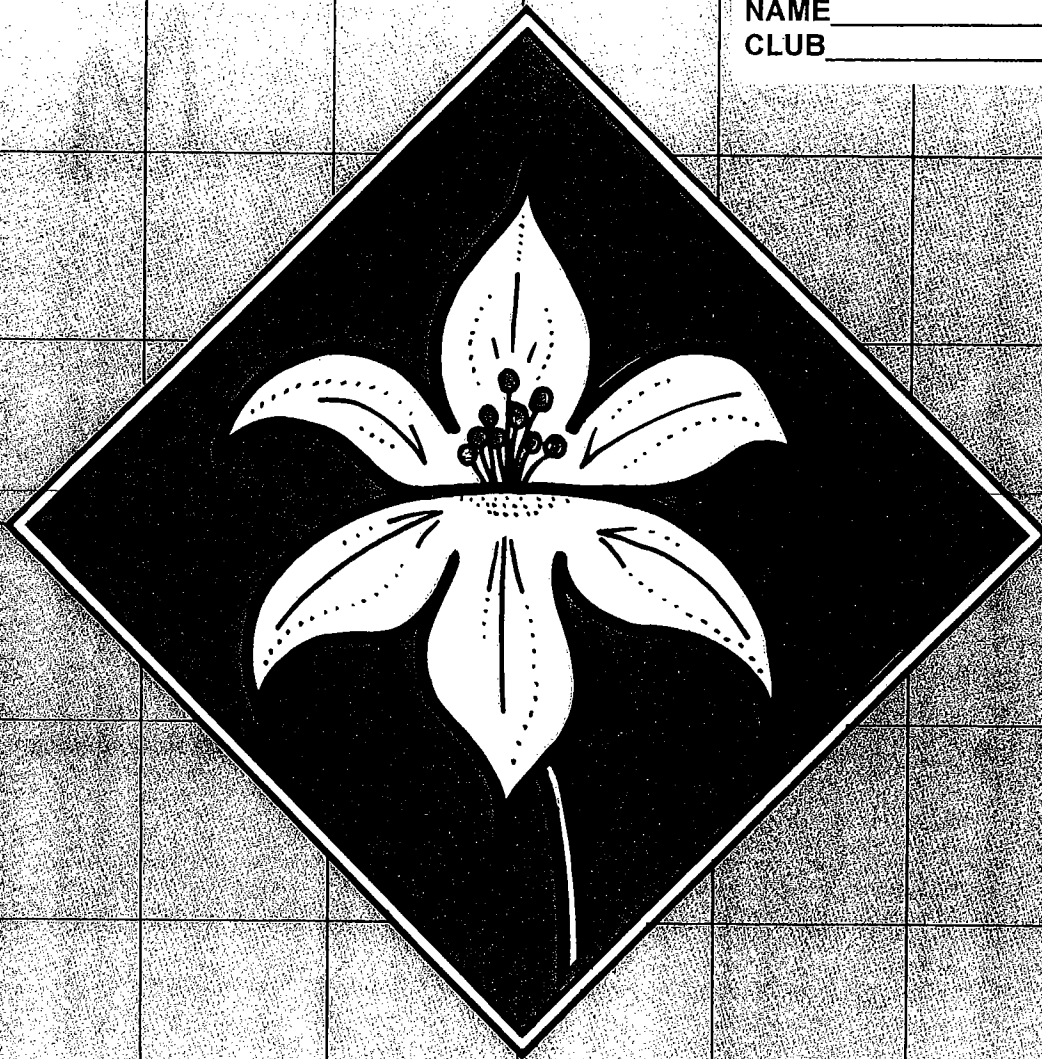


EXPLORING

the world of

PLANTS & SOILS

NAME _____
CLUB _____



Intermediate Member's Manual

S·O·I·L·S



Acknowledgement

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Introduction

Welcome 4-H'er:

4-H can help you start building now for an exciting career related to plants and soils, or you might just be interested in developing some hobby, like gardening or plant collecting. Whatever your interest, a hobby or a career, 4-H welcomes you to "The World of Soils," an intermediate unit in the 4-H plant and soil science project series.

This manual is full of activities that can help you learn more about the structure, texture, and characteristics of soil as they relate to plant growth. You can work alone or with a friend, but try to do as many activities as you can. In each activity you will discover a new concept, and you'll have fun while doing it.

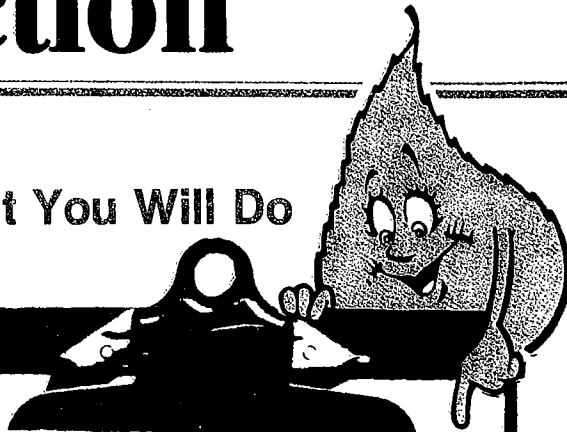
There are a lot of new terms for you to learn. For your convenience, a glossary is located in the back of this manual. There you can find definitions of new terms.

There is a record sheet in the back of this manual. You should keep a record sheet for each activity that you complete. These record sheets will come in handy when you get ready to do your final project report.

For anyone enrolled in this project who may want to use the "metric system" instead of the U.S. system, a conversion table has been included for your convenience. The figures are approximate but should be satisfactory for the activities and exercises presented in this manual. (See page 16 for the "Metric Conversion Table.")

Ready. Set. Go! Have an exciting time "Exploring the World of Plants and Soils."

What You Will Do



- Select 15 or more activities that you would like to complete. You can work by yourself, with a partner or group.
- Complete the activities that you selected.
- Attend project meetings.
- Give demonstrations at club or group meetings.
- Participate in tours planned by your club or group.
- Share what you have learned with club members and other groups through 4-H public speaking, radio talk programs or newspaper columns.
- Dig deeper. Collect more information on the area(s) of your interest.
- Keep a record sheet for each activity that you complete. Use the project record sheet on page 17 to record your observations and findings.
- Keep all your records together in one place so that they will be handy when you prepare your final project report.

(place a check mark in front of each item that you complete)



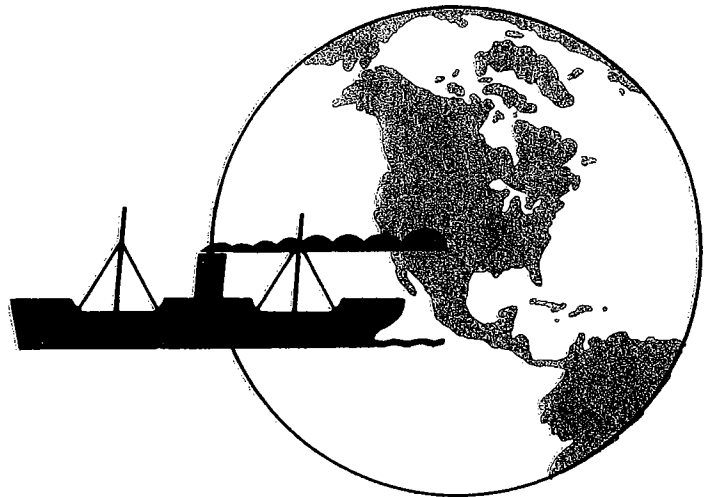
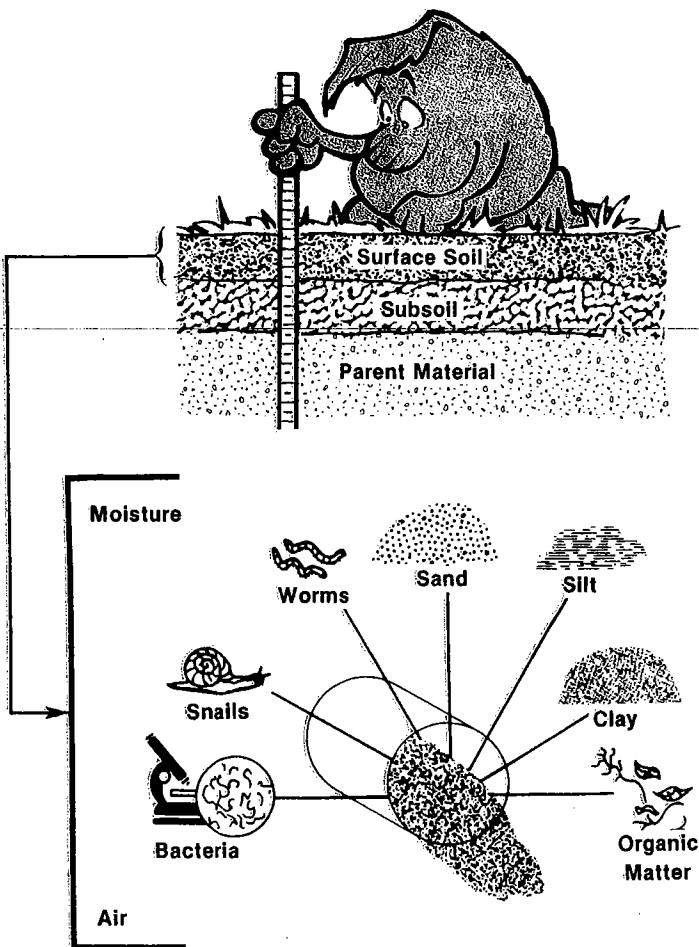
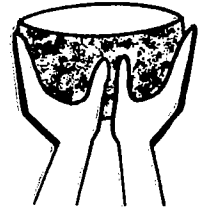
Soils

Have you ever thought of soil as a living, breathing thing? Really, it's a storehouse of decaying vegetation and animal matter, moisture and plant nutrients. Soil is the dwelling place of insects, microorganisms and other animals and plants. Where would we be if there were no soils? What would we do? Soils produce the food we eat. They produce healthy lawns and ornamentals that we use to beautify our homes. They provide indoor plants and gardens which give off oxygen for us to breathe. Soils provide the foundation upon which we build our homes. What would we do without soils?

- Others who study plant diseases and ways to overcome losses by disease are "*Plant Pathologists.*"
- Some people study how quality and crop yields can be improved. These people are "*Agronomists.*"
- Many study ways to protect and better use soils. They are "*Soil Conservationists.*"
- Then there are those who work to improve the beauty of communities and homes as well as crop quality and yield. These people work with garden plants, flowers and ornamentals, vegetables and orchards. They are "*Horticulturists.*"

There are many more occupations. Don't forget other related careers such as sales and distribution of agricultural goods and products, crop production and consulting in any number of areas. And, we can't forget the educators in schools, universities, Extension Service and other organizations.

More than half the people in the world go to bed hungry each night. We in America, after meeting our needs, export 1/5 to 1/2 of our wheat, rice, corn and soybeans to countries who do not have enough of these foods. America is the world's leading exporter of farm products, and in



order to continue to produce enough to feed our people and to share with others, we must continue to study, conserve and improve our soils. Also, we need to make the best of our renewable and non-renewable resources.

When people remove *vegetation* from the land, wind and water may join forces to erode the soil. If this continues, it can lead to hunger, despair and starvation. That's why understanding the soil and its care is so important to all of us. In order for us to live well in our environment we need to understand soils.

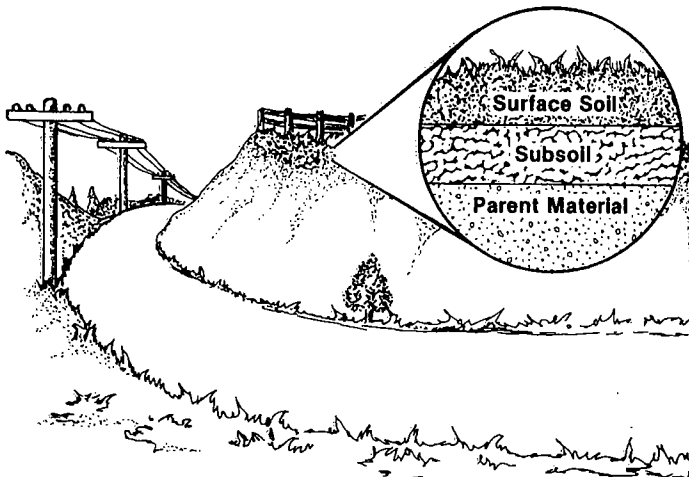
The following activities will help you learn more about soils and their relation to plants and people.

Persons trained in areas related to the study of soils find many opportunities for work. Included are those who study. . .

- Physical, chemical, biological and behavioral characteristics of soil. It includes research, soil testing and laboratory work. People who do these jobs are "*Soil Scientists.*"

ACTIVITY

1 What Is Soil?



If you did not do this activity in the Beginning Unit, it would help you to do it now.

1. Look at the banks of road cuts, excavations and other places where soil depth is exposed.
2. Keep a record of your observations. Include: location; depth of the surface soil (topsoil)* to a definite change in appearance (2" to 8" deep); depth of the subsoil* from the surface soil to the parent material; color of surface soil, subsoil and parent material.
3. Take and label separate samples of the surface soil, subsoil and parent material at a few locations. These soils can be dried and placed in small bottles for display.
4. Summarize and write down your findings. Tell what differences you observed among the surface soil, subsoil and parent material. Include any other observations such as differences observed at different locations. Use the record form in the back of this manual to record your observations.

The following explanation is offered as a footnote to the activities presented in this manual.

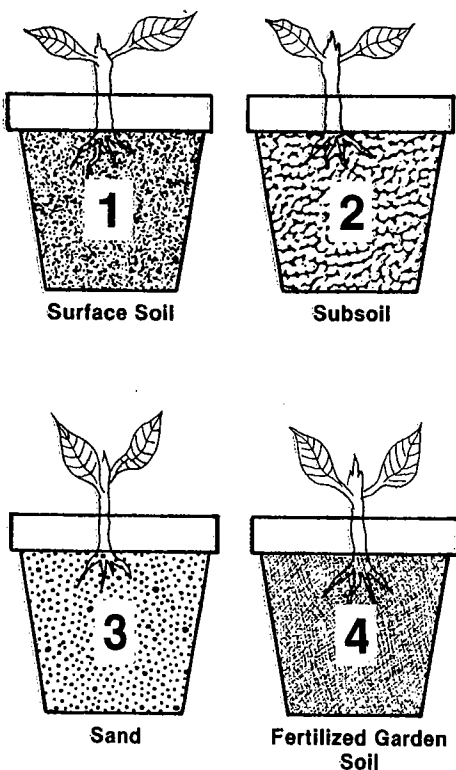
*"Surface soil" is the upper 2 to 6 inches of the land surface. For these activities, subsoil is defined as the first layer of soil beneath the surface soil that is different in color and texture from the surface soil. If there is no noticeable difference between the surface soil and the underlying soil, then the subsoil should be considered that layer of soil that is 12 to 30 inches beneath the surface. Contact your local Extension Agriculture Agent for more specific information on your local conditions.

- Soil texture is the relative amounts of sand, silt and clay in the soil.
- (1) Sand grains can be seen with the naked eye and are coarse feeling.
- (2) Silt particles can not be seen with the naked eye, and when rubbed between the fingers are smooth feeling like flour or powder.
- (3) Clay particles are the smallest (they are sticky and slick when wet). They can be rolled into a ball or rod shape.

ACTIVITY

2

Grow Plants on Different Soils



Here you will see the differences in four kinds of soil: *sand*, *surface soil**, *subsoil** and a *garden soil*. The garden soil should be typical of one that has had good treatment with fertilizer added.

1. Get four 5 quart cans or other suitable containers of equal size. The bottom 8 inches of a cut-off gallon milk carton is satisfactory as a container.
2. Punch several holes in the bottom with a large nail to allow drainage.
3. Label #1, #2, #3 and #4.
4. Fill #1 with surface soil from a field or garden.
5. Fill #2 with subsoil from the same area (taken from a depth below an observable change such as color, texture or structure.)
6. Fill #3 with sand.
7. Fill #4 with a well-fertilized garden soil.
8. Be sure the soil in each container has been crumbled and broken up into small particles. Remove stones and trash.

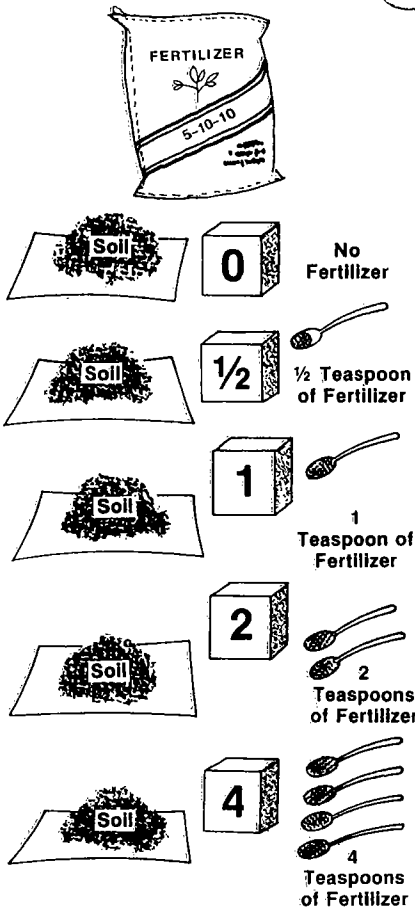
9. Plant six peas, beans, corn or other seeds 1½ inches deep in each container. Set containers in warm, well-lighted place.
10. Keep moist and covered with a clear plastic bag until the seed sprouts (germinates). Remove when seeds germinate.
11. Observe and write down your explanation of any differences you see in the number of seeds germinating, also on the rate of plant growth and appearance.
12. Keep soil moist. Record the height of the plants in each container once a week for at least 6 weeks.
13. Write in your own words what you have learned by doing this exercise. How does this apply to understanding soils and plant growth? Use the record form in the back of this manual to record your findings and observations.

*See explanation of surface soil and subsoil at top of this page.

ACTIVITY

3

Plant Response to Fertilizer



1. Select five suitable pots, tin cans or cut-off milk cartons that will hold 1 pint of soil. Punch holes in the bottoms for drainage.
2. Label 0, $\frac{1}{2}$, 1, 2 and 4.
3. Select a sandy, light-colored, low fertility soil, or fine sand from a builder's supply company.
4. Screen the soil to remove lumps, rocks and foreign material.
5. Place 1 pint of soil in each of the five numbered containers.
6. Get a small amount of *fertilizer* (8 teaspoons). This fertilizer should have three numbers such as 5-10-10, 5-20-20, 10-10-10, etc. Do not use 0-10-20 or a fertilizer with zero as any one of the numbers. (a 5-10-10 means a fertilizer with 5% nitrogen (N) — 10% phosphate (P_2O_5) and 10% potash (K_2O). Some states use N, P, & K instead of N, P_2O_5 & K_2O .)
7. Select the container marked $\frac{1}{2}$. Dump the soil out on a large piece of paper. Add $\frac{1}{2}$ teaspoon of fertilizer and mix thoroughly. Replace in container marked $\frac{1}{2}$.
8. Repeat step 7 adding the specific amount of fertilizer indicated by

- the number on the container for each. Do not add any fertilizer to the container marked 0.
9. Plant five seeds such as corn or beans $1\frac{1}{2}$ inches deep in the soil.
10. Moisten the soils until water just starts to run out of the holes in the bottom.
11. Water as needed and keep the containers in a warm, well-lighted place.
12. Record the height of the plants from the rim of the container at least every week. Also, write down your observations on the color and general appearance of the plants.

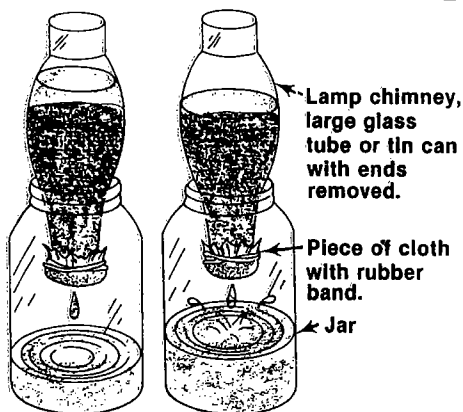
Questions:

- Did fertilizer increase the size of the plants? _____ Did you observe any unfavorable effect of the fertilizer, such as seeds which failed to germinate? _____
- Explain in your own words how fertilizer helps to grow plants. Also, list any precautions that you think should be taken when using fertilizer. Use the record form in the back of this manual to record your answers.

ACTIVITY

4

Capacity of Soil to Hold Water

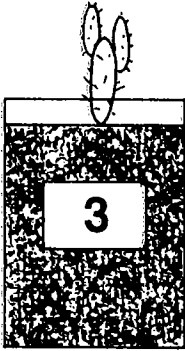
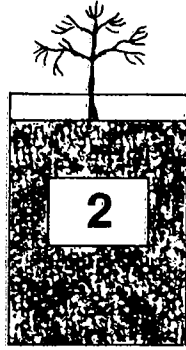
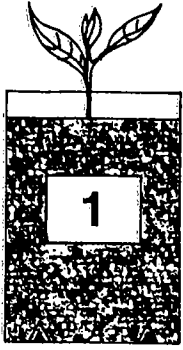


1. Select two or more soils that differ in color or texture. Try to get a *sandy soil* and *clay* or *silty soil*.
2. You will need two glass lamp chimneys (above) or two large glass tubes. Two drink cans with both ends removed or cans with one end removed and holes punched in the other will also serve.
3. Fasten a piece of cloth, such as from an old cotton shirt, over the ends of the glass tubes or lamp chimneys. Apply a string or rubber band. Be sure it is held tight. If using cans with the holes, fit a piece of cloth or paper towel over the holes so the soil won't plug them.
4. Fill the containers with equal amounts of soil (one kind of soil per container).
5. Place them as illustrated over jars of equal size.
6. Add equal amounts of measured water to each container — about $\frac{1}{2}$ the volume of the soil. Avoid pouring water into the jar below.
7. Note the rate that water is added and the time when water stops coming out of the bottom of the tube. This time interval indicates the rate that water moved through the soil (*permeability* or *filtration rate*).
8. Determine the amount of water held by each soil and compare.
9. Write an explanation for any difference noted in the amount of water held by each soil.
10. Explain in your record how you might change a soil's ability to hold water. Also describe how to change the rate that water moves through a soil.

ACTIVITY

5

How Much Water Can Plants Take From the Soil?



There are three kinds of water in soil:

1. The water held so tightly by the soil particles that plants can't use it.
2. The water held loosely by soil particles so that plants can use it readily.
3. The water free in the soil that runs through by the pull of gravity.

Plants differ in their need for water. Soils also differ in their ability to supply water to plants. A broad leaf plant and grass will soon use up the available water in the soil. Plants with needles for leaves evaporate less water than broad leaf plants. The third group of plants, like the cactus, can survive on a small amount of water.

1. Select two or more kinds of plants. Plants should be similar in size, too. Include a broad leaf plant such as the bean or a small shrub or tree. Also, include a plant with narrow leaves (pine, hemlock or spruce) and a "succulent" (cactus or other desert plant).

2. Plant them in gallon containers filled to the same height using the same soil. There should be large nail holes in the bottoms of the containers.
3. Water as needed until well established (2 to 4 weeks).
4. Stop watering the plants. (Record date).
5. Record your observations each day. Look for signs of wilting, leaf shedding or death of the plant. Explain in your record any differences observed in the behavior of the plant. Differences observed are the characteristics of the plants to conserve water, or the ability of the plant's root system to extract the water from the same soil.

ACTIVITY

6

See How Water Erodes the Soil

1. Drive a white stake 3 inches wide into bare soil (no vegetation) deep enough for it to stand. Lay a fifty cent piece near the stake.
2. Drive a second white stake in good sod or lawn.
3. Fill a sprinkler can with water or use a hose with a nozzle set to sprinkle.
4. Place a box or step ladder near one of the stakes.
5. Stand on the box or step ladder and sprinkle around the first stake. Let the water fall from the can or hose to the ground.
6. Repeat steps 4 and 5 at the other stake.
7. Observe splashing of soil on the white stakes. List any effect of the fifty cent piece on the erosion of the soil. Write down your explanation for any differences between the *sod* and the *bare soil*.

