

Growing Camelina Sativa as a Biofuel

Time required:

This lab will take four months to complete. Start the growth at the beginning of the semester and then teach as usual until the plants are ready to harvest. I recommend using the growth of the plants as a main theme to discuss several topics in the essential standards. The care for the plants should not take more than five minutes to complete on any given day.

Materials per group of four:

One small pot (4")
Tape or pot labels for labeling pots with plant type, date, pot number, and initials
Timer to set lighting conditions
Soil with lots of vermiculite (white clumps) for aeration
Fluorescent light fixtures (preferably two 48" fixtures with two 40 Watt bulbs to fit eight groups worth of pots under)
Osmocote brand slow release granulated fertilizer
Digital Balance or scale
Dowel rods or plant stakes to support the plant as it grows
Screen Sieve
Gloves
Graduated cylinder to keep track of amount of water added each day.
Spray Bottle for gentle misting while plants are young.

Instructions:

Each day the students will need to come in and care for their plant by checking the soil moisture and watering as needed. This will preferably be done before the class begins, but no longer than 5 minutes after class has started. The biggest challenge with growing these plants will be during extended breaks such as Holidays or long weekends. I recommend having the groups assign a "Head Gardener" who is responsible for either delegating who will take the plant home on longer breaks, or for coming to the school to water if possible. Placing the plant by a couple of 40 Watt fluorescent lights and next to a window for a couple of days will provide the plant with enough light until it can be placed back under the fluorescents for the 14 hour light/10 hour dark timers. If you are planting during the fall semester, start as early as possible to use the December Holiday break as the drying period. I have attached a Class Comparison Growth Data Page after the growth record to assist with improving the growing conditions each semester.

Planting the Camelina Sativa seeds:

- 1.) Place the Camelina Sativa seeds in a sealed test tube or vial with water and place them in a refrigerator for vernalization over a couple of days or over a weekend. Vernalization is the ability a plant develops for their seeds to germinate after the chill of winter. Placing the seeds in the refrigerator mimics the process of winter chilling and allows the water to penetrate the seed coat. The seed will absorb the water and they will get a gel like coating around it. They are now more permeable and ready to grow.
- 2.) Create a space for Camelina to grow and hang four 40 Watt fluorescent light bulbs 6 inches from the top of three 4 inch pots. I originally used wire mesh shelving so that I could adjust the height of the shelves and the distance to the light as the plants grew. After getting some materials donated from our local nursery and hardware store, our construction class built us two 6ft. 10in. mobile growing stations out of wood with the fixtures attached to the underside of the top and middle shelves so that we could move the growing stations when needed in the elevator to another floor or to another classroom.
- 3.) After the seeds have vernalized, use a 250mL graduated cylinder and wet some vermiculite rich soil down in a large tub and gently mix the soil with your gloved hands until the soil is moist and clumps a little bit. Do not squeeze the soil too hard, the more aeration the better.

- 4.) Place the soil into the 4-inch diameter pots. Once again, do not mash the soil down so that the aeration will help with the development of the seeds. Use the tape to label the pots with *Camelina Sativa*, group name, date planted, and pot number.
- 5.) Weigh a tablespoon of Osmocote Fertilizer and RECORD THE MASS IN THE GROWTH CHART. Place the tablespoon of Osmocote fertilizer on the top of the soil and water the soil slowly until water comes out the bottom of the pots. Move the Osmocote around with a small spatula until it is just peeking out of the soil.
- 6.) Place 10 seeds on the surface of the pots and spread them around gently with a small spatula. Do not push the seeds in the soil with the spatula; just let the soil cover it slightly as you spread the seeds. *Camelina* will germinate about 60% of the time under normal conditions. This means that 8-10 seeds can successfully germinate four or five plants per 4" pot with very little difficulty with a good batch.

Growing the *Camelina Sativa*:

- 1.) For the first three days, spray the pots with three squirts (approx. 3mL) of distilled water from a spray bottle twice a day or as needed and cover each pot with some clear plastic wrap until the seeds start to germinate. KEEP TRACK OF AMOUNT OF WATER SPRAYED EACH DAY ON YOUR GROWTH RECORD.
- 2.) On Fridays, using a 250mL beaker, gently pour water around the plants until the water begins to seep out of the bottom of the pot into the tray. The plants should not need water for a couple of days after this application. Water the plants in this manner as necessary. KEEP TRACK OF THE AMOUNT OF WATER POURED ON YOUR GROWTH RECORD.
- 3.) On the growth chart, write down the number of leaves on your plant as it grows and make observations on the plant health, color, and stability.
- 4.) When the plants get more than a few inches tall, use the wooden dowel rods and some string to LOOSELY support the stalks. Continue to water as needed. The easiest way to kill these plants would be to overwater! If the soil is still really moist, then wait until the next day to water.
- 5.) The plants will tend to flower between 24-27 leaves.
- 6.) Once the pods appear, do not be concerned if the leaves or the stalk begins to yellow because that means that most of the energy is going towards the production of oil and seeds and you will be able to harvest soon.

Procedure for Harvesting *Camelina Sativa*:

- 1.) Once the pods start to turn yellow, the plants are almost ready to harvest. You may see the leaves at the bottom start to go through senescence (aging and withering) which means that the plant has used all of the nutrients from the osmocote and is focusing its energy on making the seeds.
- 2.) Once the pods start to yellow, stop watering and let the plant dry out for one to two weeks. When all of the pods are dry, brittle, and a straw yellow color then they are ready to harvest. The pods do not shatter which makes it easier to harvest.
- 3.) Use a Screen Sieve that has 14 holes per square inch and place it on top of a piece of white paper.
- 4.) Holding the *Camelina* over the sieve, pinch a branch between your thumb and index finger and slowly slide and pull the pods off of the branch into the sieve. Try and pinch the pods open as you go. Do this until all of the pods are in the sieve.
- 5.) Go through the sieve and make sure that all of the pods are open and tap the sides of the sieve to work the seeds through to the white paper beneath.
- 6.) Remove the sieve and clean anything that is not a seed out of the seed pile on the white paper.
- 7.) Mass the weight of the seeds.

*If you have access to a seed press, then the oil your students produce could be made very easily into a biodiesel! Call the Biofuels Center of North Carolina in Oxford for more information at 919 693-3000. If your students don't have enough seeds to convert, then you can purchase *Camelina* oil at your local nursery for less than \$10.00. There are also several kits that you can order to safely convert oil to diesel through most science catalogs.*

Camelina Sativa Wild Type Growth Record

Date of planting: _____ Group Names: _____

Lighting conditions: _____

Mass of Fertilizer used: _____ Total Amount of Water Used: _____

Mass of Harvested Seeds: _____

Day	Number of leaves per plant	Observations (height, health, color, atmospheric conditions, etc.)	Amount of water added in mL	Initials
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Class Comparison of Growth Data

1. What was the highest amount of water that was used by a group in the class? What was the least amount of water used by a group? Were they successful in growing their plants to maturity?

Most: _____

Least: _____

2. What was the total mass of seeds for the class? _____
3. What was the average mass of seeds per group? _____
4. Graph the relationship between the mass of seeds that were produced and the amount of water that was used by each group. Use two lines on the graph below with the group numbers on the x-axis and the mass of seeds and the amount of water used on the two y-axes.
5. Do you have any suggestions for future classes to be more successful with growing Camelina? _____

