they are rinsed and drained, you can lay them on your counter. I like to lay mine sideways or flat so that the seeds can lay out. They have more room to grow, and then you can just get on with the rest of your day!



Day 3: Look at the difference between Days 2 and 3! As you can see, the seeds have sprouted significantly. They've grown tails. They're starting to look like real sprouts.





We will follow the same process that we did yesterday: rinsing twice and draining twice, twice a day.



The only difference I'll do today is to be sure to mix the seeds around a little bit in the jar so that they don't clump together.



And, I will make sure that they're well-rinsed. Now you can use any kind of a long spoon here or a chopstick or any kind of tool to make sure that these seeds are broken up.



Just make sure that they are well-rinsed and drained. This will also help to eliminate or reduce any molding that might be happening.

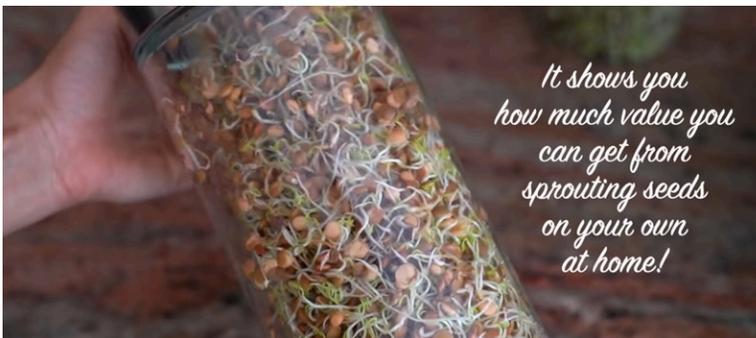


It is day four. Wahoo!

Typically your sprouts should be ready by day four.



And as you can see from these jars, they have expanded significantly. They look amazing!



We went from half a cup of seeds to nearly filling up a half-gallon jar.



You can see how much these seeds have sprouted. They look delicious.



So what we want to do now is we want to remove our seeds from their jars and put them each into their own separate bowls.

Fill each bowl up with water not only to give them one final wash or rinse, but also because during this process you'll see that the unsprouted seeds will float to the top.



This is a great way to separate the seeds that have sprouted from the few that didn't. The seeds that don't sprout will usually just float to the top with their shells and you can simply remove them by scooping your hand at the surface of the water.

Those seeds that didn't sprout are still good. you don't have to throw them away. You can begin the sprouting process with those again if you'd like. It's optional.



From here, we're gonna pour everything into a larger strainer. One at a time, I will strain my protein mix, my lentil sprouts, and my broccoli sprouts.



I'll give them one final wash in the strainer, and then you can place each of these either into a tray or bowl of choice.



I like to line the bottom either with a cloth or a towel or paper towel and from this point on - Voila! You have sprouted seeds!



These look fresh and ready to eat. You can store them just like this (or you can place them in a container of your choice), and they will last in the refrigerator for three to seven days.



How amazing do these look, and how easy was this process?!



Sprouting is so much fun - not just for us adults - but also for kids too!



There are three different ways that I love to enjoy at my sprouts. The first way is on a salad. Sprouts will make any salad more hearty, especially a rainbow salad. They just have this delicious crunch, and this ... just juiciness to your salad.



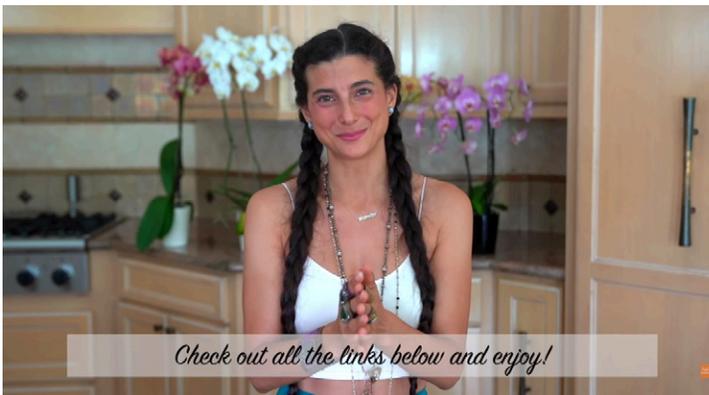
I also love to enjoy my sprouts on a flax cracker with some avocado and tomato. It's like a mini sandwich. It's a raw vegan sandwich!



I also love to enjoy my sprouts on top of a raw vegan soup. When you mix them in, the texture is just perfect and it just adds this different consistency to it that I really love.



So those are three different ways I love to enjoy my sprouts.



If you're interested in sprouting seeds or any of the jars or trays that I've talked about in this video, definitely check the links below. They're waiting for you.

Sprouting Seeds I LOVE (12 lb. Bulk Set): <https://bit.ly/trueleafsprouts>  
Easy Sprouting Starter Kit (Jars Included): <https://bit.ly/sproutingstarterkit>  
More Sprouting Jars: <https://amzn.to/37vEqvQ>

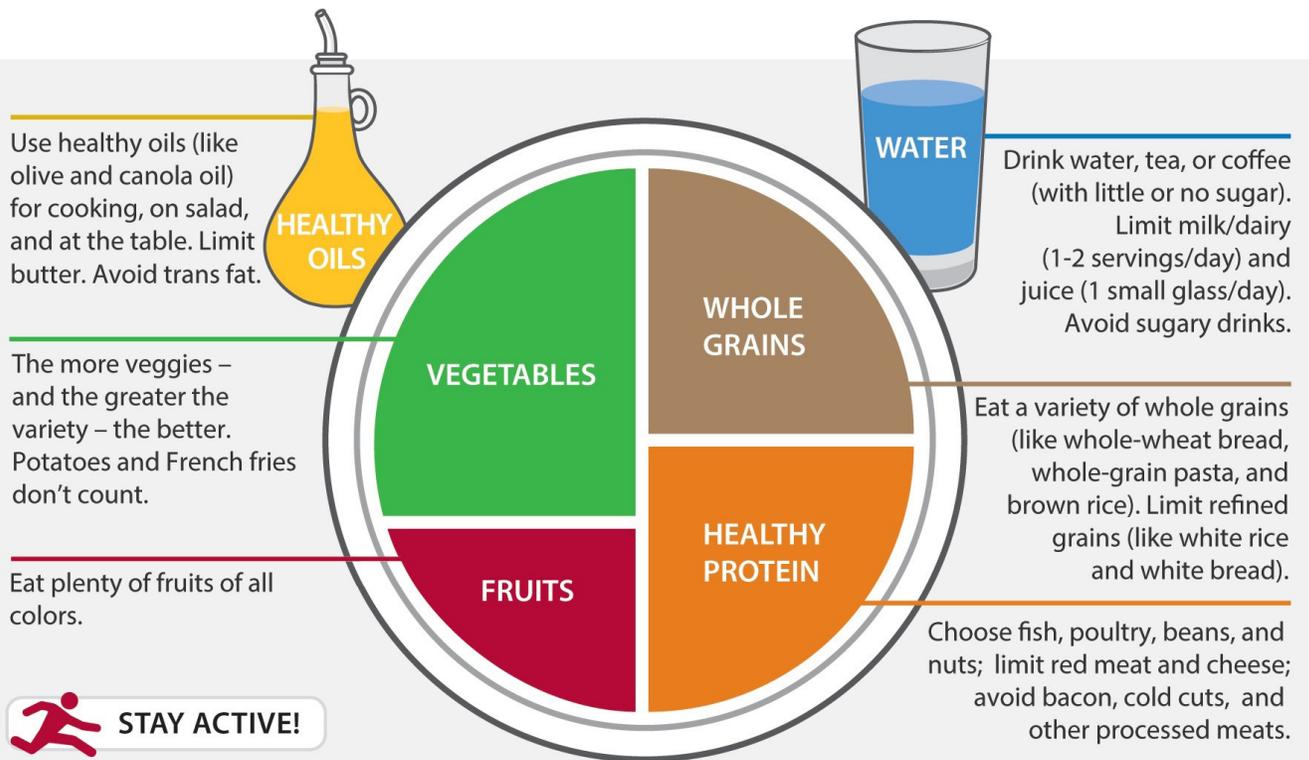


## Activity 2: Review the diagram below

Answer the following questions:

- ▶ What changes would you be interested in making?
- ▶ What new foods would you like to try?
- ▶ How can you promote health?

# HEALTHY EATING PLATE



**STAY ACTIVE!**

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## Post Assessment

Refer to your pre-assessment answers. Would you now answer any of these questions differently?

1. How do plants grow from a seed?
2. Describe the environment required for a seed to grow.
3. At what stage of growth does a plant contain the most nutrients?
4. What is required for a healthy diet?
5. \_\_\_\_\_ helps our gut function properly.
6. What is a food desert?
7. How can we improve the problem of food scarcity?
8. Why is it important to purchase organic produce when possible?