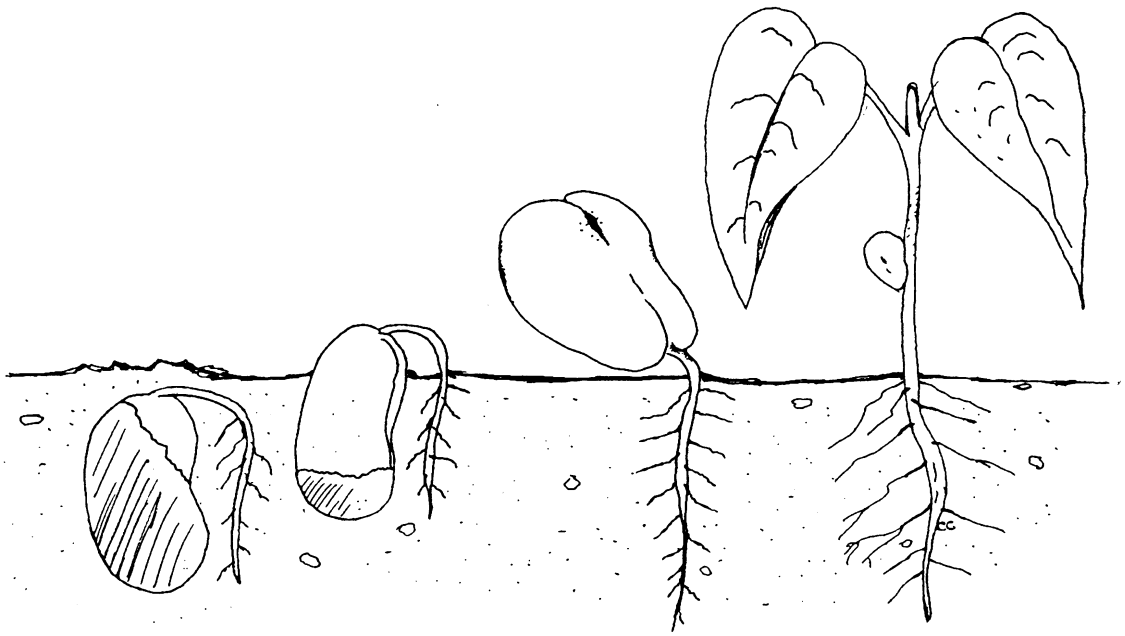
Lit. No. 500

4-H Classroom Activities in

Plant Science



Oklahoma Cooperative Extension Service
Oklahoma State University

CLASSROOM ACTIVITIES IN PLANT SCIENCE

by
Joe Maxson
Emeritus 4-H Specialist, Plant Science

reviewed by
Dean McCraw
Extension Vegetable and Youth Specialist
Horticulture and Landscape Architecture

Charles Cox
Extension 4-H and Youth Development Specialist

These lesson plans have been designed to enrich classroom science curriculum. The lessons are provided by the Oklahoma Cooperative Extension Service, 4-H Program.

An attempt has been made to prepare the plans in such a manner that they can be duplicated for distribution to the students.

Instructors are encouraged to use the material in the manner that it will best fit the grade level of their students. Some of the lessons may be completed in one session while others may require several class sessions to complete.

A letter to parents is also provided. This information page should be sent home with the students to inform parents about classroom activities at the beginning of the unit.

Additional Plant Science related activities are available in the Oklahoma Ag In the Classroom Curriculum available from your county Cooperative Extension Service Office.

OKLAHOMA COOPERATIVE EXTENSION SERVICE

Electronically formatted by Mark S. Gregory
Area Extension Agronomy Specialist

Dear Parent,

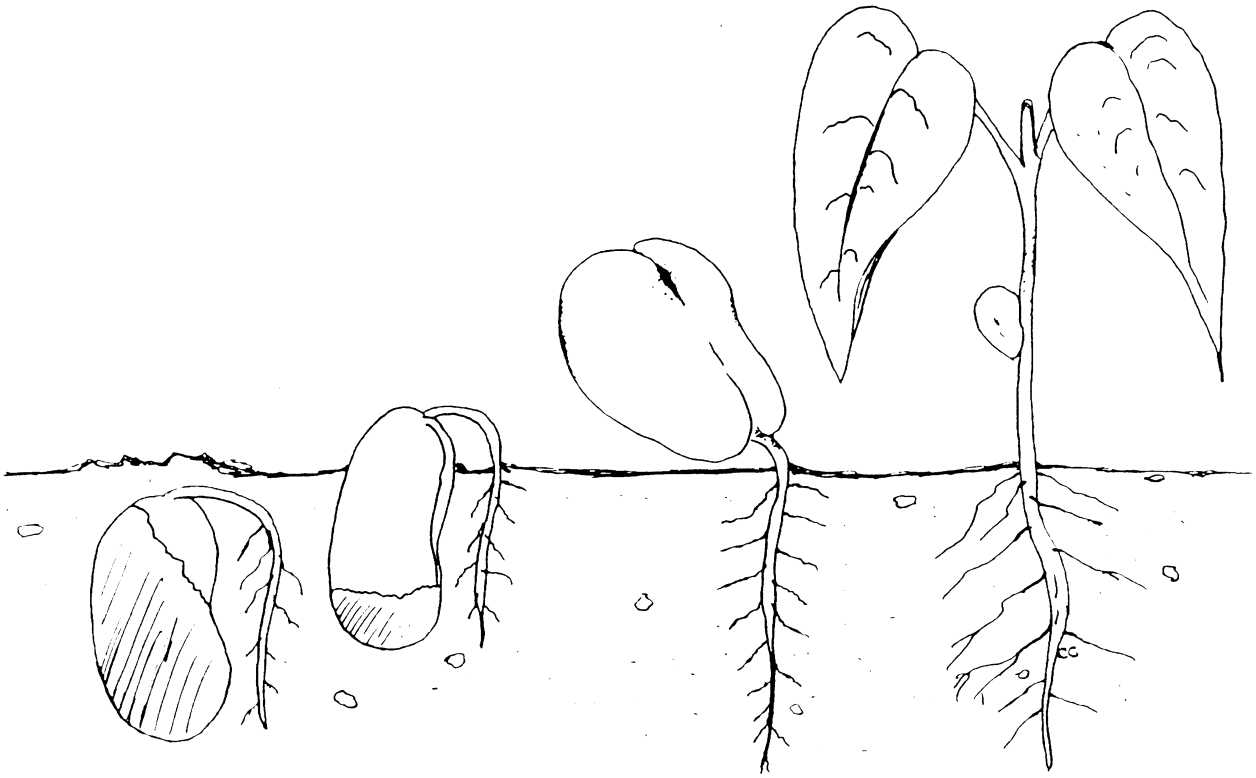
Today your child began a new adventure in education. It's called, 4-H Plant Science. This unit will help your child learn more about plants and how they grow.

You can help encourage additional learning by discussing the events of the day with your child. You may even wish to repeat some of the activities at home, letting your child be the teacher. This will help your child gain valuable skills by sharing, processing, generalizing and applying the information he or she has received.

This program is sponsored by the Oklahoma Cooperative Extension Service, 4-H Program and your child's school.

-----This is an example of what I am learning.----

Color your bean seed and plant. Write or tell a story about your seed.



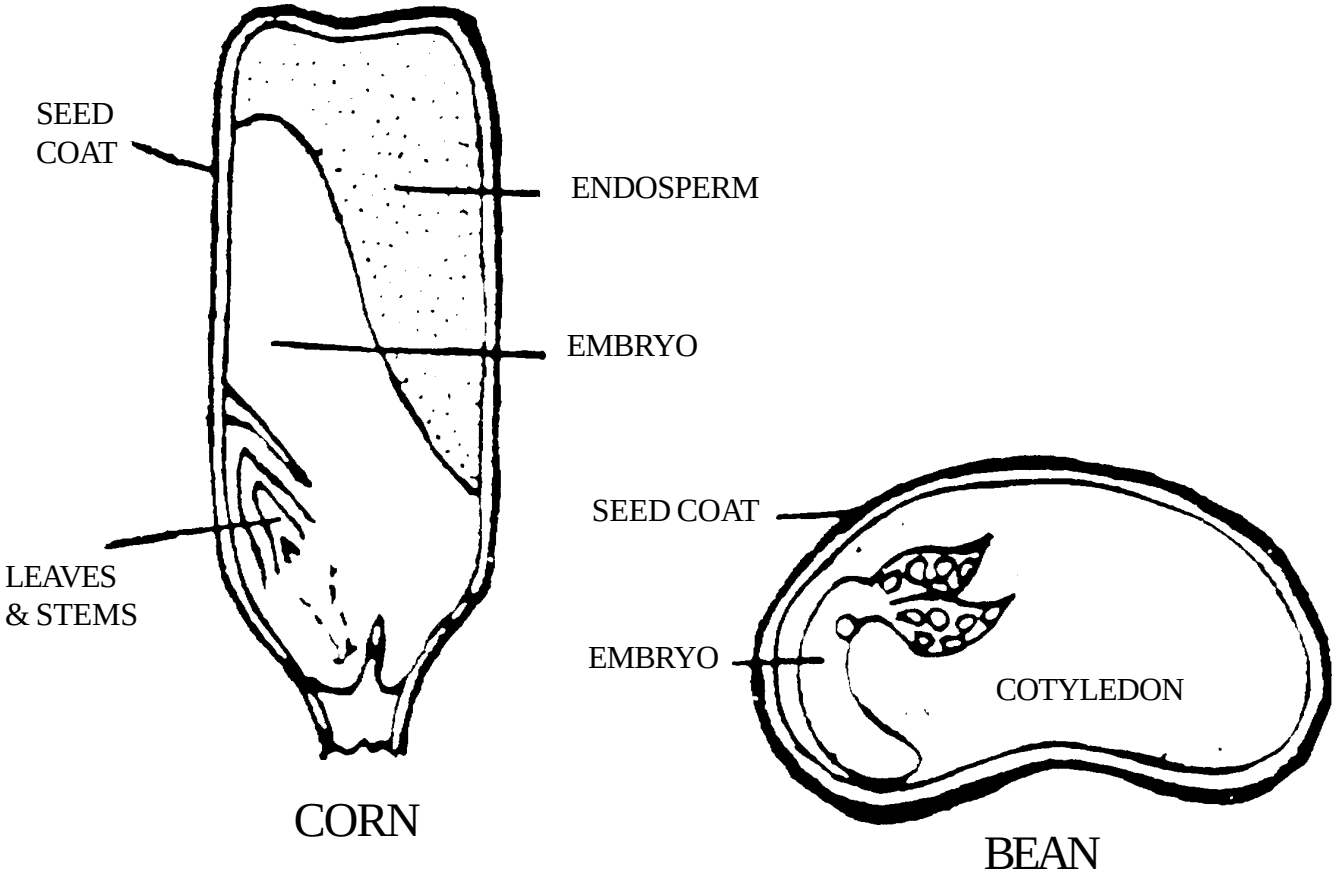
The process of a seed forming a new plant is called, germination.

Produced by Oklahoma Cooperative Extension Service, 4-H Programs
in cooperation with the USDA and County Commissioners.

LESSON I

LET'S LOOK AT SEEDS

Most plants are started from seeds—when the seeds begin to grow and produce a plant it is called germination. Let's look closer at some seeds to learn more about it.



The embryo is a small plant within the seed that is alive. When conditions are favorable, the embryo starts to grow and break out of the seed coat. Remember, this is called germination.

Seeds have stored food which the young plant lives on after germination until the roots become established. In seeds such as beans and peas this stored food is called cotyledons In seeds such as corn and wheat it is called the endosperm.

WHAT IS IMPORTANT TO GERMINATE SEEDS?

1. Correct moisture-too much moisture may cause rotting.

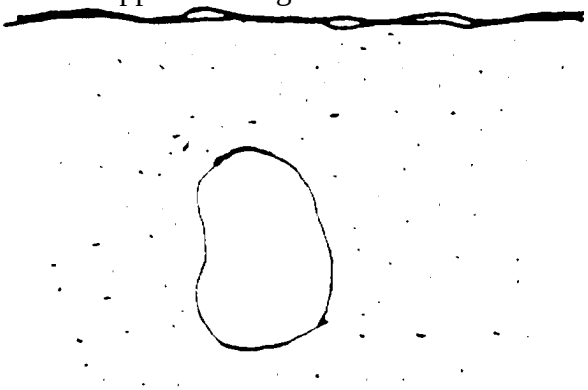
2. Correct temperature-most germinate best at 65 to 70 degrees F.

3. Oxygen.

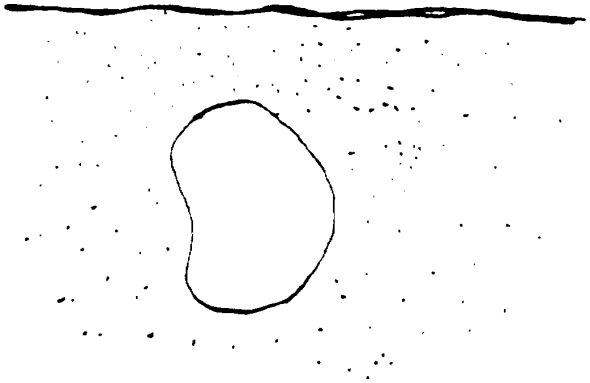
4. Some plants need light-others do not.

WHAT HAPPENS DURING GERMINATION?

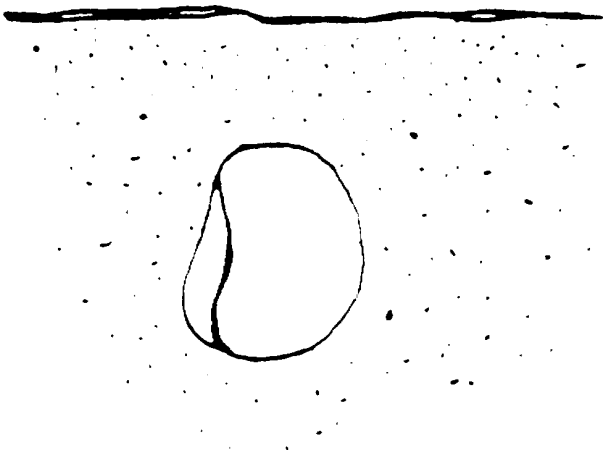
Remember, germination is when the embryo or small plant within the seed begins to grow. The young plant that appears after germination is called a seedling



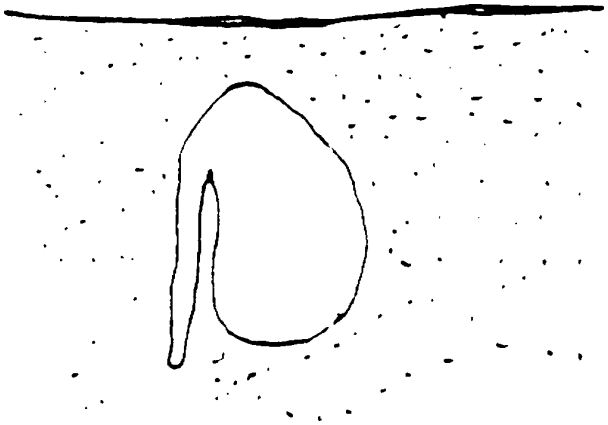
1. Seed absorbs water.



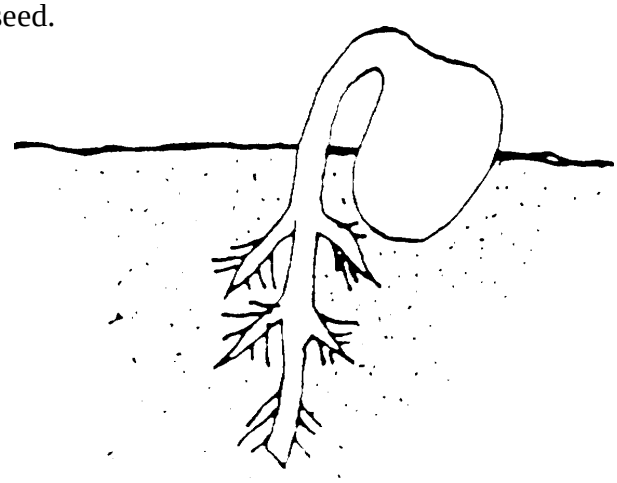
2. Seed coat softens and swells.



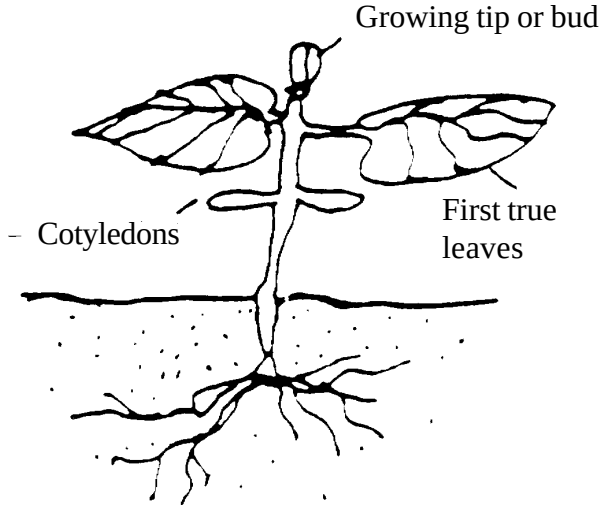
3.The seed coat splits as a result of the In-crease In pressure as water Is absorbed by the seed.



4.The root grows through the spilt and down-ward to form the root system of the seedling.



5.The upper part of the embryo grows up to form the stem and leaves.

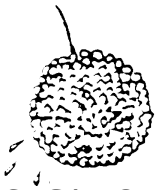


6. The true leaves unroll or unfold exposing the growth bud from which growth proceeds.

MORE ABOUT SEED

Seeds are very important to us. As you have already learned, they may be the part of the plant we use for food. Beans and corn are examples of seeds we eat for food. Seeds are also the way many new plants get started. Seeds have many different shapes.

BEAN



SYCAMORE

SUGAR MAPLE

RED OAK

ELM

SQUASH

CORN

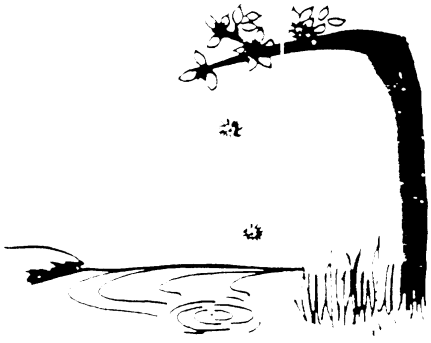
WHEAT

OATS

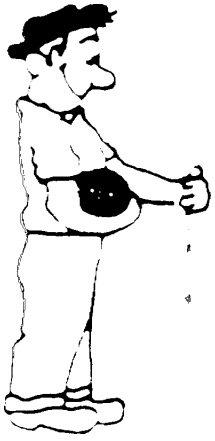
SEEDS ARE SCATTERED IN DIFFERENT WAYS

BIRDS

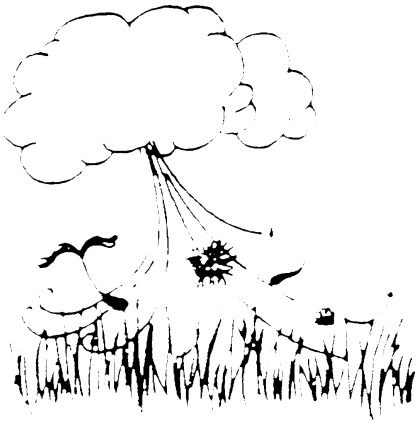
WATER



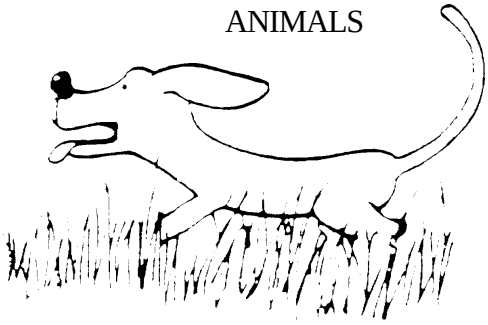
MAN



WIND



ANIMALS



LESSON I
CLASSROOM ACTIVITIES

A closer look at seeds

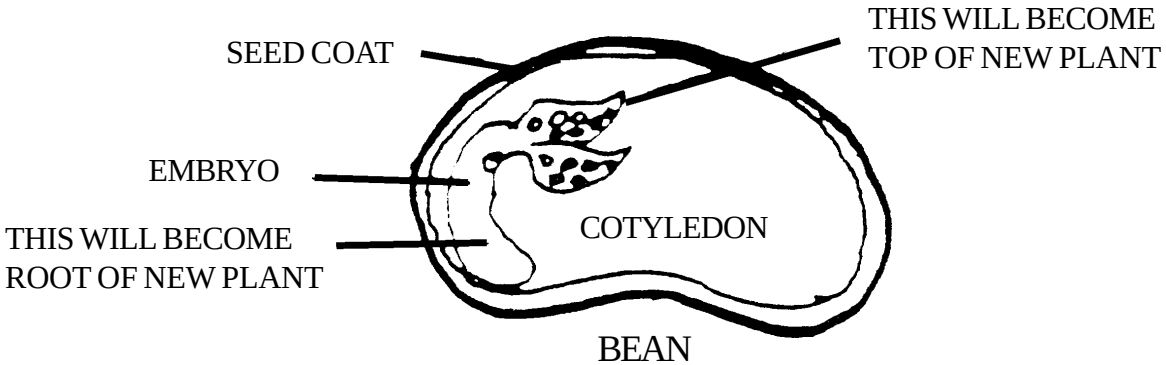
Procedure:

1. Place bean seeds (dry beans from the grocery store) in a glass or jar.

2. Add water to cover the beans and let set for 12-24 hours.

3. Give each student one or two bean seeds and let them remove the seed coat and separate the two halves.

Instruct each one to point out the seed parts.

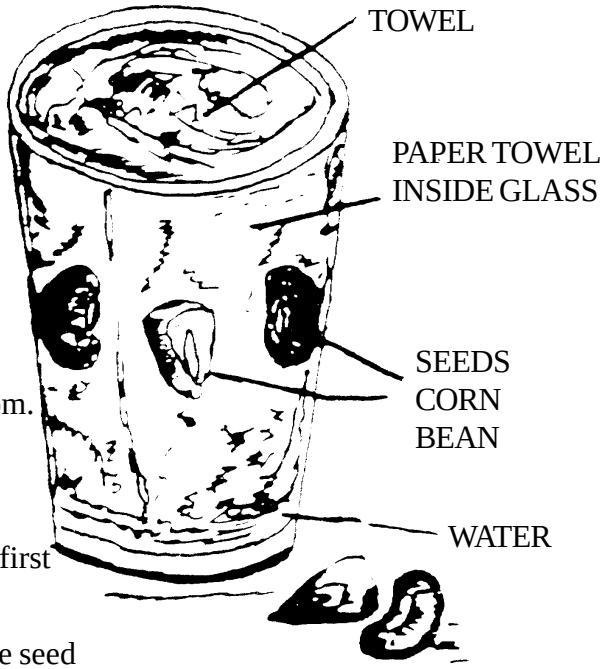


BEAN

How seeds germinate and grow

Materials needed:

1 Paper towels
2 Glass tumbler
3 Corn and bean seeds



Procedure:

1. Line the sides and bottom of a glass with a paper towel

2. Add water to wet the towel and leave extra water on the bottom.

3. Stuff the center with more wet towels to keep the first towel firmly against the sides of the glass

4. Slip two beans and two corn seeds between the glass and the first towel

5. Look at the glass each day. Write down what you see about the seed coat coming off, how the corn and bean plants emerge, first leaves, and development of the roots. Also, note any other observations you may have.

LETS GROW SOME PLANTS

In this exercise the student will learn to grow plants from seed that will produce flowers or perhaps food.

Peat pellets will be used to start the seeds. They are porous enough to hold water, air, and the minerals necessary for plant growth The pellet is made of peat (decayed plant remains) which has been soaked with mineral nutrients, compressed to reduce size, and wrapped with thin plastic to hold it together. (Fig. 1)

Fig. 1

When the pellet is placed in water, it absorbs the water quickly and swells to provide a planting pot within ten minutes. (Fig. 2)

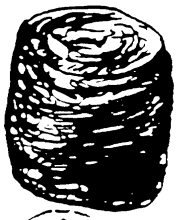


Fig. 2

The peat pellet contains enough plant food for about four weeks of growth Water must be added every two or three days to keep it moist. The new plant (seedling) should come up between four or seven days after the seed is planted. (Fig. 3)

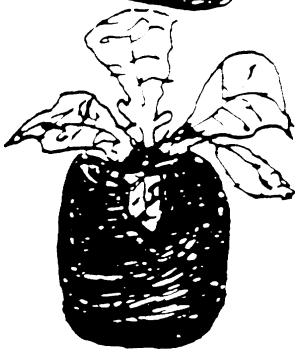


Fig. 3

When the plant is four to six weeks old, it should be old enough to set into a larger pot or outside Procedure:

1.Place peat pellets in trays.

2.Pour one inch of water in the trays.

3.Allow to set until the water has been soaked up and pellets are fully expanded if the pellets are not fully expanded when all the water is gone, add more water. If the pellets are fully expanded with standing water, pour out the water.

4.Use a pencil to punch a hole 1/4 to 1/2" deep in the center of the pellet.

5.Place two or three seeds into the hole and cover by pressing the sides of the hole together.

6.Place the small tray of peat pellets in the larger tray under the grow lights. Adjust the light so it is approximately 8 inches above the top of the pellets.

7.Turn lights off at the end of each day. Leave lights on during the weekends.

8.Observe the pellets each day and water as they begin to dry out. Do not leave excess water in the tray or plants may become overwatered.

9.When plants begin to bloom (if you use flower seeds), let students take plant home to plant in larger pot or outside.

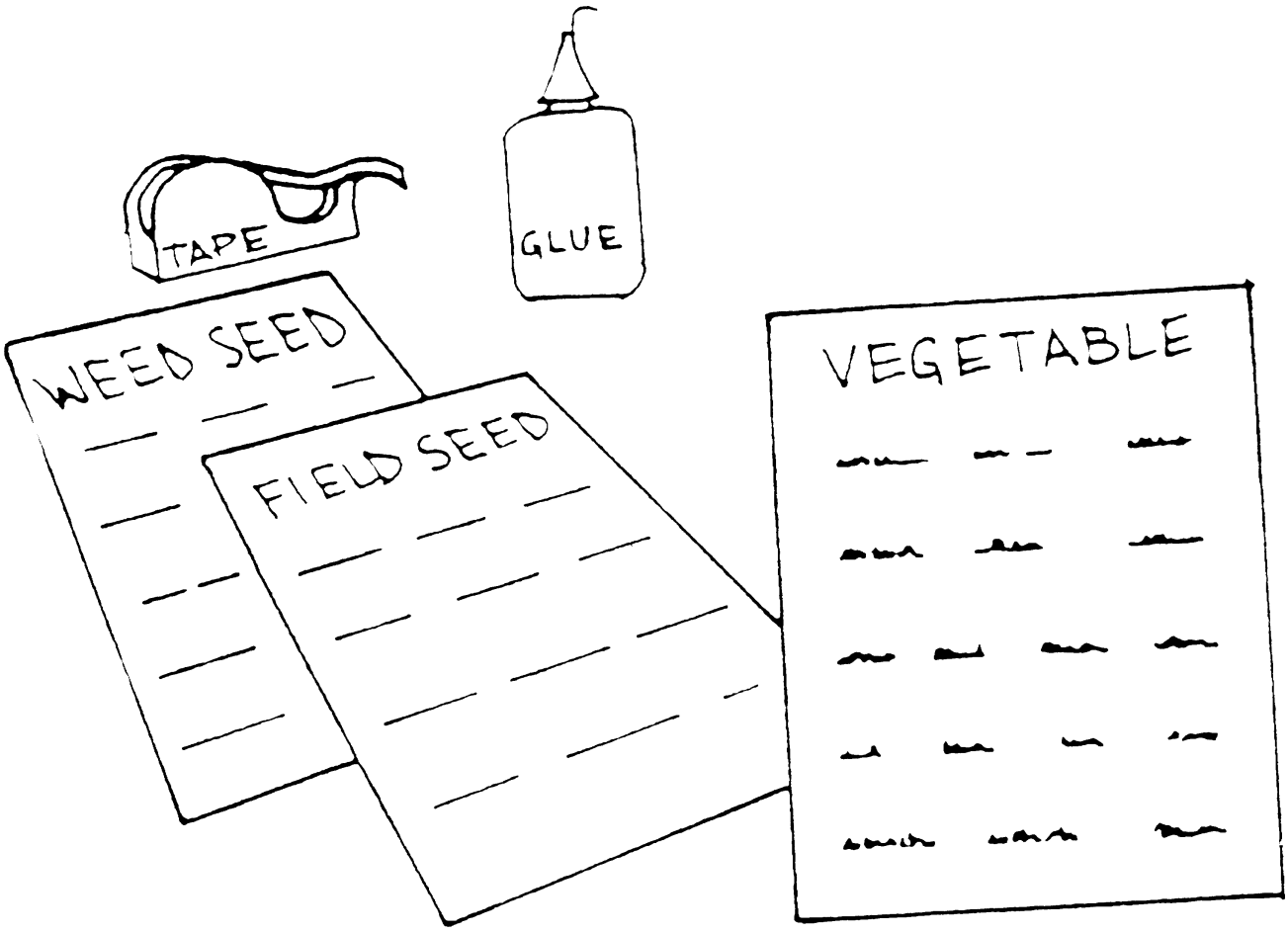
If this activity is carried out in the spring, tomato plants can be used and students can plant them in their garden or in a large container outside

MAKE YOUR OWN SEED COLLECTION

You can learn more about seeds by collecting and mounting them so you can look at them and study them from time to time. See how many you can collect and learn to identify.

You will need several pieces of cardboard, glue, paste and a ball-point pen. Use pieces of cardboard about the size of a sheet of paper. Mark one for field crop seeds, one for vegetable seeds, flower seeds, fruit seeds, weed seeds, etc.

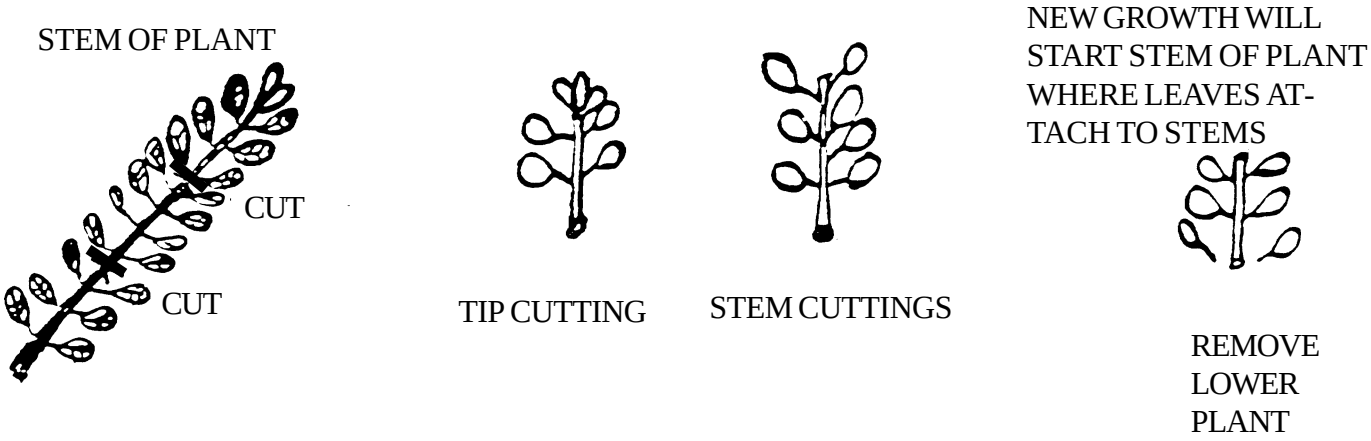
Fasten the seeds to the cards by placing a drop of glue on the cardboard and placing the seed in the glue, or you may tape the seed on the cardboard.



LESSON II

STARTING PLANTS FROM CUTTINGS

Some plants are started by rooting cuttings instead of by planting seeds. This diagram shows how to make cuttings.



MAKING THREE CUTTINGS FROM ONE STEM

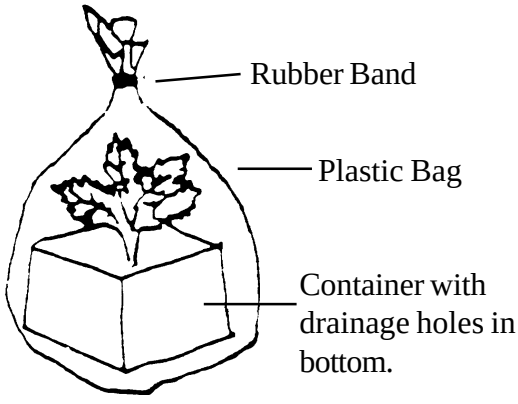
Cuttings from some plants will root in two weeks and cuttings from other plants may take up to three months to root. Usually, cuttings from house plants will root in two or three weeks.

In order for the cuttings to root, they must be placed in moist soil or rooting media so they will not dry out.

High humidity is very important when cuttings are rooting. If the air is too dry, the cuttings will dry out and die. A rooting chamber or humidity chamber is used to keep the cuttings from drying out. Below are sketches of different ways to make humidity chambers.

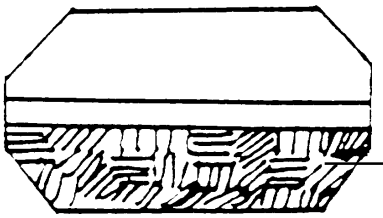
Plastic refrigerator box makes a good rooting chamber for cuttings.

Flower pot covered with plastic bag makes a small "greenhouse"for rooting a few



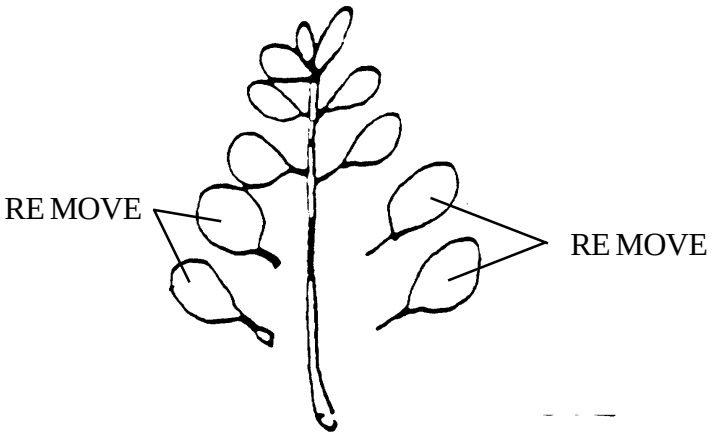
When you are ready for root cuttings, select a propagation chamber with drainage holes. If a plastic container is used, punch three or four 1!4 inch holes in the bottom, Then place :2 - 2 1/2" of the rooting media in the chamber.

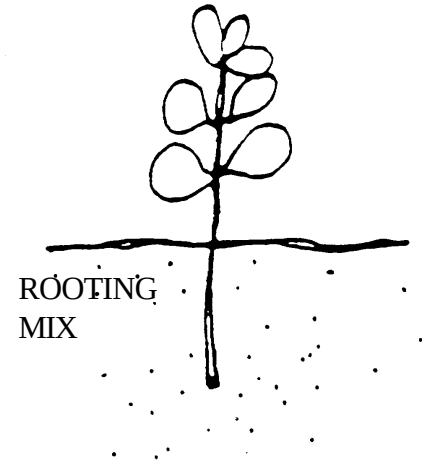
PROPAGATION CHAMBER



Water the media until it is moist all the way through.

Place the cutting in the chamber to a depth of 1/2" to 1 1/2" depending on its size.





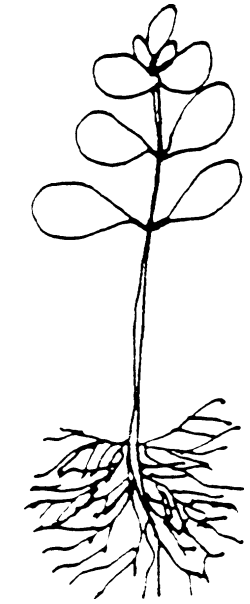
After cuttings are placed in the container, water lightly and place the cover on the chamber. It can be secured with tape. Place the chamber under the lights or in a well-lighted area of the room. Be sure to place the chamber in a tray to catch excess water. If the cover remains on the chamber, it should remain moist enough without watering,

When the cuttings have rooted, class members can take them home and plant them in a pot. Plastic sandwich bags can be used to get the plants home.

Another good classroom activity is to let each class member make a terrarium using the cuttings they rooted.

Some plants which root easily are:

Artillery Plant
Begonia
Chrysanthemum
Coleus
English Ivy
Peperomia
Swedish Ivy
Wandering Jew

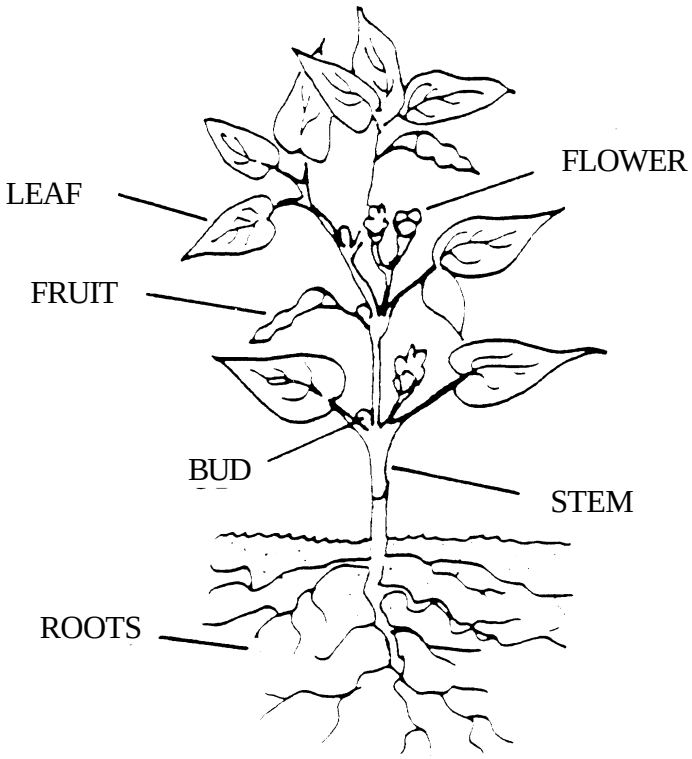


ROOTED CUTTING

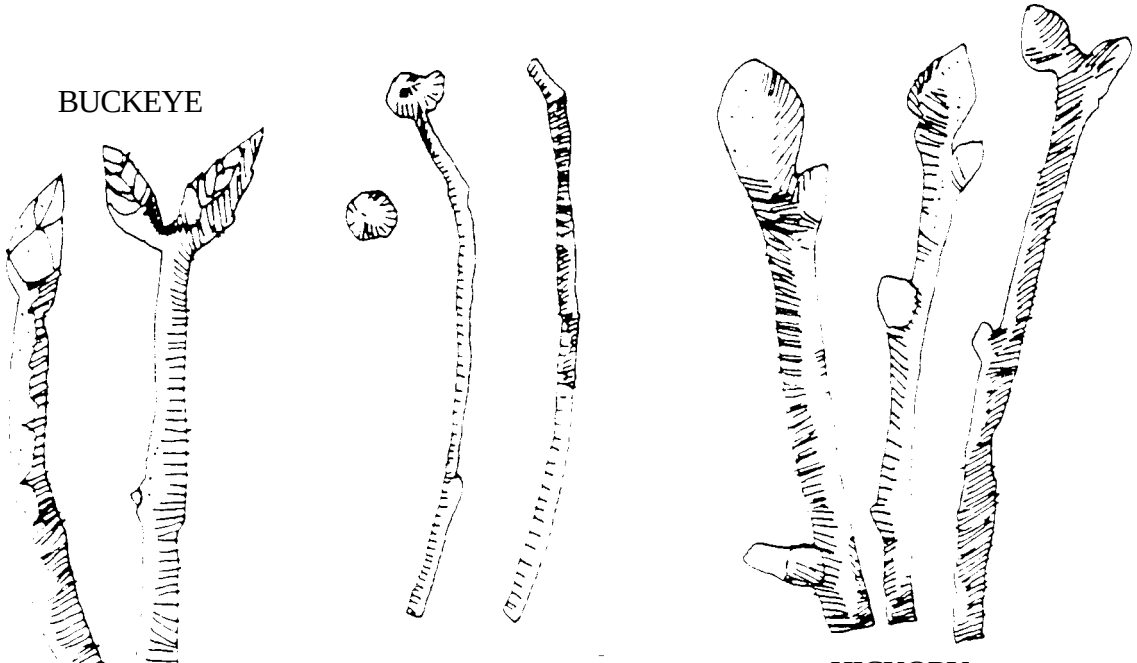
LESSON III

PARTS OF PLANT

SINCE YOU ARE STUDYING ABOUT PLANTS, YOU NEED TO KNOW THE PARTS OF A PLANT.



BUDS may be flower buds or leaf buds. Flower buds produce the flower. Leaf buds produce leaves or new limbs. The edible part of the brussels sprout is the bud.



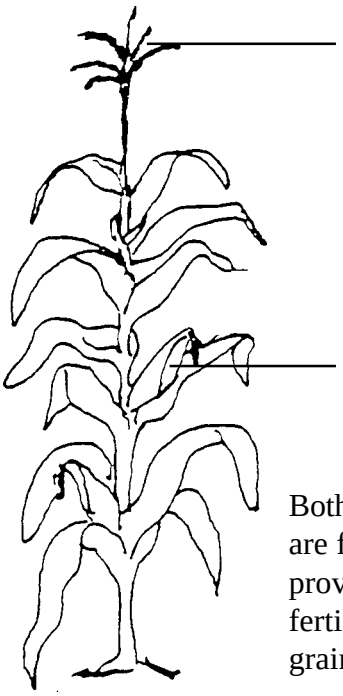
The FLOWER has many functions or jobs. Some plants are grown for the beauty of the flowers or for their good odor. Bees use pollen from flowers to make honey. The main function of the flower is to become pollinated so a fruit can grow and other plants can be produced from its seed. We eat the flower of some plants such as broccoli and cauliflower.

DOGWOOD

GERANIUM

ROSE

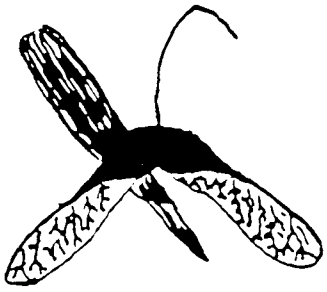
ORCHID



Both TASSLE and EAR are flowers. (the tassel provides the pollen that fertilizes the ovary end a grain of corn is formed).

The FRUIT of different plants may take many different forms -the fruit contains the seeds that we can plant to get new plants. Many plants produce a fruit as the edible product e.g., apple, peach, tomato.

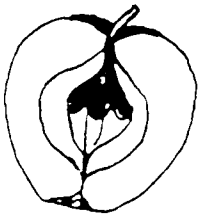
BEAN



MAPLE

BERRY

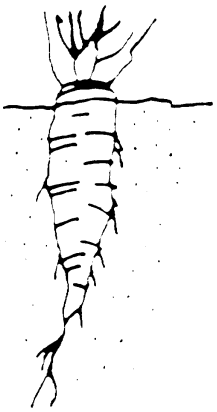
COTTON



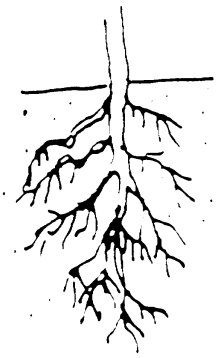
APPLE

The ROOT'S job is to take water and minerals from the soil for the plant to make food. The roots also provide support for the plant. Roots may be in many different sizes and shapes. Some are used for food like carrots or turnips.

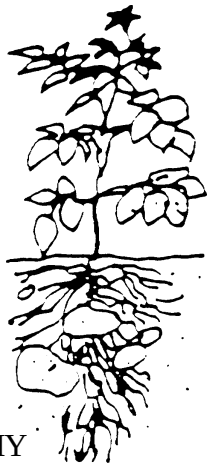
FLESHY TAP ROOT



BRANCHED TAP ROOT

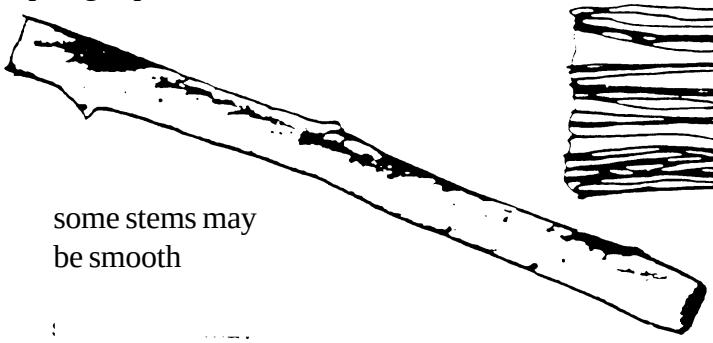


FIBROUS ROOTS

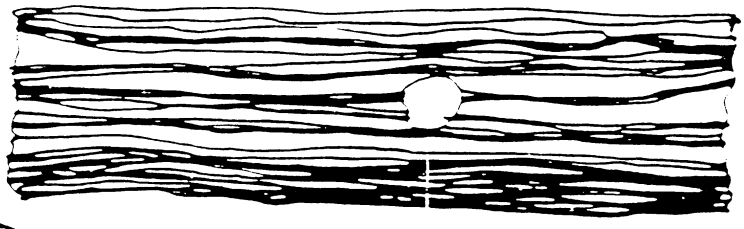


FLESHY TUBEROUS ROOT

The STEM is that part of the plant that comes up from the soil. On large plants like trees, this stem is called the trunk. This stem or trunk has smaller stems limbs, and leaves attached to it. The flower and fruit will also be attached to the stem at some point. This main stem moves water and minerals from the roots to other parts of the plant. It also returns food to be stored in the roots. We eat the stems of the asparagus plant.



some stems may be smooth

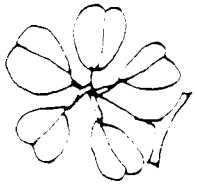


some stems may have rough bark

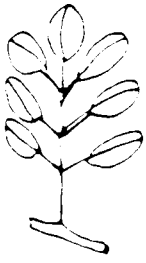
The LEAF has a very important job. It must make food for the entire plant. When the sun shines on a leaf, it takes carbon dioxide and the water that's already in the plant to make sugar. Chlorophyll in the leaves help make this possible. As this food is being made, the plant gives off oxygen which is important to animal life. This is a process known as photosynthesis that you will learn about in Unit 11. We eat the leaves of leafy green vegetables, such as spinach and lettuce. We eat only the leaf stem (Petiole) of the rhubarb plant. There are many different kinds of leaves.

LEAF TYPES

SIMPLE



PALMATELY COMPOUND



PINNATELY COMPOUND

LEAF VEIN TYPES

PARALLEL VEINS

NETTED VEINS

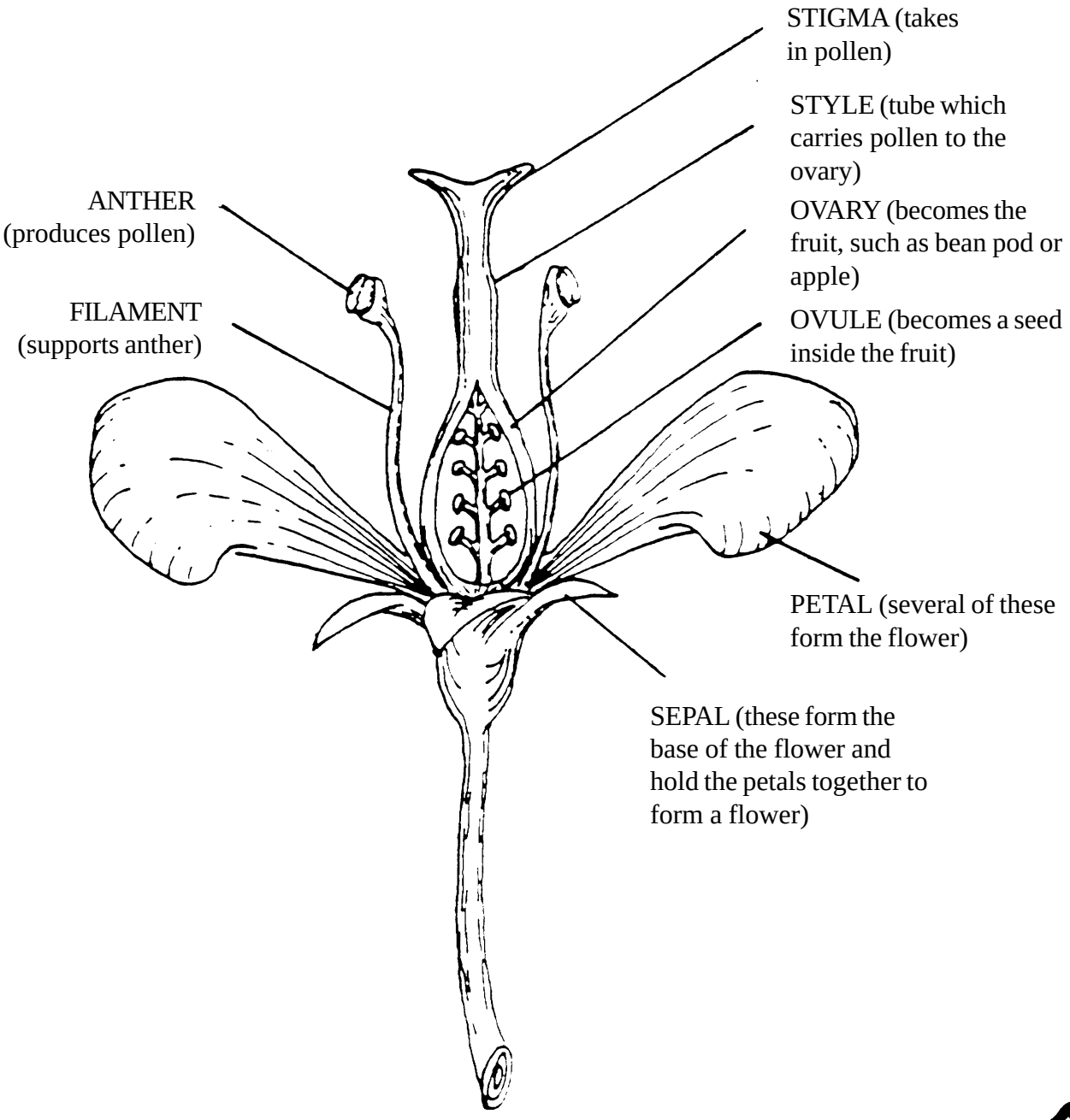
LESSON IV

A CLOSER LOOK AT FLOWERS

REMEMBER!!

Flowers are very important plant parts. Some plants are grown for the beauty of their flower or for their good color. Bees use pollen from flowers to make honey. The main job of the flower is to become pollinated so fruit can grow and other plants can be produced from its seed.

THE PARTS OF A COMPLETE FLOWER

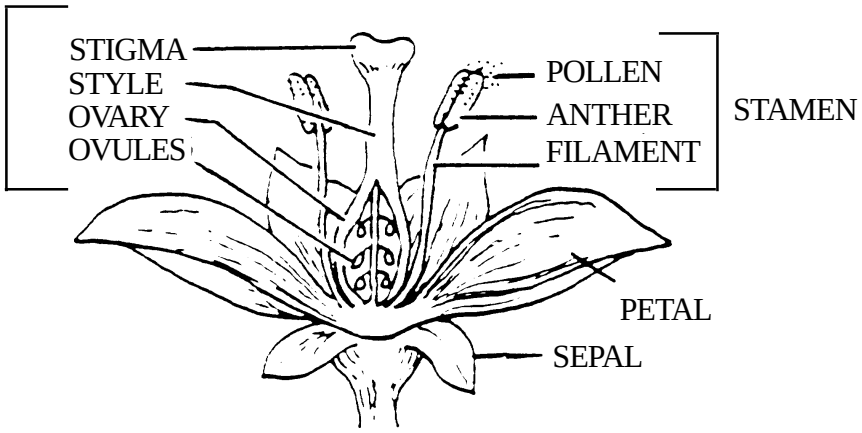


LETS LOOK AT ANOTHER COMPETE FLOWER

When we say a flower is complete we mean it has both male and female parts in one flower.

REMEMBER!

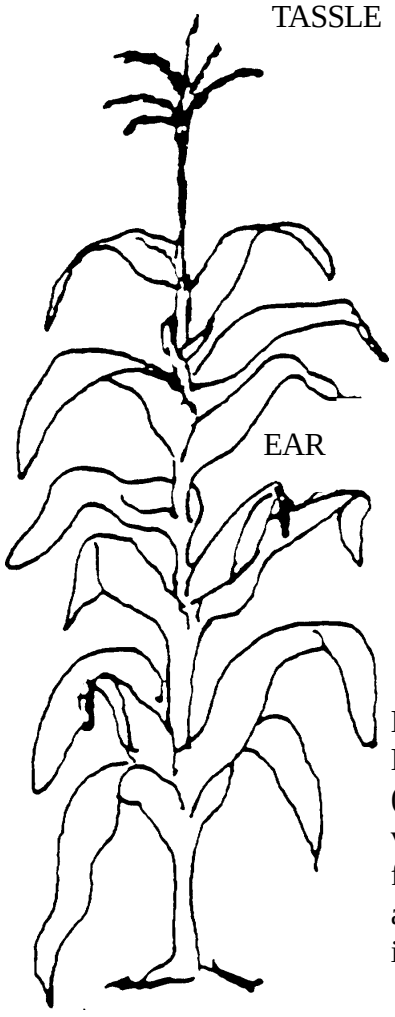
The STIGMA, STYLE and OVARY form the pistil which is the female part of the flower. The ANTHER and FILAMENT form the stamen which is the male part of the flower.



A COMPLETE FLOWER

Many flowers will have several pistils and stamens while others may have only a few or even one.

SOME PLANTS HAVE MALE AND FEMALE FLOWERS SEPARATE - BUT ON THE SAME PLANT



Both TASSLE and EAR are flowers. (The tassle, provides the pollen that fertilizes the ovary and a grain of corn is forced).

Let's look at the corn plant again. The tassle is the male flower that produces the pollen and the small ear is the female flower that produces the fruit which is an ear of corn.

Plants with this type of flowering system are called monoecious plants.

Other plants that are monoecious are cucumber, watermelon, cantaloupe, pumpkins and gourds.

SOME PLANTS HAVE FEMALE FLOWERS ON ONE PLANT AND MALE FLOWERS ON ANOTHER PLANT

Have you noticed that some holly plants have berries and some do not?

REMEMBER

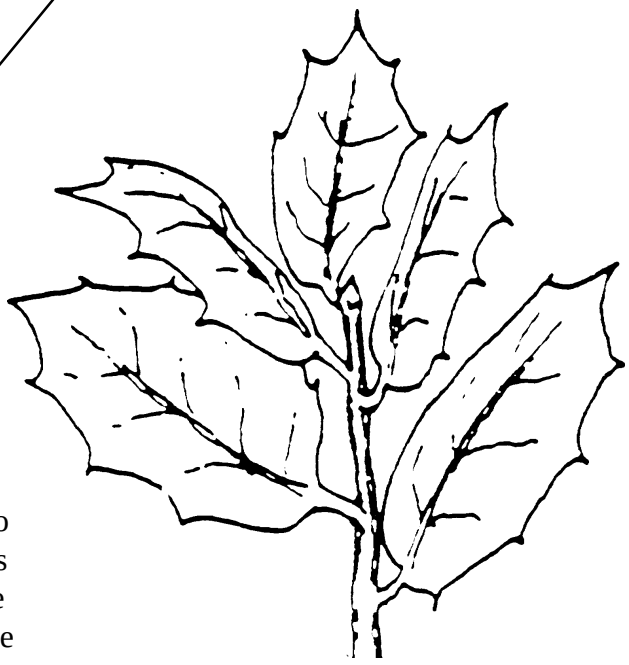
Only female flowers produce fruit which in the case of hollies is the berries.

On some plants the male flower is on one plant and the female flower is on another plant. This is why some holly plants produce berries and others do not.

Other plants that have male flowers on one plant and female on the other are asparagus and cottonwood.

Plants with this type of flowering system are called dioecious.

Female plants produce only female flowers.



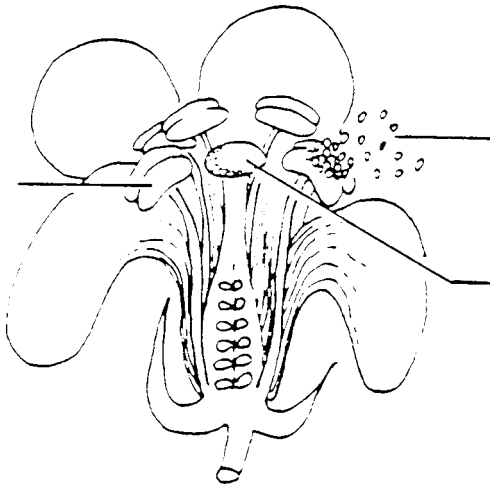
Male plant has no fruit but produces pollen to fertilize flowers on female plant.

LESSON V

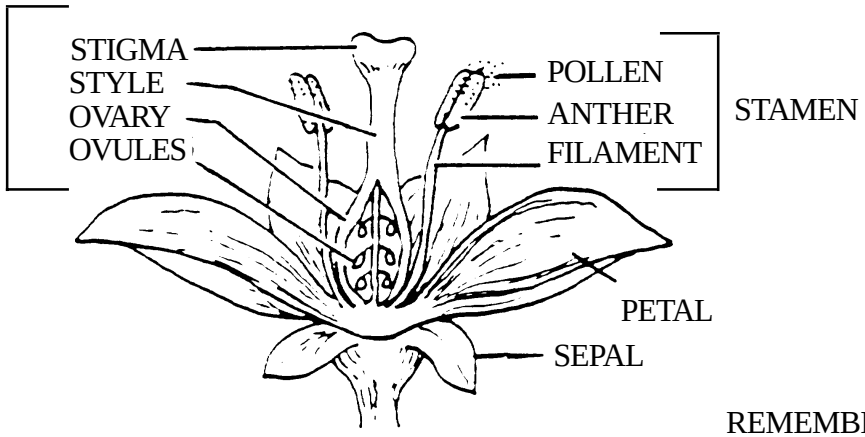
LET'S LEARN - HOW FLOWERS ARE POLLINATED

In Lesson IV you reamed about flower parts and the different kinds of flowering systems of plants. What is the most important function or job of a flower?? Do you remember the answer from Lesson III?? The main function of the flower is pollination so fruit can grow and other plants can be produced from its seed.

WHAT HAPPENS DURING POLLINATION?



Pollen is released by the anther and it must get to the stigma. (It is most often moved by wind or insects).



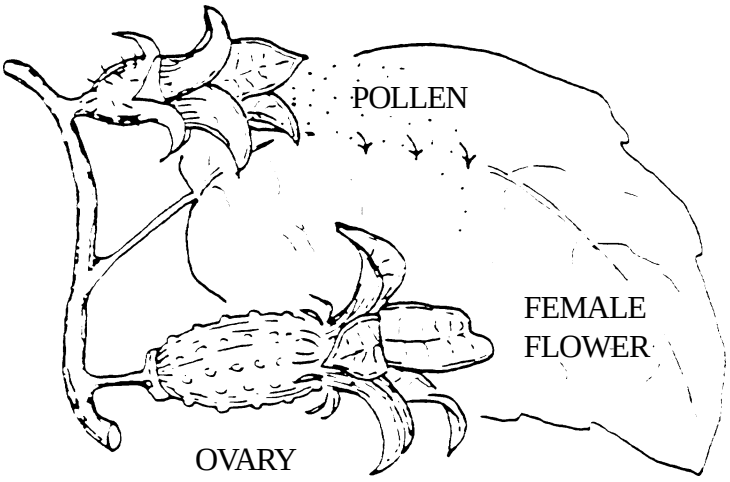
A COMPLETE FLOWER

REMEMBER

In complete flowers the stigma and anther are on the same flower

SOME PLANTS HAVE MALE AND FEMALE FLOWERS SEPARATE -
BUT ON THE SAME PLANT

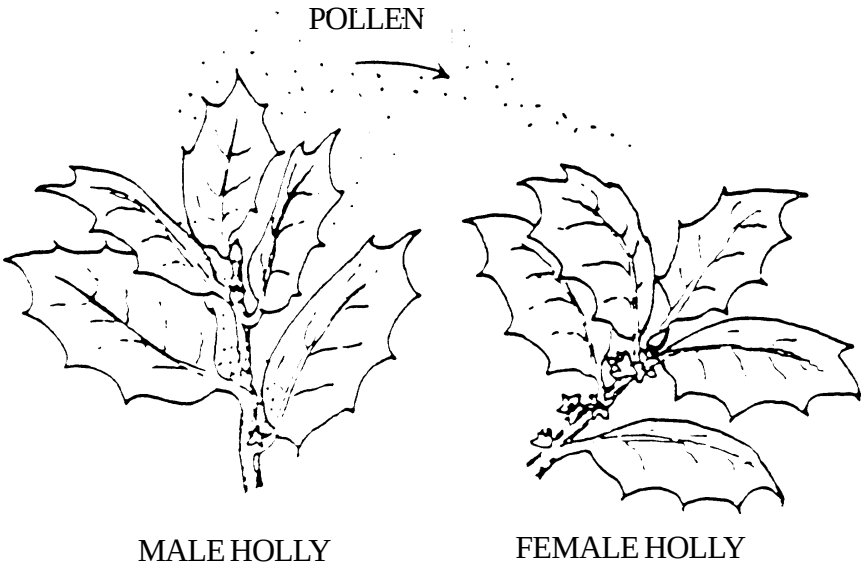
MALE FLOWER



In this case the pollen must be moved from the male flower to the female flower. This may be done by bees, wire, and water, etc.

An example of this is the cucumber flower.

SOME PLANTS HAVE MALE AND FEMALE FLOWERS ON DIFFERENT PLANTS

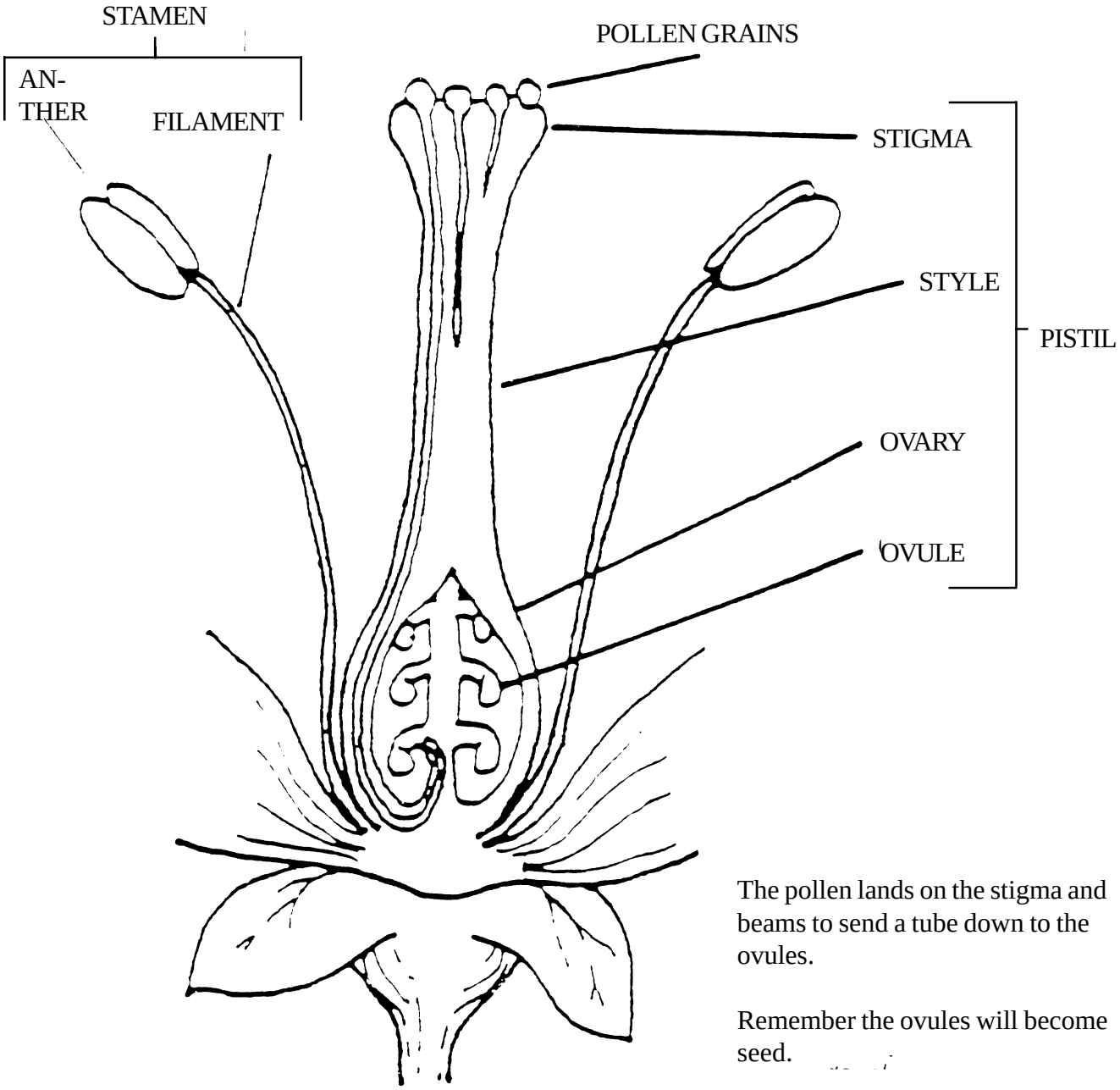


In this case the pollen must be moved from the flowers on the male plant to the flowers on the female plant.

An example of this is the holly plant.

NOW!!

WHAT HAPPENS WHEN THE POLLEN GOES TO THE STIGMA OR FEMALE PART OF THE FLOWER?



The pollen lands on the stigma and beams to send a tube down to the ovules.

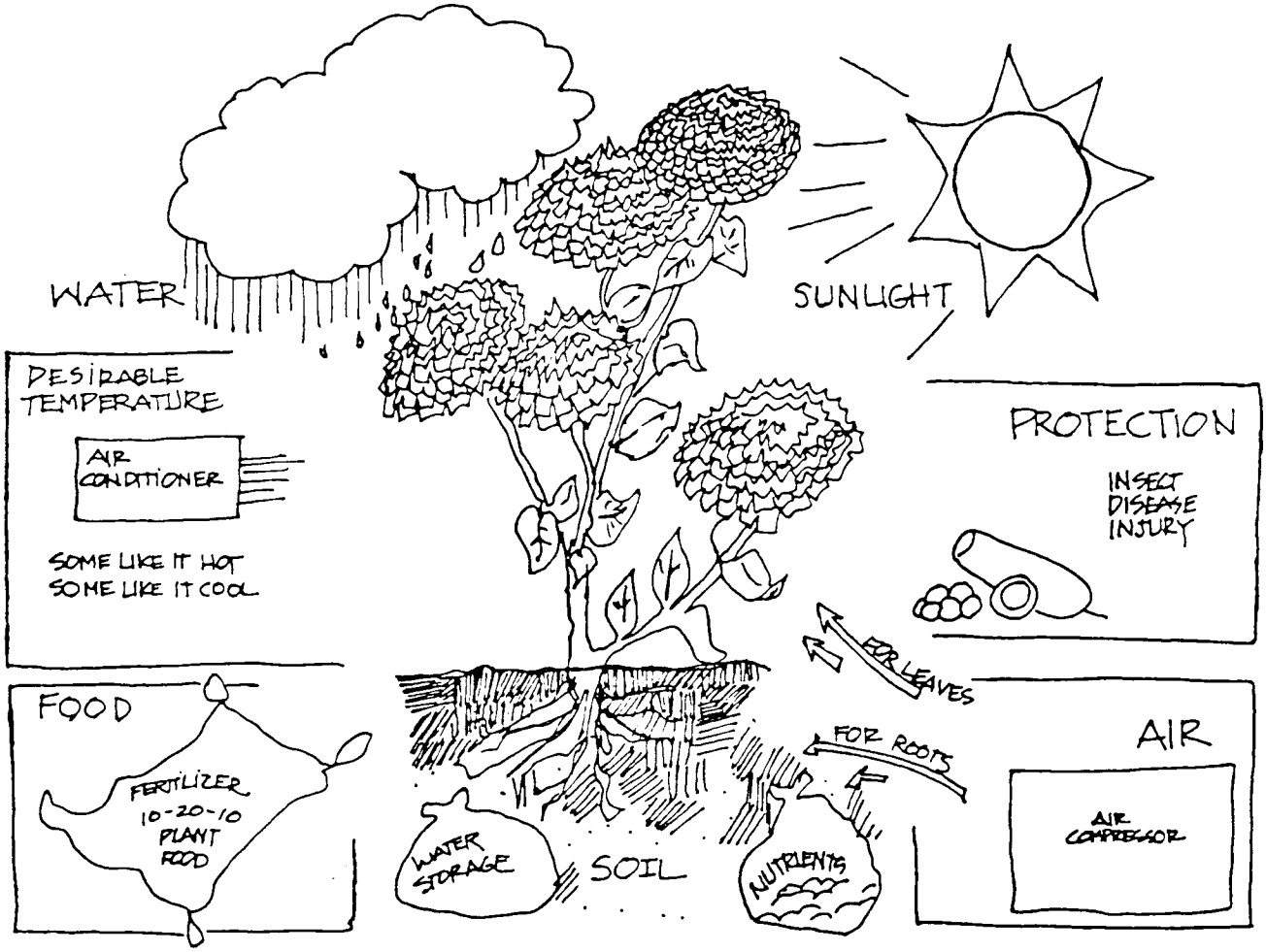
Remember the ovules will become seed.

When this tube reaches the ovule it is fertilized and the ovary begins to develop into a fruit and the ovules develop into seeds.

LESSON VI

WHAT PLANTS NEED TO GROW

Plants need several things to allow them to grow. How many can you name without looking below?



WATER -- Water dissolves and transports minerals to different plant parts. It is also used in food manufacture and in regulating the temperature of the plant. Water circulates through the plant and evaporates from the leaves. This protects the plant from rapid changes in temperature.

AIR -- Air contains oxygen, carbon dioxide, and nitrogen All are very important to plant growth. Oxygen is important for many things that happen such as helping the plant use nitrogen from the soil. Plant roots cannot grow in a soil without any oxygen. Leaves must also have air in order to manufacture food.

FOOD -- In order to grow, plants must have regular supply of food. Through the process called photosynthesis, the plant manufactures food. In order for it to do this, the plant must have light, water, carbon dioxide, and nutrients. Many of the nutrients needed by plants are supplied by adding fertilizer to the soil.

LIGHT — Is the energy plants use to make food. The green color in leaves, called chlorophyll, takes up light. With the help of water, nutrients, and carbon dioxide from the air, leaves change light energy to sugars and starches. This is called photosynthesis. You will learn more about it later. These sugars and starches are then changed to fats and proteins.

Sunlight is the best source of this light. However, plants can be grown under electric lights in the home.

In addition to light, most plants need a dark period each day. For example, soybeans will not produce seed without a period of dark each day. There are many flowers that will not bloom until fall when nights get longer and days get shorter.

TEMPERATURE — Some plants like cool temperatures to grow while others like warm temperatures. Some plants will not live in areas where winter temperatures get below freezing while others must have cool weather to grow well. At cooler temperatures, chemical reactions in the soil become slower and the plant may go through a rest period until temperatures get warmer. Some plants require this rest period in order to grow the next year.

PROTECTION — In order to grow well, plants must be protected from insects, disease, and injury from man. They must also be protected from weeds that use their water and fertilizers intended for the crop. Many plants must also be protected from bad weather. This is the reason many crops are not planted until warm weather in the spring. It is also why greenhouses are used to grow plants.

SOIL — Is not necessary for all plants to grow. Mistletoe is a plant that lives on other plants. It grows in trees and takes its nutrients from them. Another example is water plants that live without soil.

However, we normally consider soil as a requirement for plant growth.

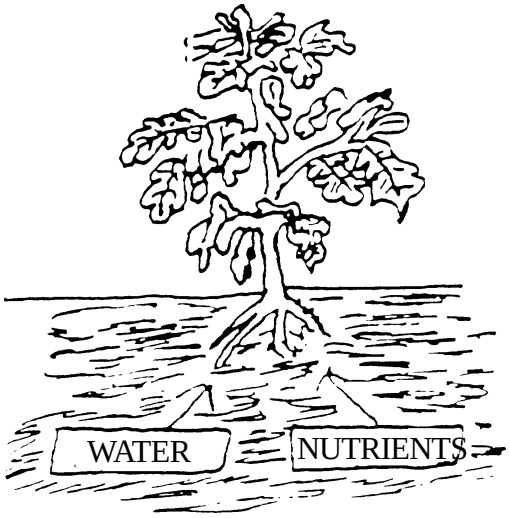
WHY IS SOIL IMPORTANT

Because:

1. It contains the minerals which supply the food plants needed to grow.

2. It is a storage place for much of the water plants use.

3. Soil provides support for plants; it holds them in place.



Not only is soil important, but the kind of soil you have helps determine the kind of crops you can grow.

Some plants will not grow well if the soil contains too much clay while others do not grow well in very sandy soils.

SOIL TEXTURE

When we talk about sandy soils or clay soils, we are talking about soil texture. Soil texture refers to the amounts of different sized particles. Sand is large soil particles and clay is small soil particles. Silt is made up of those particles between sand and clay.

MORE ABOUT SAND, SILT, AND CLAY

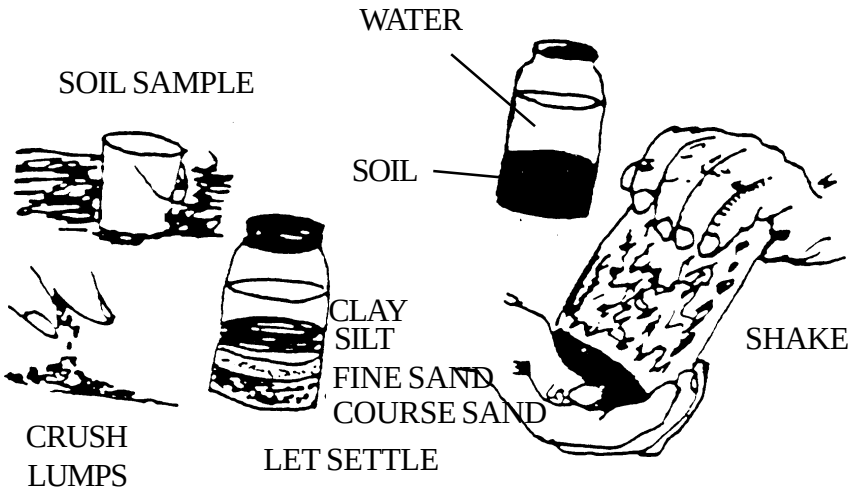
SAND - Is the largest particles of soil. When rubbed between the thumb and finger, it feels rough and gritty. This is because the large particles have sharp edges on them. Soils with a large amount of sand in them are called “light-textured” soils.

SILT - Is soil with particle sizes between those of sand and clay. These particles feel smooth and powdery. When wet, it still feels smooth but not slick or sticky. If silt is rolled between the fingers, it will break up before a long ribbon can be formed.

CLAY - The smallest soil particles are called clay. When dry, clay feels smooth, but when wet it becomes sticky. When wet clay is rubbed between the thumb and finger, a long ribbon can be formed before it breaks apart. Soils high in clay are called “heavy textured” soils.

AN ACTIVITY

<u>SEPARATE SAND, SILT, AND CLAY OF SOILS</u>



1. Get a quart of soil from the garden, flower bed, or field.
2. Let the soil dry. Crush lumps between your thumb and finger as the soil dries.
3. Remove trash, rocks, and roots.
4. Fill a quart jar 1/4 full
5. Add water until the jar is 3/4 full.
6. Add a tablespoon of nonfoamy detergent.
7. Close the lid and shake hard for about three minutes. Keep shaking until particles are separated from each other.

TRY TO ANSWER THESE QUESTIONS

How long did it take for each fraction to settle to the bottom?

Clay_____,

silt_____,

fine sand _____,

coarse sand _____.

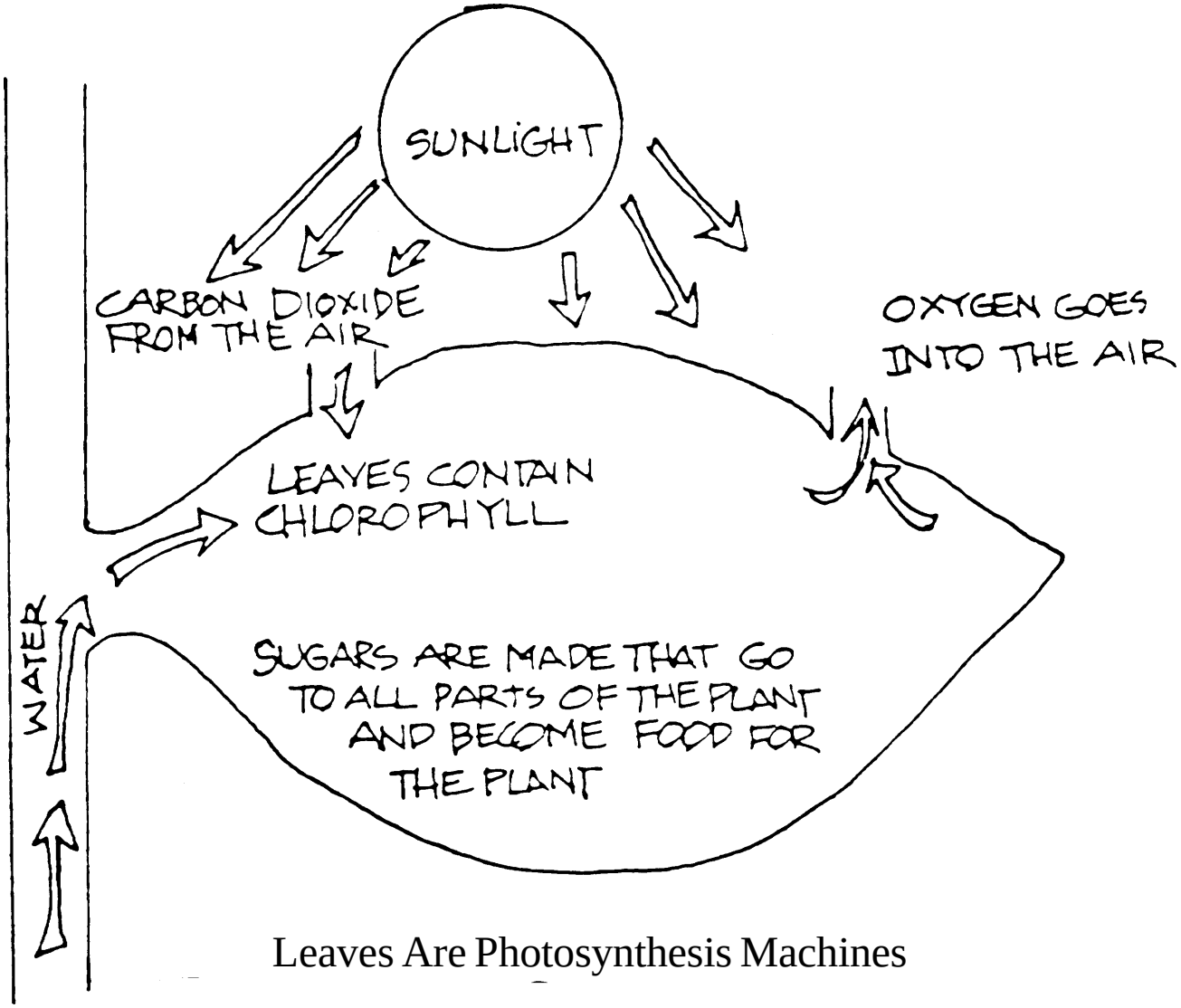
8. Set the jar on the table and watch very closely for a few minutes. Write down what you see happening.
9. Do not disturb the jar for two days.
10. Place a card alongside the jar. Mark off the depth of the clay, silt, fine sand and coarse sand. Label your card for each layer.
11. Fasten the card to the jar with tape as shown in the illustration.

LESSON VII

HOW PLANTS MAKE THEIR FOOD (PHOTOSYNTHESIS)

Plants use a process called photosynthesis to make their food. The feat uses water that comes through the roots and carbon dioxide it takes from the air. With the help of chlorophyll (the green color in leaves) and sunlight, the leaf makes sugars and oxygen. The sugars move to all parts of the plant and become food for the plant.

The diagram below will help show how it works.



Leaves Are Photosynthesis Machines

Some plants store sugars and starches which are used for human food A good example of this is potatoes.

LESSON VIII

PLANTS FOR FOOD

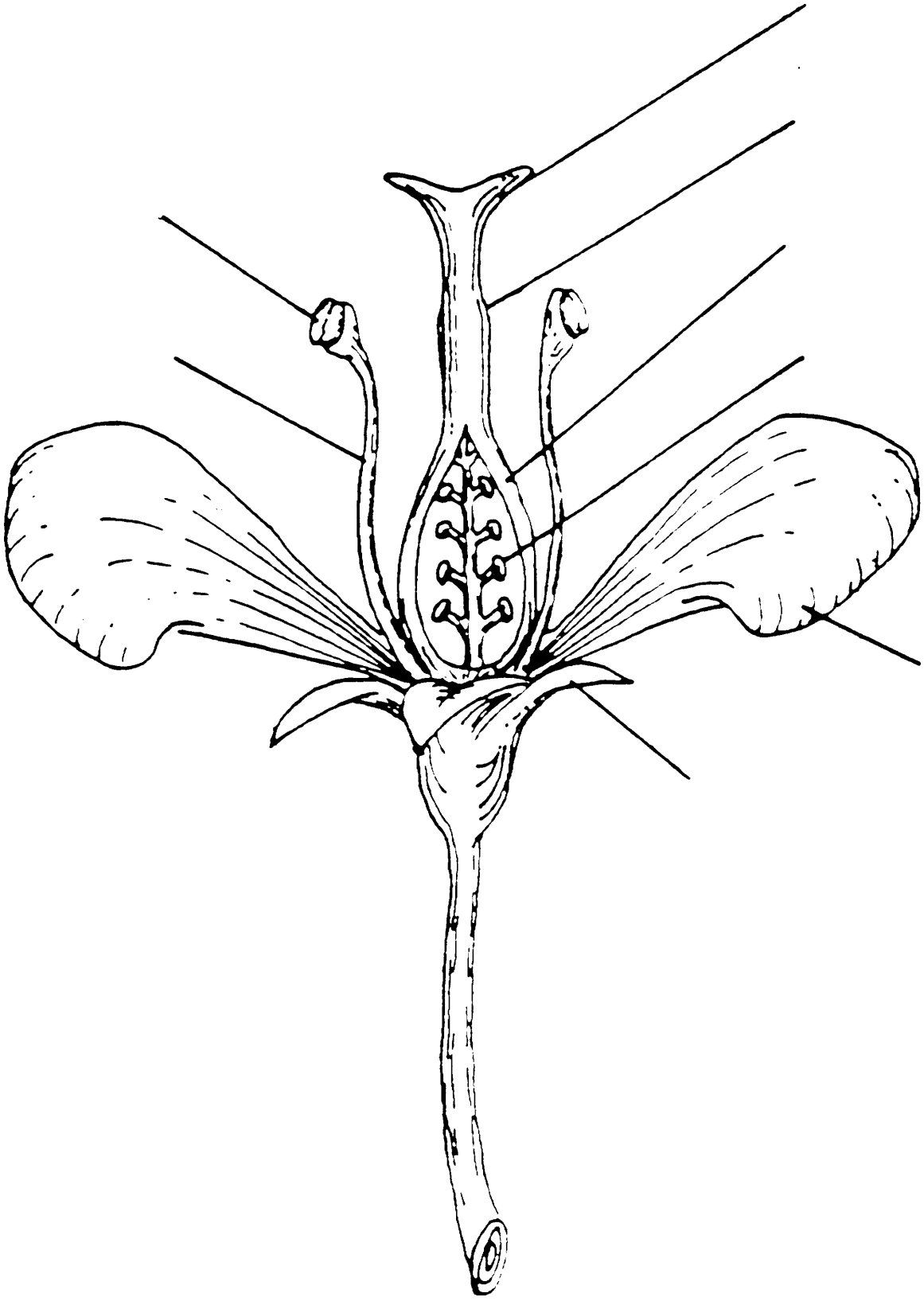
Plants provide us with much of the food we eat. Different parts of plants are eaten for food.

We eat the SEED of some plants	PECAN PEAS BEANS CORN
only the flesh COVERING of the SEED on some	PEACHES APPLES PEARS GRAPES
the LEAF of others	LETTUCE CABBAGE SPINACH
and on others me ROOTS	RADISHES TURNIPS BEETS CARROTS SWEET POTATOES
and we even eat the FLOWER on	BROCCOLI CAULIFLOWER
or the STEM of	ASPARAGUS
also some foods are prepared from the JUICES of the FRUIT or other parts of the plant	JELLY DRINKS
many products made from field crop plants are used for food	FLOUR FROM WHEAT MEAL FROM CORN OILS FROM PEANUTS & COTTONSEED
many plants and plant part are made into drugs, medicines, and seasonings	SAGE DILL SPEARMINT BASIL DIGITALIS PEPPER

REMEMBER!!

THERE ARE SOME PLANTS AND PLANT PARTS THAT ARE POISONOUS AND SHOULD NOT BE USED FOR FOOD.

PARTS OF A COMPLETE FLOWER



AN ACTIVITY

Keep a record of the foods you eat for a week and see what parts of different plants you eat.

Here are some tips:

Flour is made from wheat seed.
Potatoes are underground stems.
Check mom's spice shelf - some are made from leaves, some from stems, etc.

Black pepper is ground seed.
Read the lable on food containers.

Name of Food	Part of Plant It Comes From	Name of Food	Part of Plant It Comes From

FOOD PLANT SCRAMBLE

There are names of food plants hidden in this scramble. Find these names and circle them.

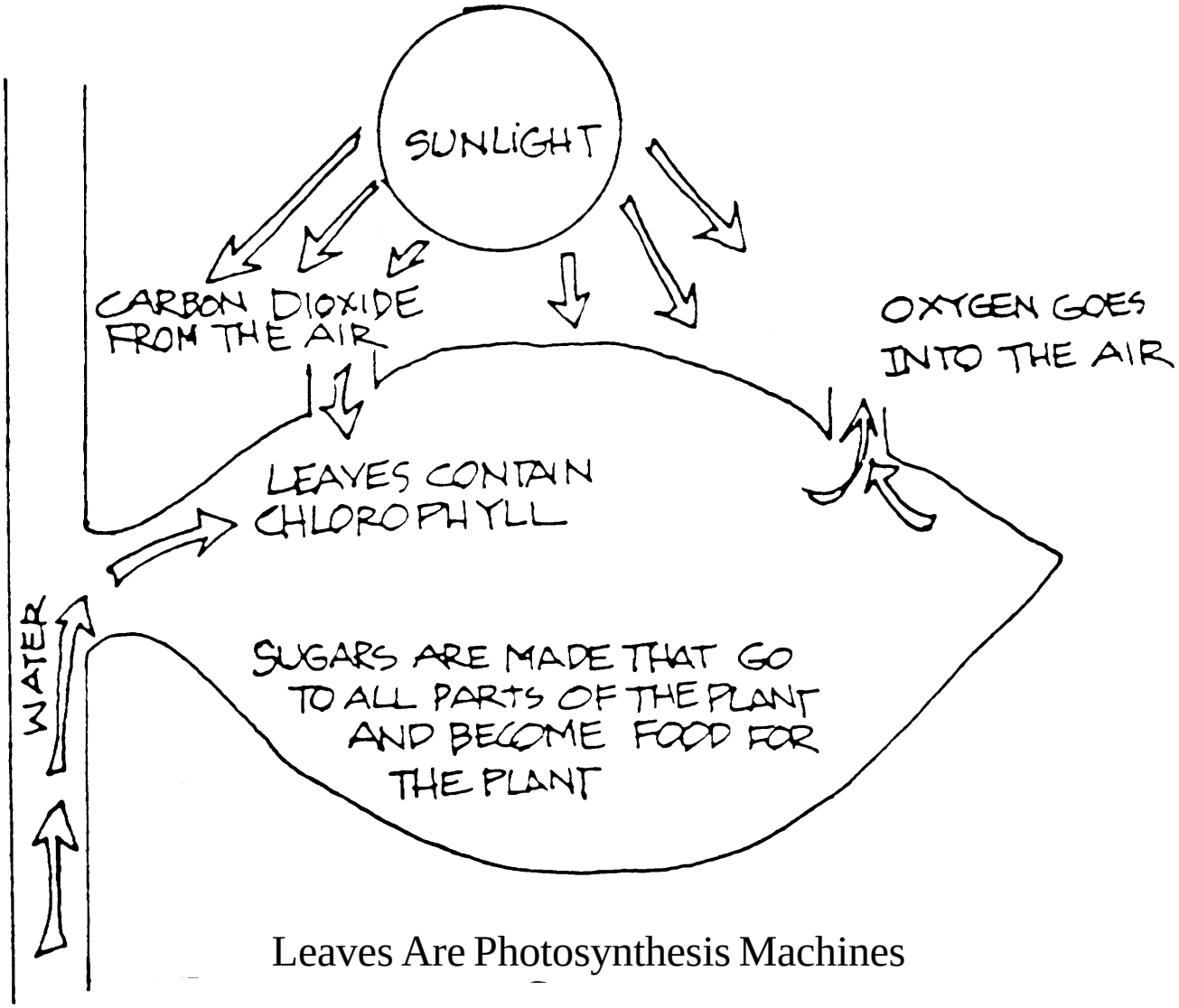
Some are straight across and some are straight down. The circles may overlap.

Can you find names of all these plants?

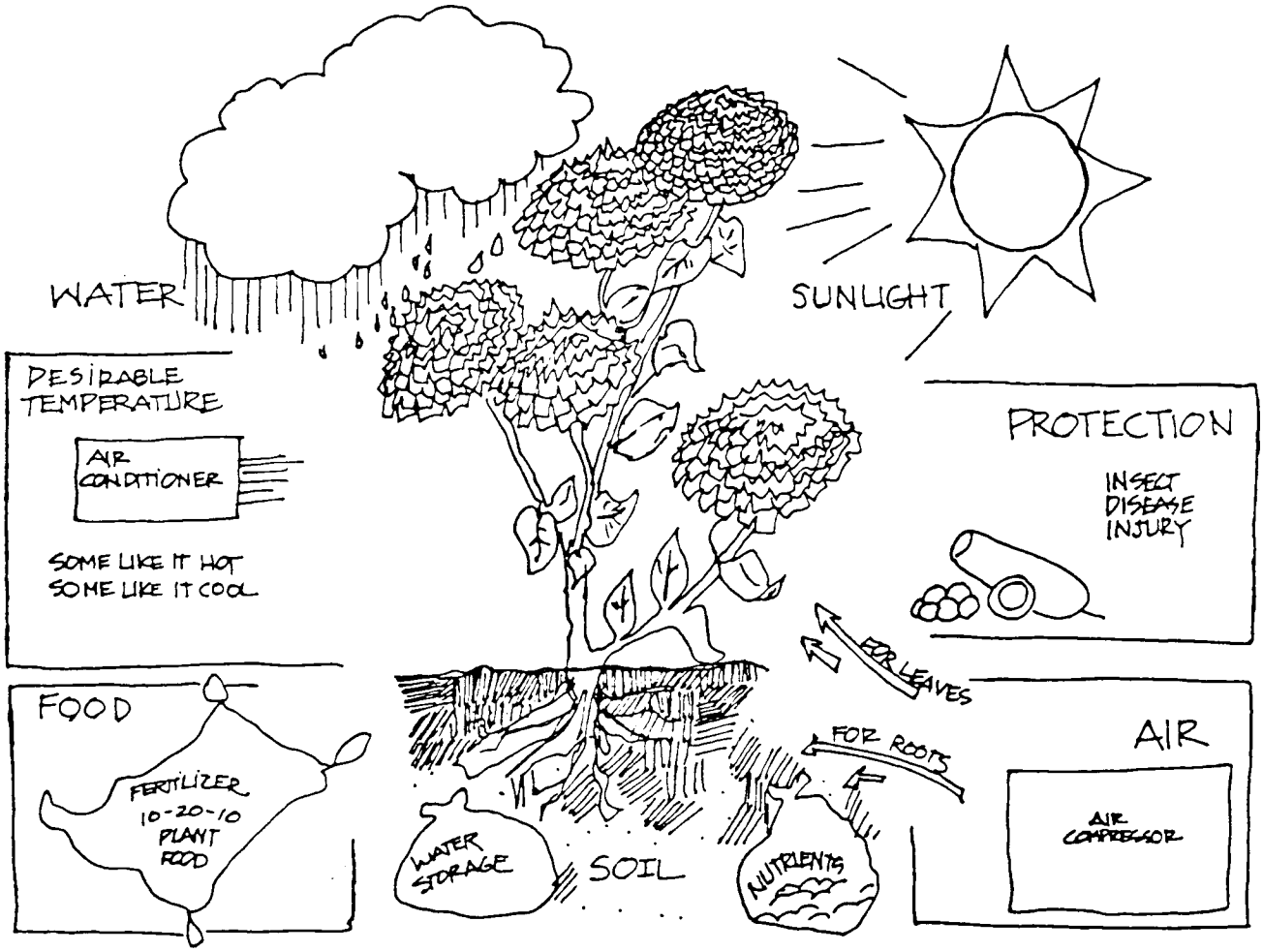
POTATO
APPLE
PEAS
WHEAT
TOMATO
BEAN
OATS
CORN

P	O	T	A	T	O	Z	O	K	L	Y
X	C	V	D	O	A	P	P	L	E	C
A	A	I	X	N	T	Y	Z	T	S	Z
T	Y	P	E	A	S	S	A	N	G	D
Y	B	Z	A	Y	X	C	O	R	N	D
L	B	W	H	E	A	T	I	Y	O	X
Z	N	Y	L	C	S	T	B	A	B	A
T	O	M	A	T	O	X	E	T	I	L
O	Z	L	A	Y	T	R	S	Q	T	U
B	E	A	N	M	X	E	I	O	N	Z

HOW PLANTS MAKE THEIR FOOD



Leaves Are Photosynthesis Machines



WHAT PLANTS NEED TO GROW