



GEORGE WATTS
MONTESSORI
EDIBLE GARDEN

sow it. grow it. eat it. know it.

Upper Elementary
Lessons for
Classroom & Garden

Written by

Cathy Carinder and Pattie LeSueur

Edited by

Alice Bumgarner

This series made possible through a grant from Blue Cross and Blue Shield North Carolina Foundation

Table of Contents

Lesson	Title	Page
	Introduction	1
1:	Garden Changes Over Time	2
2:	Tracking the Sun.....	3
	<i>Master Data Sheet</i>	
3:	Garden Adjectives.....	7
4:	Garden Soil Investigators (G.S.I.), Part I.....	9
5:	G.S.I., Part II.....	11
6:	Preparing the Garden	13
7:	Planting a Winter Vegetable Garden	15
	<i>Recipe for Minestrone Soup</i>	
	<i>Recipe for Green Smoothies</i>	
	<i>Recipe for Yogurt-based Veggie Dip</i>	
	<i>Recipe for Creamy Miso Dressing (for salads)</i>	
8:	Planting Wheat	19
9:	Harvesting Wheat, Part I.....	21
10:	Harvesting Wheat, Part II	23
	<i>Recipe for Pretzels</i>	
11:	Garden Scavenger Hunt.....	25
	<i>Garden Scavenger Hunt List</i>	
12:	Pollination	27
13:	Gathering Seeds	30
14:	Simple Machines in the Garden.....	33
15:	Worms.....	35

Helpful Documents

Planting and Harvesting Guide for Piedmont Vegetables: *What and when to plant in Durham*

Map of the Courtyard Garden

Map of the Urban Ave. Garden



Introduction

These 30 lessons for 4th and 5th graders assume a couple of things:

First, that your school has already carved out a space for a garden. We don't delve into how to start or design a school garden, since plenty of other sources can guide you through that. We're going to talk about how to *use* a garden, now that you have started one.

Second, we assume that you want to make a school garden relevant to the N.C. Standard Course of Study. We've tried to come up with lessons that help teachers teach the SCOS, while being meaningful for students in ways that extend beyond academics. While learning about soil and plant life cycles, for example, students will also experience the pleasure of digging in the garden, learn to understand growing seasons and where food comes from, taste some healthful vegetables, learn to exercise patience and caring and cooperation, etc.

These 30 lessons are designed to enhance teachers' knowledge of their school garden and to offer quick, fun, relevant ways to use a garden weekly. Please feel free to do additional research or pursue other ideas and/or experiments in the garden. And ask your students what *they* want to learn about in the garden.

While reading these lesson please take into consideration:

- We welcome your help and feedback on these lessons to make them better or to add more to them in the future
- These lessons may be done with your whole class or in small groups
- The lessons vary in length and include an estimated amount of time for inside and outside activities and discussion. Feel free to break the lessons into smaller parts to fit your schedule
- The lesson have suggested months for teaching to help teachers sequence the lessons.
- Each lesson follows the same format with the following sections:
 - ✓ Objective
 - ✓ NC SCOS Correlation
 - ✓ Time
 - ✓ Materials
 - ✓ Vocabulary Focus
 - ✓ Lesson / Step-by-Step
 - ✓ Review / Journaling
 - ✓ Extensions



UPPER EL LESSON 1: Garden Changes Over Time

Objective:

This lesson is to introduce the students to the Edible Garden and will set the routine for looking at changes in the garden for the rest of the year. Brief review lesson of perimeter and area.

Vocabulary Focus:

- Grid
- Changes over time

Lesson / Step-by-Step:

1. Begin by taking a tour of the garden using the map to identify the various areas.
2. Have the students work in pairs to measure the length and width of the garden. Use this information to determine the area of the garden.
3. Discuss the grid that can be made by the information. Use this information to make one-meter squares of the garden. Assign each student a square. If there are not enough squares, two students may have the same square.
4. Each student should mark her square on her map. You should keep the master map.
5. Explain to the students that they will be observing and sketching their patches of the garden once a week for the entire year and recording the changes.

Review / Journaling:

The students should use their sketch pads to draw their section of the garden. They should then write some notes explaining their observations, along with the date. Encourage them to use their rulers to measure some of the plants found in their patches, as part of their observations.

Extensions:

The students may choose one of the plants in their area to research more in depth.

TIME:

Suggested month:

August or September

MATERIALS:

For the teacher:

- Master map and grid
- Click wheels
(for measuring the perimeter of the garden)

For the students:

- Notebooks
- Sketch books
- Pencils
- Garden maps
- Rulers



UPPER EL LESSON 2: Tracking the Sun

Objective:

This lesson will demonstrate the reason we have different seasons. The students will use the Shadow Tool to track the position of the sun at approximately the same time weekly throughout the year.

This lesson will also set the routine for tracking the sun's position for the rest of the year. Assign a different student to record the data every week. You should keep the master data sheet and the Shadow Tool (directions below).

Because the Earth's axis is at a 23 ½ degree tilt, the direct rays of the sun change throughout the year. During our summer months, the Northern Hemisphere is tilted toward the sun, thus the longer and warmer days. Conversely, during our winter months, the Southern Hemisphere is tilted toward the sun. They have longer and warmer days (summer), while we have shorter and colder days (winter).

The students will use the Shadow Tool to record the angle of the sun. It is important that the tool is put in the same location each day to get accurate data. There will be an outline on the sidewalk for the tool.

NC SCOS Correlation:

5th grade SCOS, Objective 3.05:

- Compile and use weather data to establish a climate record and reveal any trends.

Vocabulary Focus:

- Rotate
- Revolve
- Axis

TIME:

Suggested month:

September (continuing throughout year)

MATERIALS:

For the teacher:

- Master data sheet
- Manila folder
- Colored pencils
- Ruler
- Penny
- Grape-size piece of clay
- Protractor
- Toothpick

Lesson / Step-by-Step:

Background:

Begin the lesson by explaining that ancient civilizations used the position of the sun and the stars as calendars. The positions of these heavenly bodies change because of the tilt of the Earth. If the Earth were not tilted, there would not be seasons. Depending on where you were located on the Earth, the temperature in your town would be pretty much the same day in and day out. But because of the tilt of the Earth, we have seasons.

The Earth moves in two ways. It rotates around its axis, which takes 24 hours (or one day). It revolves around the sun, which takes about 365 days (or one year).

The Earth's tilt explains why we don't have 12 hours of daylight and 12 hours of night every day. This only happens twice a year on the first day of spring and the first day of fall. These are called the Vernal Equinox and the Autumnal Equinox. On these two days, the direct rays of the sun fall directly on the Equator. At all other times we are either gaining or losing daylight depending on the season.

Explain to students that they will be tracking the position of the sun, just as the ancient civilizations did. The way they will do this is to build a Shadow Tool to measure the angle of the sun over time.

Making the Shadow Tool:

1. Open the manila folder, and using a pen and ruler, draw a line down the crease of the folder. Label one end of the crease line "N" to indicate the compass direction of North.
2. At the other end of the crease line, about 2 cm from the edge, draw a second line parallel to the long edge and perpendicular to the line down the crease.
3. Center the penny at the point where the two lines cross, and trace the outline of the penny.
4. Take the grape-size ball of clay, and stick the toothpick into the center of the clay.
5. Place the clay on the drawn circle, with the toothpick lined up with the crease line of the folder.

Using the Shadow Tool:

Demonstrate the following routine for students. They will be using the tool and gathering the data from this point on. You may need to help the first couple of students do this independently. After this, those students who have already used the tool should be able to help the other students instead of you.

1. Place the folder in the outline already marked on the sidewalk. Make sure that the crease line is lined up with the North line marked on the sidewalk.
2. Use a colored pencil and ruler to trace the length of the toothpick's shadow on the folder.

1. Label the date on the shadow.
2. Measure and record the length of the shadow on the data sheet. To do this, lift the clay and measure from the center of the circle where the lines cross to the end of the shadow.
3. Use the protractor to measure the angle between the toothpick's shadow and the crease line. Record on the data sheet.
4. Use a different colored pencil each week.
5. Note the time that you measured the shadow. Explain to the students that it is important to gather the data as close to the same time each week, since the Earth is constantly rotating and revolving. Near the end of each weekly garden session, the student in charge should collect the data for the week.

Review / Journaling:

Have the students make a hypothesis about what they think will happen to the shadow over the weeks. They should use data from the background lesson to support their guess.

- *Do they think the shadow will remain the same length, be longer or shorter?*
- *Will the angle measurement change? If so, how?*

Remind them that a hypothesis is just an educated guess. It doesn't matter if it is right or not. What is important is that they learn to use their data to either revise or expand their hypotheses over time.

Extensions:

1. **Display the master data sheet in the classroom** or make a poster with the transferred data on it, so that the students are able to look at and think about it. Periodically during the year, take a few minutes to have the class discuss what patterns they see, how it aligns with their original hypothesis, or any other insights they may have.
2. **Each week, assign a student to log on to weather.com** and record the sunrise and sunset times in Durham for every day of the week. They can then figure out how many hours and minutes of sunlight there are each day. This is a good way for the students to become more comfortable figuring out elapsed time. The results could also be charted on a graph in the room for the students to see patterns that arise.

Date	Length of Shadow
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24



UPPER EL LESSON 3: Garden Adjectives

Objective:

This lesson will integrate the garden with writing. Students will use specific and/or unique adjectives to describe things they hear, see, feel, touch, and taste in the garden. Check the garden before this lesson to see what is available for tasting. Use this lesson while you are teaching about adjectives.

Vocabulary Focus:

- Adjectives

TIME:

Suggested month:

Anytime

MATERIALS:

For the students:

- Notebooks
- Pencils
- Small plastic or paper bags

Lesson / Step-by-Step:

1. Tell students that today in the garden, they'll be quietly walking around and using their senses.
2. Ask them to divide a page of their notebook into five sections and label them "Sight," "Smell," "Sound," "Taste" and "Touch."
3. Choose one sense at a time. For each sense, give students two or three minutes to walk around the garden exploring various plants or other items using that sense. When it's time for "Taste," point out the plants that students can taste -- perhaps the leaves of herb plants or ripened vegetables.
4. At the end of each exploration, students should choose one item, and write at least three specific adjectives that describe that item. For example, if the sense is sight and they choose a strawberry leaf, they should not use words like "green," "small" or "cute." Instead they should use words like "jagged," "tripled" and "veined," which help distinguish the strawberry leaf from other leaves.
5. Circulate during the writing time to make sure the students are using specific adjectives. Guide those students who aren't having as much success, so they have at least one word for their list.
6. Without destroying the plants, the students should also gather a *small* sample (a piece of a leaf) of each thing they've described and put it in their bags. **NOTE:** It's best to use a leaf sample *already on the ground*. When picking a live leaf sample, students should use one hand to pull the leaf and the other to hold the plant steady, so branches or stems aren't damaged.

7. If there is time at the end of the lesson, gather the students around the outdoor table. They should each place their five items in front of them. Ask a student to choose one set of his adjectives and read them out loud. Other students should decide which sense the reader was using and which of his five items he is describing.

Review / Journaling:

For their journal assignment they should write a descriptive paragraph entitled “A Walk in the Garden.”

Extensions:

Students should continue to use specific and unique adjectives in their writing. Refer to this lesson during writing times so the students can visualize the process they went through to come up with strong adjectives.



UPPER EL LESSON 4: G.S.I. (Garden Soil Investigators), Part I

Objective:

The students will observe soil samples using a magnifying glass to determine the makeup of the soil.

NC SCOS Correlation:

Science SCOS 5th grade, Objective 1.04, 1.05, 1.06 and 1.07

- Discuss and determine the role of light, temperature, and soil composition in an ecosystem's capacity to support life.
- Determine the interaction of organisms within an ecosystem.
- Explain and evaluate some ways that humans affect ecosystems: Habitat reduction due to development, pollutants, increased nutrients.
- Determine how materials are recycled in nature.

Vocabulary Focus:

- Soil
- Organic
- Inorganic

Lesson / Step-by-Step:

Background:

This should be a review for most of the students, since soil is covered in 3rd grade science.

Soil is a mixture of mineral (inorganic) and organic materials, plus air and water. The contents of soil vary in different locations and are constantly changing.

There are many different kinds and types of soils. Each has certain characteristics, including a specific color and composition. Different kinds of soils support the growth of different types of plants and also determine how well that plant life grows.

TIME:

Suggested month:

Anytime

MATERIALS:

For each student:

- Notebook
- Paper plate
- Magnifying glass
- Plastic spoon or some other item to scoop up dirt samples.

It makes up the outermost layer of the Earth. Earth is the only known planet that has soil. Other planets do not have the organic composition that makes up soil.

Ask the students what *inorganic* elements they might find in the soil. They should be able to talk about small pieces of rock or stone, minerals, sand, pieces of plastic, glass or other litter.

Next, ask about the *organic* elements that might be found in soil. They might name things like leaves (whole or in pieces), wood, plant parts, animals (both living or dead pieces), or food.

Investigation:

1. Tell the students they are going to be G.S.I.'s or garden soil investigators. They'll be looking at two different soil samples to determine what composes the soil.
2. Instruct them to draw a line down the middle of their paper plates. One side should be labeled "Sample 1" and the other side "Sample 2." They should divide a page in their notebooks and label it in the same way.
3. The two soil samples they choose should come from two different parts of the garden -- one area with lots of plant growth and one with little or no vegetation.
4. The students should put a spoonful of soil on each side of the paper plate.
5. Then they should move to an area and use their magnifying glasses to look at the soil samples, one at a time. They should write down in their notebooks each individual component of the soil that they see, and note whether it is organic or inorganic.
6. They should also note:
 - the color of the soil (*dark brown, reddish brown, tan, etc.*)
 - the texture of the soil (*soft, hard clumps, a lot of pieces, etc.*)
 - how it feels (*smooth, gritty, wet, damp, dry, etc.*)
 - how it smells (*rotten, musty, like dirt, etc.*)

Review / Journaling:

The students should use their journals to compare and contrast the soil samples. They should be able to draw some conclusions as to why one sample supports more vegetation than the other, and support their conclusions with the data they have gathered.

Extensions:

Bring two of the samples back to the classroom. Connect the Big Blue microscope to the computer. Use the various magnifications of the microscope so the students can see even more detail.



UPPER EL LESSON 5: G.S.I., Part II

Objective:

The students will observe soil samples and determine the soil's capacity to retain water.

You will need to get garden trowels from the storage building. Know where there is soil with a lot of clay content. This may be close to the fence. You will probably need a shovel to dig down to the clay.

NC SCOS Correlation:

Science SCOS 3rd grade, Objective 2.01

- Observe and describe the properties of soil, including the texture, color and capacity to hold water.

Vocabulary Focus:

- Soil
- Absorption
- Drainage

Lesson / Step-by-Step:

Background:

Review some of the properties of soil from the previous soil lesson, and what soil needs to support the growth of vegetation. Another important characteristic of soil (that determines plant growth or the type of plant that can grow in it) is the soil's ability to hold the water that a plant needs to grow.

Investigation:

1. Have the students take a few minutes to wander around the garden to find fertile soils that support a lot of vegetation, soil that has very little vegetation, and soil that contains a lot of clay.

TIME:

Suggested month:

Non-winter months

MATERIALS:

For the teacher:

- 3 cups of sand
- 3 empty containers
- 1 measuring cup
- Strainer
- Pan or other large container

For the students:

- Notebooks
- Pencils

2. The group should collect about one cup of each type of soil and put each into a separate container. Tell the students they are going to observe the absorption or water retention of each type of soil, and of the sand that you have brought in a cup. They will note their observations in their notebooks.
3. Return to the classroom. Put the first sample into the strainer, and hold the strainer over the pan. Measure one cup of water and pour it over the sample. Make sure the students can see what is happening.
4. Students should write what they see in their journals. If any water drips into the pan, use the measuring cup to measure how much water drained out. If students notice that water isn't being immediately absorbed by the soil (which will probably be the case with the clay sample) they should write that down.
5. Repeat the procedure for each soil and sand sample.
6. Ask students (if there is time):
 - *“What do you think would happen if we mixed some of the sand into the clay?”*
 - *“What if we mixed some clay into the fertile soil?”*

Review / Journaling:

The students should use their journals to compare and contrast the soil samples. They should be able to draw some conclusions as to how plants would or would not grow in each of the samples. Encourage them to use the words “absorption” and “drainage” in their writing.

Extensions:

Have the students plant seeds in containers filled with each of the different types of soils used. Water each with the same amount of water and place the containers in the classroom. Each plant should be given the same amount of water and warmth/sunlight. The students should monitor the growth of the seeds into plants.



UPPER EL LESSON 6: Preparing the Garden

Objective:

The students will be preparing the soil for the planting of the wheat and winter vegetables.

NC SCOS Correlation:

4th grade science SCOS

- Objective 4.05: Determine that foods are made up of a variety of components.

5th grade science SCOS

- Objective 1.04: Discuss and determine the role of light, temperature, and soil composition in an ecosystem's capacity to support life.
- Objective 1.05: Explain and evaluate some ways that humans affect ecosystems.
- Objective 1.06: Explain and evaluate some ways that humans affect ecosystems.

Lesson / Step-by-Step:

Background:

Begin by asking the students, *"How does food go from the ground to the grocery store?"*

Possible answers: Fresh fruits and vegetables are picked and put in the produce department, or canned for a longer shelf life.

Ask, *"Does bread come from the garden?"*

Answer: Yes. Wheat is a grain that grows like a grass. The central part of the United States is known as the "bread basket," because so much wheat is grown there.

Students will be doing on a small scale what farmers have done for centuries -- planting, harvesting and making bread from wheat.

Investigation:

1. Students will start by preparing the beds for the wheat and winter vegetables. Soil needs to be tilled or turned under to loosen it up. Demonstrate to the students how they should first step on the shovel and take the shovel full of soil and turn it over, replacing

TIME:

Suggested month:

Sept/Early Oct.

MATERIALS:

For the teacher:

- 2-3 Shovels
- Hand cultivators
- Hard rake

For the students:

- Notebooks
- Pencils

it in the spot where they removed it. They should use the shovel blade to break up any big pieces of dirt. Students may also use the cultivating tools to “chop” the soil.

2. The next student should place her shovel next to the place that has just been turned under. Let each student turn under one or two shovels full of dirt. Don't worry that the entire bed has not been finished, since more than one class will be doing this lesson.
3. After each student has had a turn, the soil needs to be evened out with a hard garden rake. The students should take turns performing this task also.

Review / Journaling:

Have students write about their experience getting the soil ready for the seeds. Reflect on what it must have been like for farmers to do an entire field before the invention of machinery.

Extensions:

Have the students figure out the square footage of one garden bed. Compare it to the size of an acre (4840 square yards). Investigate how many acres the average wheat/vegetable farm is.



UPPER EL LESSON 7: Planting a Winter Vegetable Garden

Objective:

The students will plant seeds for vegetables that they'll later harvest.

NC SCOS Correlation:

4th grade science SCOS

- Objective 4.05: Determine that foods are made up of a variety of components.

5th grade science SCOS

- Objective 3.02: Discuss and determine how the following are affected by predictable patterns of weather:

Temperature

Wind direction and speed

Precipitation

Cloud cover

Air pressure

Vocabulary Focus:

- Growing season
- Crop
- Frost
- Hardy

TIME:

Suggested month:

September

MATERIALS:

For the teacher:

- Seeds
- String
- Wooden stakes
- Tacks
- Scissors
- Water key

For the students:

- Notebooks
- Pencils

Lesson / Step-by-Step:

Background:

Remind the students of the discussion about how food goes from the farm to the grocery store.

There is a specific growing season for various plants. The *growing season* is the period during the year in which plants grow. This is true for flowers as well as crops. *Crops* are plants that are grown for food.

The growing season is determined by the climate of a region. Farmers look at the amount of daylight, the temperature, and the amount of rainfall for an area to determine what crops to plant.

In the United States, the growing season for most plants occurs between the last frost and the first frost of the year. *Frost* is frozen dew, so it occurs when the temperature is 32 degrees or colder.

Some plants in North Carolina have a limited growing season. For example, the strawberries in the garden only produce one harvest, usually sometime in May. People used to get fresh strawberries only once a year. Students' grandparents probably saw fresh strawberries in the grocery store for a only short period each year. The strawberries could be preserved, usually as jelly or jam, to last throughout the year. But it would have been done with the May crop.

Now, with refrigeration and air/ground transportation, the students can buy fresh strawberries from the grocery store anytime. These strawberries usually come from California or South America, where the growing season is longer.

Some plants are hardier than others. A *hardy* plant is one that can survive colder temperatures. Some plants have a longer growing season than others.

Over the next two lessons, the students will be planting two types of seeds: In this lesson, students will plant hardy seeds with a relatively short growing season. It will take roughly two to three months for them to go from seed to harvest. Because these crops grow quickly, farmers can plant them more than once per growing season.

For the next lesson, the students will plant wheat seeds. Wheat has a fairly long growing season. It will take several months for the plant to mature before it can be harvested.

Different classes will plant different seeds. When all the crops are harvested, we will make a winter stew for the classes to enjoy.

Investigation:

1. Head outside to the garden bed where you'll be planting. Read the directions on the seed package aloud to the class. Make sure the students understand the directions for planting, demonstrating the method once.

2. Mark any rows you planted by putting a wooden stake at each end of the row, then stretching a piece of string across the length of the row, and tacking the ends of the string to the stakes.
3. “Water in” the seeds. Over the next few weeks, students should water their vegetables and weed their garden. NOTE: Make sure they don’t mistakenly pull up plant seedlings! **Seeds need to be kept moist until they germinate.** Watering could be done during playground time. Caution them to step carefully around the garden and not to step *inside the beds*, since other seeds or plants may be trying to grow there.

Review / Journaling:

The students can use their journal time to use what they know about growing seasons to infer what people in Alaska might grow during their growing season. How do you think their growing season would compare to the growing season in North Carolina?

Extensions:

1. The students can chart the growth rate/germination rate of the plants in their row. They can do this by keeping a data page in their notebook and check on the plants weekly.
2. Read *Stone Soup*. Have the students come up with a recipe for the winter stew.

MINESTRONE SOUP



Variation of Marcella Hazan's Minestrone Soup

Ingredients

3 tablespoons olive oil
3 cloves garlic, chopped
2 onions, chopped
2 cups chopped celery
5 carrots, sliced
2 cups chicken broth
2 cups water
1 can whole tomatoes
1 cup canned kidney beans, white beans, cannellini, or great northern beans, drained
1 cup diced green beans
2 cups baby spinach
3 zucchinis, quartered and sliced
2 large potatoes, peeled and chopped
1 tablespoon chopped fresh oregano
2 tablespoons chopped fresh basil
salt and pepper to taste
2 tablespoons grated Parmesan cheese for topping

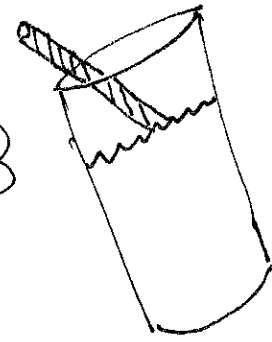
Time Estimates

Prep time: 10 min
Cook time: 50 min
Total time: 1 hr

Directions

1. In a large stock pot, over medium-low heat, heat olive oil and sauté garlic for 2 to 3 minutes. Add onion and sauté for 4 to 5 minutes. Add celery and carrots, sauté for 1 to 2 minutes.
2. Add chicken broth, water and tomato sauce, bring to boil, stirring frequently. Reduce heat to low and add kidney beans, green beans, spinach leaves, zucchini, potatoes, oregano, basil, salt and pepper. Simmer for 30 to 40 minutes, the longer the better.
3. Ladle soup into bowls and sprinkle Parmesan cheese on top.

green Smoothies



Ingredients

1/2 banana

12 strawberries

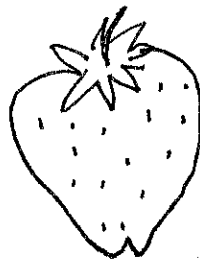
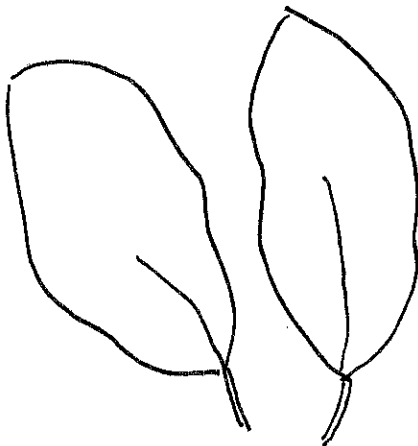
2 cups spinach

1/4 cup orange juice

1 tbsp honey

ice cubes

Combine all ingredients in a blender.
Blend until smooth. Add ice as desired.



Veggie dip

Ingredients

1/2 cup plain yogurt

1/2 cup light cream cheese

2 tbsp chopped chives

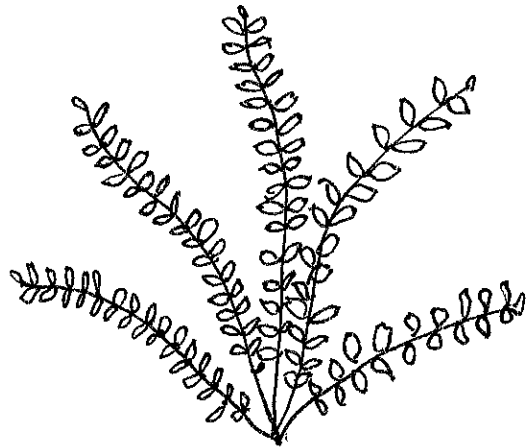
1 tsp chopped thyme

1 tsp chopped sage

} or whatever is growing
in the garden

Measure yogurt and cream cheese, and put them in a large bowl. Mix well.

Chop fresh herbs from the garden. Blend in bowl.



Creamy Miso Dressing

* from the Edible Schoolyard in CA

Ingredients

2 to 3 tbsp miso (red miso is especially nice for this recipe. Use yellow miso for a milder flavor.)

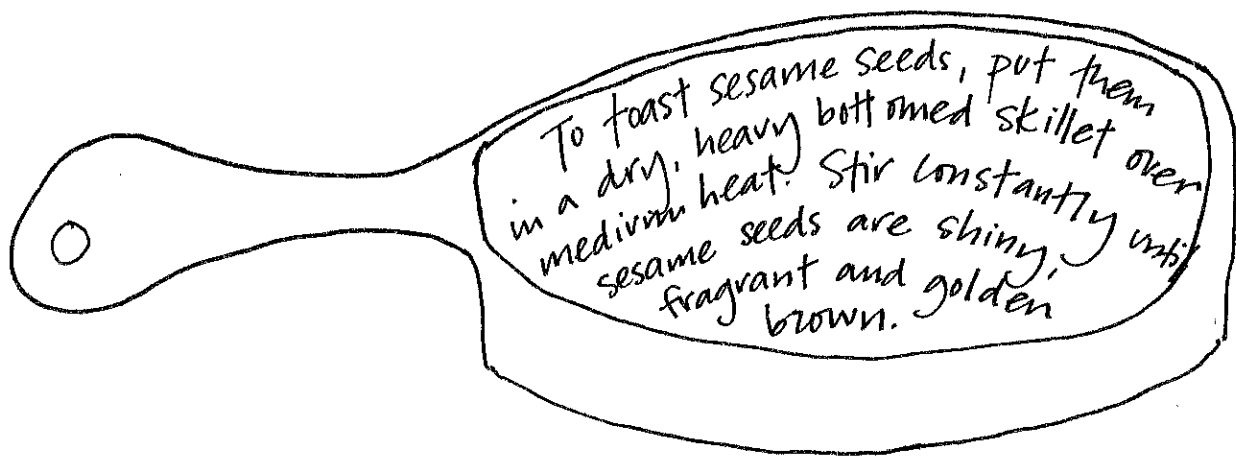
1 tsp toasted sesame oil

1/2 tsp sugar

1 cup milk (use half and half for a creamier dressing)

2 tbsp sesame seeds, toasted and ground
(a mortar and pestle works well for this)

1. Combine the miso, toasted sesame oil and sugar in a small bowl.
2. Gradually whisk in the milk. Add the ground sesame seeds, whisking well. Makes 1 cup.





UPPER EL LESSON 8: Planting Wheat

Objective:

The students will be planting wheat seeds. If all goes well, the wheat from the garden should produce enough flour to make about 20 loaves of bread.

NC SCOS Correlation:

5th grade science SCOS

- Objective 1.03 Explain why an ecosystem can support a variety of organisms.
- Objective 1.04 Discuss and determine the role of light, temperature, and soil composition in an ecosystem's capacity to support life.
- Objective 3.02: Discuss and determine how the following are affected by predictable patterns of weather:

Temperature

Wind direction and speed

Precipitation

Cloud cover

Air pressure

Vocabulary Focus:

- Dormant: *Inactive, or a period of rest.*

Lesson / Step-by-Step:

Background:

Wheat takes a long time to grow and harvest. The students will be planting winter wheat. Winter wheat is planted from late September to early October. The plants should grow quickly until the cold weather sets in.

TIME:

Suggested month:

October 10-27

MATERIALS:

For the teacher:

- Wheat berries
- String
- 4 Wooden stakes
- Tacks
- Water key

For the students:

- Notebooks
- Pencils

During the winter months, the plants will be *dormant*; you may want to compare it to hibernation of animals. There will be little to no change in the plants until spring when they will start growing again. The plants will not be ready for harvest until late May or early June.

You may compare what you're doing to the way people lived many years ago, when there were few or no grocery stores: People had to prepare ahead of time to make sure they had enough supplies to make it through the winter.

Investigation:

1. Demonstrate to the students how to plant the seeds. Start about six inches from the edge of the bed. If a previous class has already planted their row, space the next row about six inches away.
2. Make a hole with your finger to the depth just shy of the first knuckle. Put 5 to 7 seeds in the hole and gently cover with soil. Remind the students not to pat down the soil, since that will make it difficult for the seedlings to push their way through the soil. Allow each student to do this. This should create one row of seeds.
3. Mark the row that they planted by tacking a string to wooden stakes positioned at each end of the row. This will ensure that other classes will not plant over your seeds.
4. "Water in" your row of seeds. Advise the students to not get too close while they are watering, or pour the water too fast, or water in one space too much. All of these could prevent the seeds from sprouting.
5. The final step is to cover the row with a layer of straw. This will prevent the birds from eating the seeds and will keep the plants protected.
6. *Follow up:* Over the next few weeks, students should be assigned the jobs of watering their row and weeding. Wheat likes moderate dampness, but not a wet soil. During dry spells, the students may need to water the plants more than once a week. This could be done during their playground time. Caution them to be careful around the other rows, especially if the class's row is in the middle of the bed.



UPPER EL LESSON 9: Harvesting Wheat, Part I

Objective:

The students will be harvesting their wheat plants, or gathering the ripened plants.

NC SCOS Correlation:

4th grade science SCOS

- Objective 4.05: Determine that foods are made up of a variety of components.

5th grade science SCOS

- Objective 1.06: Explain and evaluate some ways that humans affect ecosystems.

TIME:

Suggested month:

May

MATERIALS:

For the teacher:

- Twine
- Picture of a scythe
- Garden shears

For the students:

- Notebooks
- Pencils

Vocabulary Focus:

- Harvesting

Lesson / Step-by-Step:

Background:

The class should have observed the wheat growing throughout the year. When the wheat begins to turn a golden color but still has a few streaks of green, it is ready to be harvested.

The traditional tool for harvesting wheat is a scythe. It is too dangerous for the students to use this tool, so they will be cutting the wheat stalks with garden shears. Show the students a picture of a scythe and explain how it is used.

Investigation:

1. Go outside to the garden bed where your wheat is planted. Demonstrate to the students how to cut the wheat close to the base of the plant using the garden shears. It is fine to let the stalks fall to the ground, that way the students can gather them.

2. Students should gather the stalks, tie them into bundles, and stand them upright in a corner of the garden. The grain will then need to fully ripen into a golden color. These are known as shocks of wheat.
3. It is important that the shocks remain dry. If it looks like rain, or rain is forecast over the weekend, bring them inside.

Review / Journaling:

This would be a good opportunity for the students to reflect on the process of growing the wheat from the beginning.

Extensions:

1. Count the wheat berries from one stalk of wheat. Estimate how many are in the entire shock.
2. Have the students determine how many stalks were harvested as compared to how many were planted. What percentage is it? Use this average to determine how stalks would have been harvested per acre. (Look at the first wheat lesson for the info.)



UPPER EL LESSON 10: Harvesting Wheat, Part II

Objective:

Students will be threshing and winnowing the wheat.

NC SCOS Correlation:

4th grade science SCOS

- Objective 4.04: Identify starches and sugars as carbohydrates.

5th grade science SCOS

- Objective 1.07: Determine how materials are recycled in nature.

Vocabulary Focus:

- Thresh: *Separate the wheat berries from the stalks.*
- Winnow: *Separate the wheat berries from the chaff.*
- Chaff: *Seed coverings and small pieces of stem.*

Lesson / Step-by-Step:

Background:

The procedure that the students will use is the way wheat was harvested for hundreds and thousands of years, until the invention of machinery. Farmers threshed the wheat by beating it. Then they winnowed by throwing the wheat berries into the air by the handfuls on a windy day to separate the wheat from the chaff. The wheat berries are heavier and would fall back to the ground, while the chaff was blown away.

In this lesson, because we can't count on having a windy day, a fan will be used.

Investigation:

1. Go outside to your classroom's shock of wheat. Demonstrate to students how to thresh the wheat: Grasp several stalks of wheat and beat them around the inside of the garbage

TIME:

Suggested month:

May

MATERIALS:

For the teacher:

- Twine
- Picture of a scythe
- 2 Bowls
- Plastic container
- Large, empty garbage can from the cafeteria or hall
- Fan and extension cord

For the students:

- Notebooks
- Pencils

can. Beat them hard enough to knock the wheat berries off, but not so hard that you break the stalks. After the grain falls off the stalks, the stalks can be put in the compost bin.

2. Next demonstrate how to winnow the wheat. Empty what is in the garbage can into one of the bowls.
3. Put your fan on top of an outdoor table. Stand beside the fan. (If students stand in front of the fan they will be covered with the chaff.) Pour the wheat and chaff from one bowl to another. Don't hold the bowls too close together. The chaff should be blown away while the seeds fall into the other bowl. Pour the wheat from bowl to bowl several times to get the chaff out.
4. Store the cleaned wheat in a plastic container with a lid.
5. *Follow up:* The students will mill the wheat berries into flour. The flour can then be used to bake bread, cake or cookies for the class.

Review / Journaling:

The students should explain the process of threshing and winnowing in their own words. Have them reflect on the process and how they felt about doing just a few stalks and what it would be like to do this daily for a week or more.

Extensions:

1. Write and illustrate a how-to book on growing and harvesting wheat.
2. Create a PowerPoint lesson for growing and harvesting wheat.

Pretzel Party

Recipe makes 8 pretzels

Courtesy of Alton Brown

4 1/2 cups flour

1 1/2 cups warm water

1 tbsp sugar

2 tsp kosher salt

1 package active dry yeast

22 oz. unsalted butter melted

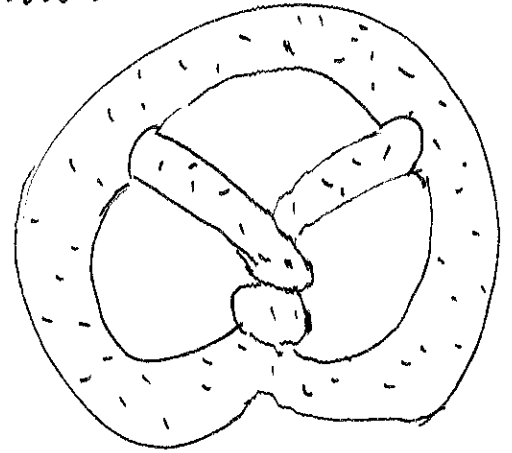
vegetable oil, for pan

10 cups water for boiling in pot

2/3 cup baking soda

1 large egg yolk beaten with 1 tbsp water

pretzel salt



Note: The first few steps involve mixing ingredients, kneading dough (5 min) and letting dough rise (50-55 min). You may wish to do this step ahead of time, without students, so the cooking can begin right away. Be sure and tell them how you've prepped.

1. Combine warm water, sugar and kosher salt in a bowl. Sprinkle yeast on top. Allow to sit for 5 min or until mixture begins to foam.
2. Add flour and butter. Mix to combine. Knead - or mix in a stand mixer with dough hook - 5 to 8 min.

3. Clean the bowl and oil it with vegetable oil. Return dough to bowl, cover with plastic wrap and sit in a warm place for 50-55 min, or until dough has doubled in size.
4. Preheat oven to 450°. Line 2 half-sheet pans with parchment paper and lightly brush with vegetable oil. Set aside.
5. Bring 10 cups of water and baking soda to a rolling boil in an 8-qt saucepan or roasting pan.
 - b. Turn dough out onto slightly oiled work surface and divide into 8 equal pieces. Roll each piece into a rope 2 ft. long. Twist ends together, then flip the twisted end over to meet the other side of the circle. Or have students make their own creative shape! Place on sheets until ready...
7. Place pretzels into boiling water, 1 by 1, for 30 seconds. Remove them with a large flat spatula. Return to half-sheet pans. Brush the tops with beaten egg and water mixture. Sprinkle with salt.
8. Bake 12-14 min until golden brown. Cool. Eat!



UPPER EL LESSON 11: Garden Scavenger Hunt

Objective:

The students will be searching through the garden to find several items. Students can collect some of the items, but they should document other items by sketching, detailed notes, and/or photos.

This lesson is a good review for several science and mathematics concepts. The students can work in groups of two, three or more for this activity. It would be ideal for each group to have a digital camera, because not all the items on the list can be gathered.

NC SCOS Correlation:

4th grade science SCOS

- Objective 4.03: Discuss how foods provide both energy and nutrients for living organisms.

5th grade science SCOS

- Objective 1.02: Identify and analyze the functions of organisms within the population of the ecosystem:
 - Producers.
 - Consumers.
 - Decomposers.
- Objective 1.03: Explain why an ecosystem can support a variety of organisms.
- Objective 1.07: Determine how materials are recycled in nature.

Vocabulary Focus:

This is a review lesson so the vocabulary from the list should be familiar to students. You may want to explain to the students that a scavenger hunt is a game/challenge where

TIME:

Suggested month:

Sept/Oct/Nov or Spring

MATERIALS:

For the teacher:

- A bag for each group of students
- A ruler for each group
- Optional: Digital camera for each group

For the students:

- Notebooks
- Pencils
- Copy of Garden Scavenger Hunt List

people are given a list of specific items to find. The participants try to be the first to find all the objects or to find the most items from the list in a given time frame.

Lesson / Step-by-Step:

1. Divide the students into groups and tell them that they will be working with their group to find as many items as they can on their list within the next 20 minutes.
2. Explain that the items on the list with an “X” in front of them are not to collect. Let the students know how you want them to “collect” these items. For example, you may want them to call you over to see it, sketch it in their journals and write a note describing where it is located, write a description without the sketch or, if a camera is available, take a picture of the item.

Review / Journaling:

The students should use their journal to document their hunt.

Extensions:

Students can come up with their own lists for the Primary students or Lower El students to use in the garden. They would have to use the appropriate vocabulary for younger students.

GARDEN SCAVENGER HUNT LIST

A leaf

- | | |
|--|---|
| <input type="checkbox"/> with five points | <input type="checkbox"/> a seed |
| <input type="checkbox"/> longer than 5 cm | <input type="checkbox"/> a producer |
| <input type="checkbox"/> shorter than 5 cm | <input type="checkbox"/> (x) a consumer |
| <input type="checkbox"/> with smooth edges | <input type="checkbox"/> evidence of a decomposer |
| <input type="checkbox"/> with jagged edges | <input type="checkbox"/> a weed |
| <input type="checkbox"/> wider than 5 cm | <input type="checkbox"/> (x) a root vegetable |
| <input type="checkbox"/> thinner than 5 cm | <input type="checkbox"/> (x) an herb |
| <input type="checkbox"/> a color other than green or brown | <input type="checkbox"/> (x) a flowering plant |
| <input type="checkbox"/> that smells like mint | <input type="checkbox"/> (x) a worm |
| <input type="checkbox"/> with insect holes | <input type="checkbox"/> (x) a spider web |

A stem (Do not pick any of these)

- (x) that is stiff
- (x) that is flexible
- (x) that has more than 20 leaves on it
- (x) that is longer than 8 in.
- (x) that is shorter than 4 in.



UPPER EL LESSON 12: Pollination

Objective:

The students will be observing the relationship between plants and insects and the role each plays. The students will choose one area of the garden to observe. They may want to observe their grid area, but it is important that the area they choose has flowering plants.

NC SCOS Correlation:

4th grade science SCOS

- Objective 1.03: Observe and discuss how behaviors and body structures help animals survive in a particular habitat.

5th grade science SCOS

- Objective 1.03: Explain why an ecosystem can support a variety of organisms.
- Objective 1.05: Determine the interaction of organisms within an ecosystem.

Vocabulary Focus:

- Pollen
- Pollinators
- Pollination

Lesson / Step-by-Step:

Background:

Pollination is responsible for the reproduction of most plants. It occurs when the pollen from the stamen of a plant is transferred to the stigma of the same plant or another plant. *Pollen* is tiny grains made by the male part of a flower (stamen). In order for seeds to form, pollen must reach the female part of the flower (stigma). Insects such as bees help this process by carrying pollen between flowers as they feed. The insects and animals that carry the pollen between plants are known as *pollinators*. Some plants may be self-pollinated or pollinated by the wind, but the majority of the world's plants depend on pollinators to reproduce.

TIME:

Suggested month:

Fall (early) or spring

MATERIALS:

For the students:

- Notebooks
- Pencils

Introduction:

1. Begin the lesson by telling the students that they will be looking at how plants and certain insects depend on each other, and why their relationship is important to us. Give the students a few minutes to brainstorm some ideas.
2. Have the students look around the garden and find the plants that are flowering. Help them to identify these flowers by name and discuss their color, size and smell.
3. Ask some questions:

“In what ways do you think these plants might be helpful to insects?”

“Why do you think that?”

“What kinds of insects have you noticed around the plants?”

“Which insects pay a lot of attention to flowers?”

“Why do you think these insects are so interested in the flowers?”

Investigation:

1. Explain to the students that they are going to closely observe the interaction between plants and insects for the next 10 minutes. They will be writing their observations in their notebooks.
2. Each student should choose a small area of the garden to observe. Each should limit his or her observations to an area of about one square yard. To make this assignment more manageable, a student should only observe one insect at a time.
3. To get the best data, a student should sit quietly in one place. Demonstrate putting a notebook on your lap and quietly writing observations without making any sudden movements that may scare off the insects.
4. Students’ notes should include what type of plant or flower the insect landed on, describing its size, color, shape and name, if possible. Their notes should also describe the actions of the insect -- for example, what kind of insect it is, whether it’s crawling around, moving its legs, flying above the flower or moving from flower to flower, and how long it spent doing the activity. You may want to share with the students how to quietly count seconds by saying “1 Mississippi, 2 Mississippi, etc.” to count off the seconds. If the insect flies off to another area, students should sit quietly and wait for another to come back.
5. After 10 minutes, gather students together. Have them share their observations with a partner or in a small group, so everyone has a chance to share.

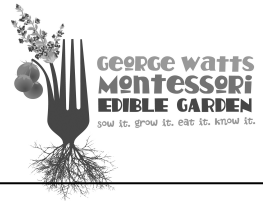
Review / Journaling:

Have the students write their predictions on what could happen if all the butterflies suddenly disappeared.



Extensions:

Research ways to attract more pollinators to the garden, by considering structures (such as bee houses). Then develop a plan for improving or creating a pollinator-friendly environment.



UPPER EL LESSON 13: Gathering Seeds

Objective:

Students will be gathering seeds from various plants in the garden in an effort to replant for next year. You can choose to harvest any or all of the plants suggested.

Many of the seeds collected, especially from the vegetables, will need to dry before you store them in a cool, dry place for next spring. Borrow breakfast trays from the cafeteria and spread seeds out on them to dry. To speed the process, you can lay a piece of screen over the lip of the trays, so that air can circulate all around.

Check the garden before starting this lesson to be sure there are seeds ready to collect.

TIME:

Suggested month:

Check garden for seeds

MATERIALS:

For the teacher:

- Scissors
- Knife

For the students:

- Small baggies
- Brown paper lunch bags
- Notebooks
- Pencils

NC SCOS Correlation:

5th grade science SCOS

- Objective 1.03: Explain why an ecosystem can support a variety of organisms.
- Objective 1.05: Determine the interaction of organisms within an ecosystem.

Vocabulary Focus:

- Seed

Lesson / Step-by-Step:

Background:

A *seed* is produced when a plant has been successfully pollinated. In simplest terms, it is a plant embryo. The outer covering is the seed coat. It protects the tiny plant and its food source until germination. To illustrate this you can carefully break a peanut in half. The small pointed piece at one end of the peanut is actually the stem and if you look carefully you can see the small leaves. The majority of the peanut is food supply for the young plant until it can break through the ground and grow leaves and then through photosynthesis produce its own food.

Throughout history, people needed to save and replant their seeds in order to survive. The early settlers brought seeds with them so that they could grow their favorite crops. Today, even though seeds can be bought, many farmers save their seeds to cut down on costs. One tomato or pepper could yield hundreds of seeds, each one capable of producing a plant that could have many tomatoes or peppers.

Most garden seeds mature dry in pods, capsules, flowers, or fleshy fruits. The ideal time for gathering seeds varies from crop to crop. Some are ready when the fruit or vegetable is ripe. Others should be left on the plant until weeks after you'd normally eat them. Generally, let vegetable garden seeds dry on the plant as long as possible.

When a flower starts to droop and turn brown, it is usually a sign that it no longer needs to attract pollinators, and the seed are beginning to form. The seeds are not ready for harvesting until the stalks have dried out and turned brown or the seedpod has turned to a dark color. If you can lightly tap the stalk or pod and hear rattling, the seeds are mature enough to harvest.

Introduction:

Explain that the growing season for many of the plants is over. Some of the vegetables and flowers have been left in the garden, so students can harvest the seeds for next season. Let students help determine which seeds the classroom will gather. Some of the seeds can be collected as they are, while others will have to be dried.

Investigation:

1. To harvest flower seeds, students should look for brown flowers. Carefully bend the flower stalk, then shake the flower head into a paper bag. The seeds will fall into the bag. If the seeds are encased in a pod on top, students can carefully cut off the pod and open it over the bag. If there is fluff or chaff mixed with the seeds, discard it before saving the seeds. If there is any moisture on the seeds, they must be spread out to dry before saving.
2. To harvest seeds from vegetables still in the garden, follow directions below for each type:

For beans or peas, the pod should be left on the plant until it rattles. Remove the seeds from the pods and spread them out to dry.

Peppers should be left on the plant until it is fully red. Cut open and scrape out the seeds. Spread them out to dry. They are fully dry when the seed breaks in two instead of bending.

Tomatoes should also be left on the plant until it is fully ripe. The seeds have a coating over them that needs to be removed. To do this, squeeze the seeds into a bowl. Add water and let it stand at room temperature three to four days. Have the students stir

the mixture a few times each day to prevent mold. The good seeds will sink to the bottom of the bowl. These can be spread out to dry.

The *summer squash* seeds probably will not be ready to harvest during the school year. It is only when the squash is hard and cannot be dented with a fingernail are the seeds mature enough to harvest. Cut open and scrape the seeds into a bowl.

Wash and rinse them before spreading them out to dry.

3. When the seeds are ready to be stored, place them in a jar or a ziplock bag, and keep in a cool place. Be sure to label each container so the students know what they are planting in the spring.

Review / Journaling:

Students can compare and contrast the benefits/ drawbacks of harvesting their own seeds instead of buying new ones each year.

Extensions:

Encourage the students to study different plants in their neighborhood or on the playground to discover different kinds of seeds and their containers.



UPPER EL LESSON 14: Simple Machines in the Garden

Objective:

This lesson ties in with Simple Machines/Force and Motion so that students will better understand the concept of simple machines and how they help us in the garden.

This is also a good review of Force and Motion concepts: force (push or a pull), energy (the ability to do work), gravity (the attraction or pulling force between objects and the Earth), friction (the force that slows down or stops an object in motion), and work (when a force moves an object over a distance; running, kicking a ball, and gardening).

NC SCOS Correlation:

5th grade science SCOS

- Objective 4.02: Evaluate how pushing and pulling forces can change the position or movement of an object.
- Objective 4.07: Determine how people use simple machines to solve problems.

Vocabulary Focus:

- Simple machines: machines with few or no moving parts...

inclined plane

lever

pulley

screw: an inclined plane wrapped around a post; used to hold things together.

wedge: two inclined planes together; wide at one end and pointed at the other; used to split or cut things.

wheel and axle

TIME:

Suggested month:

Anytime

MATERIALS:

For the teacher:

- List of 100 simple machines, such as a screwdriver, broom, bottle opener, hammer

For the students:

- Powers of observation
- Journals
- Pencils, graphite and colored

Lesson / Step-by-Step:

1. Outside in the garden, review simple machines and examples from Force and Motion. Review concepts of push and pull as forces. Ask, *“How do we apply these in the garden?”*

Possible answers: Pulling weeds from the ground; pushing a wheelbarrow; pushing onto the earth with a spade. Gravity causes the roots of the plant to grow down into the ground. If you roll a ball on the sidewalk and then roll it over a grassy area, friction slows the ball down.

2. Have students pull a few weeds, rake some dirt, and do other garden chores. Ask, *“Do these qualify as work. Why? Which force was used? Did students expend or use energy?”*
3. See if students can find examples of simple machines in the garden or around the school. Examples: pruning shears, a ramp, steps, spade, wheelbarrow, door knobs, the pulley on the flag pole, the slide.

Review / Journaling:

Have students write the words and definitions in their journals.

Extensions:

Make a book of simple machines with examples and definitions of each.



UPPER EL LESSON 15: Worms

Objective:

This lesson involves looking about 10 centimeters below the soil surface in the garden for earthworms.

This lesson teaches the students the important role that worms play in the garden. They help decompose the dead plants and are an integral part of the food chain.

NC SCOS Correlation:

5th grade science SCOS

- Identify and analyze the functions of organisms within the population of the ecosystem: producers, consumers, decomposers

Vocabulary Focus:

- *Aerate: to expose to the air; to cause air to circulate through something (in this case, soil). The word can be tied in with "aerial view" (view from the air) from 5th grade science landforms.*
- *Burrow: to make a hole or passage into something.*

Lesson / Step-by-Step:

Background:

Any good garden is going to have earthworms. They burrow under the garden soil because being in the sun dries out their skin, and they breathe through their skin.

As worms burrow, they consume dirt, extracting (taking out) nutrients from the decomposing organic matter. They are important to soil health because they transform (change) nutrients and minerals from below the ground to the surface via (by way of) their waste (poop). And their tunneling aerates the ground.

Worms are about seven to eight cm long and have ring-like segments called annuli. These segments are covered in small bristles (hair) which the worm uses to move and crawl. Worm castings are the earthworm's undigested waste (poop) which produces active bacteria that helps with decomposition.

TIME:

Suggested month:

Warm or mild-weather months

MATERIALS:

For the students:

- Rulers
- Hand shovels
- Journals
- Pencils, graphite and colored

Investigation:

1. Take students outside and explain that they'll each be searching for worms in the garden. Spread them out, so they will each have their own cubic foot worth of soil to examine.
2. Demonstrate to students how to measure a cubic foot -- one foot wide, by one foot long, by one foot deep. Have them measure out a space, to make sure they each have room.
3. Demonstrate how to *gently and slowly* dig into the soil approximately 10 cm, so that no worms will be damaged by the garden tool.
4. Ask students, "*How many worms do you think you might uncover?*" Answer: In a healthy garden, there might be about 25 worms in one cubic foot.
5. Ask students to investigate their cubic foot to determine how many earthworms are in it. If they wish, they may also measure the length of the earthworms they find, handling the worms gently and returning them to the soil when finished.

Review / Journaling:

As always, have students write about the lesson in their journals. There are some great Internet sites with lots of worm information. Some questions to research might be:

Worms are hermaphrodites. What does this mean?

How can you tell which end of the worm is the head?

Why do worms come on driveways and sidewalks when it rains?

Students can research worms using the website "The Adventures of Herman the Worm" -- <http://urbanext.illinois.edu/worms/facts/index.html> -- to find answers.

Extensions:

Alice Bumgarner can have an expert come and talk to the students about building their own classroom wormery. A wormery is a worm house that needs to be kept indoors, preferably in a classroom. Worms like to eat vegetable matter. When kept healthy, a wormery does not smell! If anyone is willing to keep a wormery in their class, contact parents Alice Bumgarner (alice.b@earthlink.net) or Nathan Gaddis (nathan.c.gaddis@gmail.com).

Read *Diary of a Worm* or *Worms Eat My Garbage*



Growing Small Farms

CHATHAM COUNTY CENTER
NORTH CAROLINA COOPERATIVE EXTENSION

Promoting awareness, understanding, and practice of sustainable agriculture

Planting and Harvesting Guide for Piedmont Vegetables and Herbs

Created by

Doug Jones, Piedmont Biofarm

Debbie Roos, North Carolina Cooperative Extension, Chatham County Center

Read First: How to Use this Guide: see page 6



Planting date if using season extension



Planting date if *not* using season extension



Harvesting date if using season extension



Harvesting date if *not* using season extension

SE = Season Extension

DS = Direct Seed

H = Harvest

TP = Transplant

OW = Overwinter

OS = Oversummer

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Salad Mix		SE	DS					SE	DS		OW	
	OW	Overwinter Harvest		H		SE				H		SE OW
Lettuce			SE	TP					SE	TP		
					H	SE					H	SE

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Arugula			DS						DS			
				H						H		SE
Spinach		SE	DS					SE	DS	OW		
	OW	Overwinter Harvest		H						H		SE
Kale			DS or TP						DS or TP			
		Overwinter Harvest		H						H		SE
Mustard			DS						DS			
		Overwinter Harvest		H						H		SE
Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Collards			TP Senposai						DS or TP			
		Overwinter Harvest		H						Senposai		H
Broccoli			TP						TP			
					H						H	SE
Cabbage			TP						TP			
		Overwinter Harvest			H						H	
Pac Choi			SE	TP					TP			
					H						H	SE

CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Brussels Sprouts								SE	TP				
	SE	H										H	SE
Green Onions			SE	TP				TP					
					H					H			
Bulb Onions			SE	TP									
					H green		H mature						
Leeks				DS or TP	TP								
	Overwinter Harvest		H							H		SE	
CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Parsnips				DS				DS					
	Overwinter Harvest									H		SE	
Carrots			DS					SE	DS	OW			
	Overwinter Harvest				H					H		SE	
Beets			SE	DS				SE	DS	OW			
	OW		OW Harvest	H						H		SE	OW
Peas			DS										
				H									

CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cilantro		DS						SE	DS	OW		
	Overwinter Harvest			H						H		SE
Dill		SE	DS					DS				
				H	Umbels				H	SE		
Parsley		DS or TP						DS or TP				
	OW Harvest			H					OS Harvest	H	SE	
Garlic										DS		
					H							
CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Potatoes			DS									
						H						
Chard		SE	DS or TP					DS or TP				
	OW		OW Harvest	H					H	SE	OW	
Radish		DS						DS				
				H					H			
Basil					DS or TP							
						H			SE			

CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tomatoes				SE	TP							
						H				SE		
Peppers				SE	TP							
							H			SE		
Eggplant				SE	TP							
							H			SE		
Snap Beans				SE	DS							
						H				SE		
CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lambs-quarters					DS							
						H						
Cucumbers					DS or TP							
							H					
Summer Squash					DS or TP							
							H					
Cantaloupe					DS or TP							
							H					
Watermelon					DS or TP							
							H					

CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Winter Squash					DS or TP							
							H					
Sweet Potato					TP							
										H		
Okra					DS or TP							
								H				
CROP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

How to Use this Guide

This is a planting and harvesting *guide*, not a schedule. Please use these dates as a starting point and adjust according to the conditions on your farm. These dates are not set in stone! Weather and crop conditions vary from year-to-year, and from farm-to-farm.

Doug Jones, the farm manager for Central Carolina Community College's Sustainable Farming Program in Pittsboro, developed on paper a planting and harvesting guide for his favorite vegetable crops, based on his experiences at the Land Lab. The Land Lab is CCC's five-acre outdoor classroom for research, demonstration, and crop production and is located about 1 mile west of downtown Pittsboro in Chatham County. Debbie recognized Doug's guide as a valuable tool and spent many hours working with him to flesh it out, adding additional crops and also planting and harvesting dates for growers using season extension techniques. Debbie then adapted and formatted the guide to make it easy to read (hopefully!) on the web. Our hope is that local growers will use this guide to try new crops and extend their season so we can produce for our expanding local markets like Chatham Marketplace and our farmers' markets.

The key at the top of the chart explains the colors and abbreviations. You can click on the crop name for more notes and a text description of planting and harvesting dates. Season extension techniques can be used to protect from both cold and heat and include row covers, high tunnels, shade, micro-sprinklers, etc. See below for more information on season extension techniques.

The planting windows and harvest times assume succession plantings - every 1-2 weeks.

For More Information:

- Learn all about **season extension**:
<http://chatham.ces.ncsu.edu/growingsmallfarms/SeasonExtensionOctober2005a.pdf>
- **Resources and Suppliers for Season Extension**:
<http://chatham.ces.ncsu.edu/growingsmallfarms/2005SeasonExtensionResources.pdf>
- Consult the **Vegetable Variety List** for information on recommended varieties:
<http://chatham.ces.ncsu.edu/growingsmallfarms/varietylist.html>

For more information on crop production, seed sourcing, pest management, marketing, local farms, and much more, visit Chatham County Cooperative Extension's **Growing Small Farms website** at <http://chatham.ces.ncsu.edu/growingsmallfarms>

We would really like your feedback on this guide. We plan to continue fine-tuning and expanding it. Please email Debbie Roos at debbie_roos@ncsu.edu with any comments, questions, or suggestions.

Crop Notes

Salad Mix

- Mild Salad Mix – lettuces, baby kale, baby chard, baby mild mustard
- Spicy Salad Mix – arugula, cress, spicy mustards
- Direct-seed February 1-March 15 if using season extension techniques, for harvest April 1-June 15 (up until mid-July if season extension techniques such as micro-sprinklers and shade are employed). If not using season extension, plant March 15-May 1. If not using shade cloth, harvest ends around mid-June.
- Direct-seed August 1-October 1 for harvesting September-December. Must use season extension (shade cloth, heat-tolerant varieties, micro-sprinklers) if planting in August. If not using season extension to manage heat, start harvesting in mid-October. Harvest of spicy salad mix ends sooner due to pest pressure unless you use a row cover.
- Extend season of fall planting by using row covers Dec 1-15.
- Direct-seed mix for overwintering in early November and protect with row covers or tunnels or both. Harvest begins Feb. 1 with overwintered salad mix.

Lettuce (head)

- Transplant February 15-March 15 if using season extension for harvest beginning April 1.
- Transplant March 15-April 15 if not using season extension.
- Harvest period for spring plantings runs April 1-June 1 if using season extension as weather warms. Lettuce harvested after June 1 will be bitter; use shade May 15-June 1.

- For fall lettuce, transplant August 15-September 15 if using season extension; otherwise plant September 15-October 15.
- Harvest September 15-December 15 and use row covers after November 15 (lettuce is semi-hardy).

Arugula

- Direct-seed February 15-April 1 for harvesting April 1-June 1.
- Direct-seed August 1-October 1 for harvesting September 15-January 1 (use season extension after December 15).

Spinach

- Direct-seed February 1-April 1 (use season extension techniques for February plantings) for harvesting April 1-May 15.
- Direct-seed August 15-October 15 for harvesting October 1-December 1 (use season extension like micro-sprinklers for earliest fall plantings).
- Direct-seed spinach for overwintering October 15-November 15 and protect with row covers or tunnels or both. Harvest begins Feb. 1 with overwintered spinach.

Kale

- Direct-seed or transplant February 15-March 15 for harvesting April 1-May 1.
- Direct-seed or transplant August 1-October 1 for harvesting October 1 and on through the winter (with season extension) until April.

Mustard

- Direct-seed or transplant February 15-March 15 for harvesting April 1-May 1.
- Direct-seed or transplant August 1-October 1 for harvesting September 1 and continuing through the winter (with season extension after December 15) until April.

Collards

- We recommend growers try an Asian version of collards called Senposai - it's faster growing, much more tender, equally winter hardy and also heat tolerant. Seed is available from Fedco or Doug Jones.
- Transplant Senposai February 15-March 15 for harvesting April 1-May 15.
- Direct-seed or transplant August 15-September 15 for harvest starting mid-November on through the winter (with season extension). Harvest of Senposai starts earlier, in early October.

Broccoli

- Transplant February 15-March 15 for harvesting April 15-June 1.
- Transplant August 15-September 15 for harvest October 15-December 15 (use season extension after December 1).
- If plants are well-hardened, may not need row covers in spring; best to use mid-maturing (not earliest, not latest) varieties in both the spring and fall planting windows so crop will mature in time.
- Note: **cauliflower** is a difficult crop for the Piedmont so is not included here. It has a narrower range of heat and cold tolerance than broccoli so it is less reliable. The developing head is not adapted to our extreme temperature fluctuations and the head quality becomes really poor as it warms up.

Cabbage

- Transplant February 15-April 1 for harvesting May 1-June 15.
- Transplant August 15-September 15 for harvest starting October 15 and on through the winter (use season extension after December 15) up until mid-March.
- If plants are well-hardened, may not need row covers in spring; best to use mid-maturing (not earliest, not latest) varieties in both the spring and fall planting windows so crop will mature in time.

Pac Choi

- Also called Bok Choy or Pak Choi
- Transplant March 1-April 1 for early March plantings) for harvesting April 15-May 15.
- Transplant August 15--October 1 for harvesting October 1-December 15 (use season extension after November 15).

Brussels Sprouts

- Transplant July 15-September 1 (use season extension techniques for cooling July 15-August 15).
- If planted July 15-August 15, harvest starts November 15 and continues through the winter (use season extension December 1-February 1).
- If planted in late August, harvest begins in February (use season extension December 1-February 1).

Green Onions

- Use onion sets (bulbs).
- Transplant February 1-April 1 for harvesting April 15-June 15 (use season extension for February plantings).
- Transplant August 15-September 15 for harvesting October 1-December 1.
- Onions are hardy but season extension gives them earliness.

Bulb Onions

- Transplant February 15-April 1 (use season extension for February plantings).
- Harvest fresh onions (green tops) May 15-June 15; harvest mature onions (dry bulbs) June 15-July 15.
- Onions are hardy but season extension gives them earliness.
- The earlier you get transplants into the ground, the bigger the bulb will be. To grow your own seedlings, direct-seed into flats about two months before planting.

Leeks

- Direct-seed or transplant April 1-May 1; transplant May 1-15. Direct-seeding will present more challenges with weeds.
- Harvest October 1-March 15. Use season extension Dec. 15-March 1. Use hardy varieties for late harvest, summer varieties for early harvest.

Parsnips

- Direct-seed April 15-May 15 for harvest starting in early November (100 day crop). One of the riskiest crops to establish in hot weather - needs 8-10 days to germinate.
- Direct-seed August 15-September 15 for overwintering. For fall planting, use micro-sprinklers to help with germination.
- Harvest starting November 1 and going through the winter until mid-March (use season extension after December 15).
- Parsnips do not develop sweet flavor until the ground is cold so don't rush harvest.

Carrots

- Direct-seed February 1-March 15 for harvesting May 1-June 15.
- Direct-seed August 1-October 1 for harvest starting October 15 and continuing through the winter (with season extension after December 1). For late summer planting, use micro-irrigation and shade to cool crop. Plantings September 15-October 1 will be for overwintering.
- If using season extension, harvest January 15-April 1 (certain varieties bolt earlier than others). Carrot greens are very cold hardy but carrot shoulders will rot if the ground freezes. If you have a good canopy of carrot greens, it will help protect the shoulders; can use heavy row covers or a double layer of lighter weight row cover.

Beets

- Direct-seed February 1-April 15 for harvesting April 1-June 15. Harvest small beets April 1 and full-sized beets April 15. The February plantings will require protection with season extension.
- Direct-seed August 1-October 1 for harvest starting October 1-December 15 (with season extension after November 15). For late summer planting, use micro-irrigation and shade to cool crop. Plantings September 15-October 1 will be for overwintering.
- If using season extension, harvest overwintered crop March 1-April 1.

Peas

- Direct-seed dwarf varieties like 'Sugar Anne' February 1-April 1 and harvest April 15-June 1.
- Plant trellised varieties like sugar snaps February 15-March 15 for harvest May 15-June 15.
- Peas can be tricky to germinate. Your best bet is to prepare your bed for planting in January and pay attention to the weather forecast. If it calls for 5 or more days with highs around 65° F, then go ahead and plant your peas no matter when it is. You just need to get them to germinate - once they are up and growing, they are quite hardy, even without season extension. If you haven't found a window by late February, go ahead and plant them and cover with clear plastic right on top of the bed. Once they germinate, remove the plastic and use a row cover.

Cilantro

- Direct-seed February 1-April 1 for harvesting April 1-June 1.
- Direct-seed August 15-October 15 for harvest starting October 1 and continuing through the winter (with season extension after December 15). For late summer planting, use micro-irrigation to cool crop. Plantings October 1-15 will be for overwintering.
- If using season extension, harvest overwintered crop up until April 1.

Dill

- Direct-seed February 15-April 1 for harvesting April 15-June 1. Harvest umbels (flower heads) for pickling in June. Use season extension to protect plantings February 15-March 15.
- Direct-seed August 1-September 15 for harvesting September 15-December 15 (with season extension after November 15).

Parsley

- Direct-seed or transplant February 15-March 15 for harvesting April 15-July 1. Use season extension to protect plantings February 15-March 15.
- You can get a good harvest in the fall by bringing the spring-planted parsley through the summer; it's a biennial so it's not going to bolt. Parsley is not harvestable in the summer but it will survive and pick back up in the cool weather and can be harvested again in October.
- Direct-seed or transplant September 1-15 for harvest starting November 15 and continuing through the winter (with season extension after December 15) through to early April.

Garlic

- Plant October 15-December 1 for harvesting May 15-July 1.
- The first two weeks of harvest are in the green stage (customers love green garlic!).
- Even though the harvest period is six weeks long, garlic stores very well so you can market them for six months. In general, soft-neck garlic stores better than hard-neck garlic.

Potatoes

- Plant potatoes March 15-April 1 for harvesting June 1-July 15.

Chard

- Direct-seed or transplant February 15-April 1 for harvesting April 15-July 1. Use season extension to protect plantings February 15-March 15.
- Direct-seed or transplant August 15-September 15 for harvest October 1-December 15 (use season extension after November 15).
- Protect the crop through the winter and harvest again starting March 1 (overwintered harvest will overlap with harvest from spring plantings).

Radish

- Direct-seed February 15-April 1 for harvesting April 1-May 15.
- Direct-seed or transplant September 1-October 15 for harvest October 1-December 1.

Basil

- Direct-seed or transplant May 1-August 1 for harvesting June 15-November 1 (use season extension after October 15).
- The earliest harvest presumes a transplanted crop.

Tomatoes

- Transplant April 1-June 15 (use season extension for first half of April until weather warms) for harvesting May 15-November 1 (use season extension after October 15).
- Expect yield to decline towards the end of summer.

Peppers

- Transplant April 15-June 15 (use season extension for second half of April until weather warms) for harvesting July 1-November 15 (use season extension after October 15).
- It possible to plant up until June 15 and still get a good crop but yields will generally be greater from earlier plantings.

Eggplant

- Transplant April 15-June 15 (use season extension for second half of April until weather warms) for harvesting July 15-November 1 (use season extension after October 15).
- Later plantings can provide insurance for summer flea beetle problems; need to use row covers on eggplant for first six weeks after planting for protection against flea beetles and potato beetles.

Snap Beans

- Direct-seed April 1-August 15 (use season extension for month of April until weather warms) for harvesting June 1-November 1 (use season extension after October 15).
- The soil needs to be warm for germination. For plantings in April, plant under clear plastic and remove after the beans germinate.

Lambsquarters

- Direct-seed May 1-July 15 for harvesting June 1-September 15.
- This is one of the few greens that tastes delicious and produces through the summer with minimal insect problems. A great summer green!
- Seed available from Seeds of Change, Sow Organic Seed Co.

Cucumbers

- Direct-seed or transplant May 1-August 1 for harvesting June 15-October 15.
- For both cucumbers and summer squash, the most reliable crops are the early ones. Typically productivity declines rapidly after mid-summer. Early plantings produce for about one month; later plantings for shorter periods.

Summer Squash

- Direct-seed or transplant May 1-August 1 for harvesting June 15-October 15.
- For both cucumbers and summer squash, the most reliable crops are the early ones. Typically productivity declines rapidly after mid-summer.

Cantaloupe

- Direct-seed or transplant May 1-July 1 for harvesting July 1-October 15.

Watermelon

- Direct-seed or transplant May 1-July 1 for harvesting July 1-October 15.
- Watermelons tend to be more tolerant of diseases than cantaloupes on average; therefore, watermelons are usually more reliable for a late summer crop.
- Watermelons usually store very well, as long as a month if kept cool.

Winter Squash

- Direct-seed or transplant May 1-July 15 for harvesting July 1-October 15.
- The species *moschata* (butternut) is the most reliable due to vine borer resistance.

Sweetpotato

- Transplant May 15-July 1 for harvesting September 15-November 1.
- Even though the harvest period is six weeks long, sweetpotatoes store very well so you can market them for six months total. You need to cure sweetpotatoes at relatively warm temperatures for a couple of weeks after harvest (can place in a greenhouse).

Okra

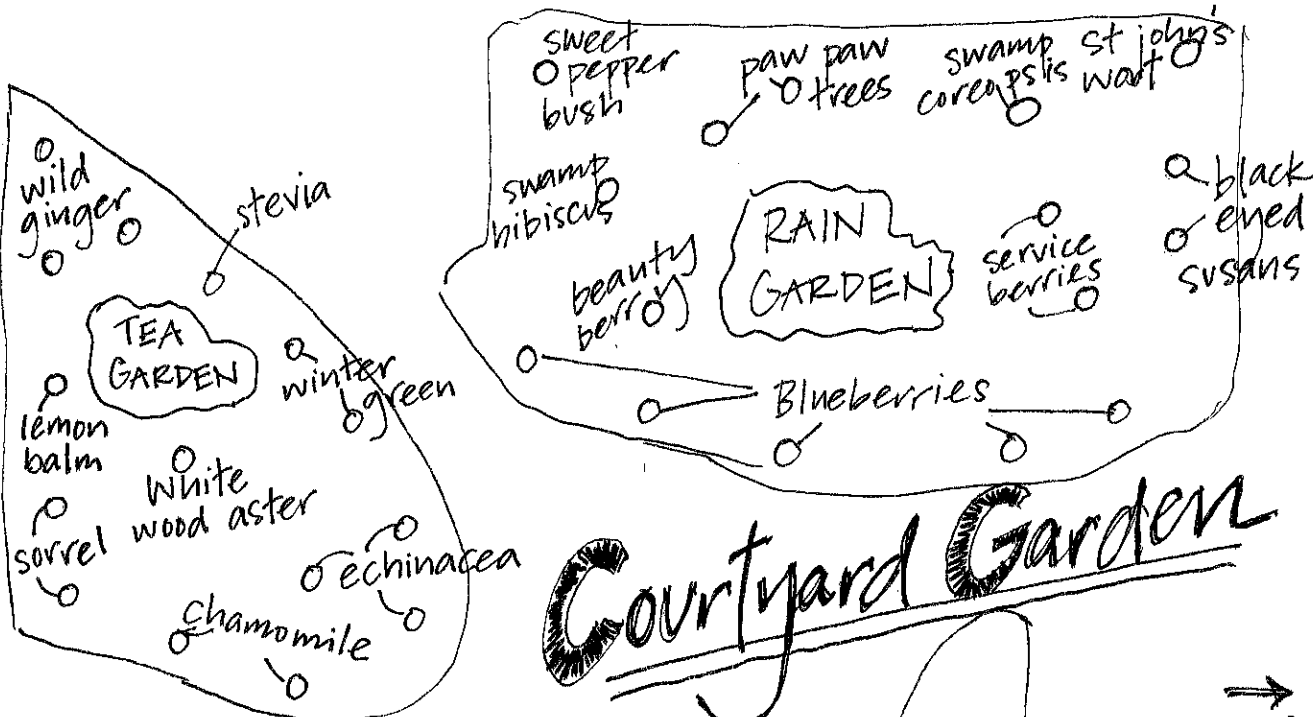
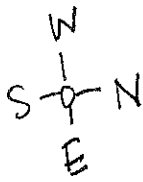
- Direct-seed or transplant May 1-June 1 for harvesting August 1-November 1.

For more information on **small farms** and **organic production**,
visit Chatham County Cooperative Extension's
Growing Small Farms website
www.growingsmallfarms.org

Over **300 pages** with hundreds of links and photos
and lots of locally-relevant content!

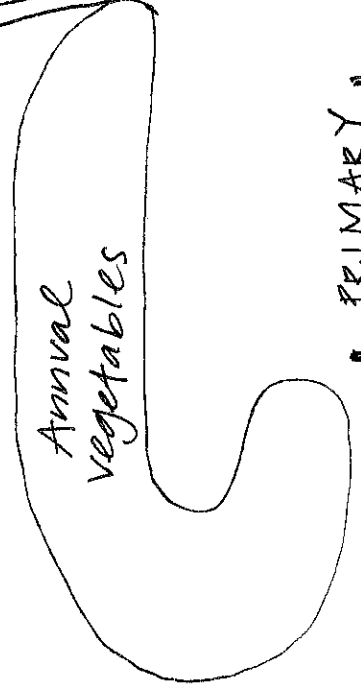
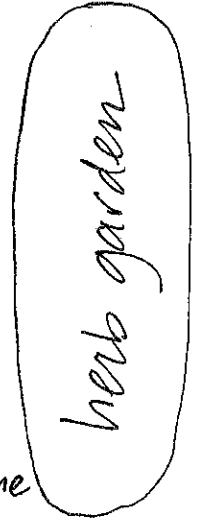
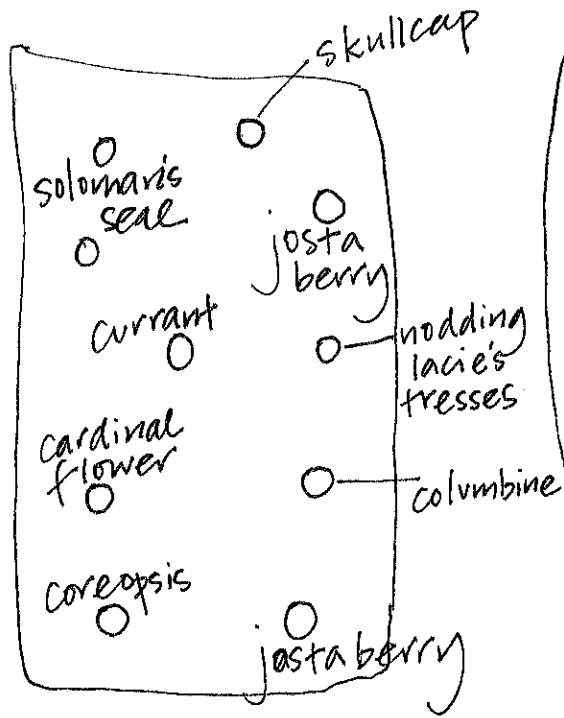
Featuring:

Grower Resource List
Organic Pest Management
Local Crop Problems
Farm Photo of the Week
Plow Sharing Newsletter
Enhancing Sustainability Workshops
Farm Planning and Recordkeeping
Organic Certification Guide
Community Supported Agriculture
Planting and Harvesting Guide
Local Farm Profiles
Farmer Listservs
Season Extension
Pastured Poultry
Beekeeping
...and much more!

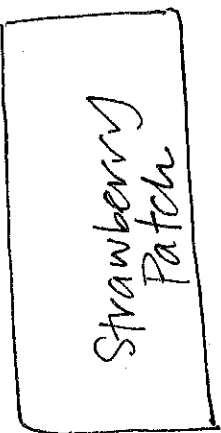
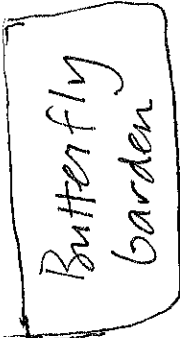


Courtyard Garden

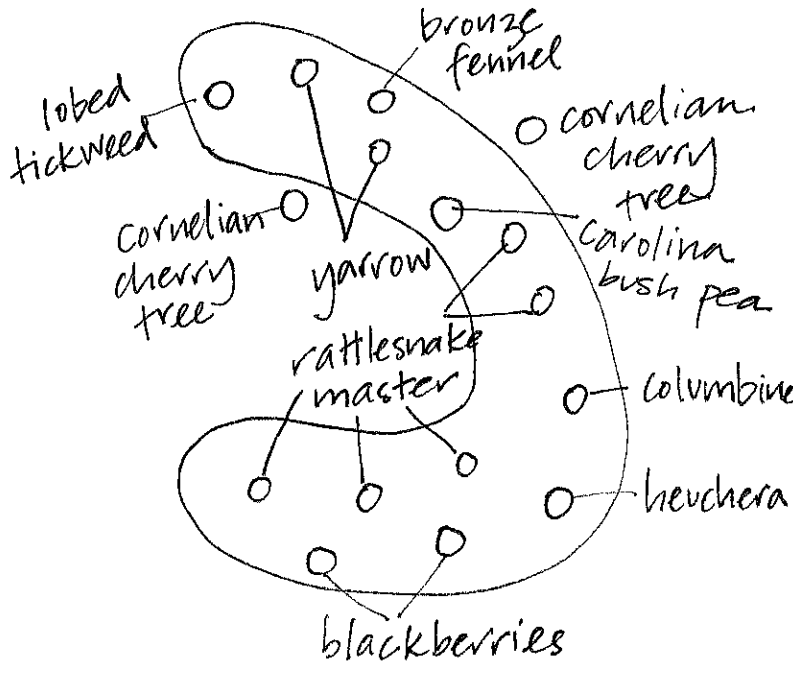
Sidewalk



PRIMARY CLASSROOMS



edible chinese dogwood



Playground

fence

○ muscadine
○ grapes

○ raspberries

○ comfrey

spearmint

○ bee balm

pathway

○ Summer
○ phlox

○ anise
○ hyssop

○ Virginia
○ sweet
○ spire

○ -Asian
○ persimmon
○ tree

arbor

○ bush
○ cherries

strawberry
patch

hardy
kiwi

○ stokes
○ aster

○ stiff
○ tickseed
○ coreopsis

○ pink
○ muhly
○ grass

--- sidewalk ---

URBAN AVE. Garden