

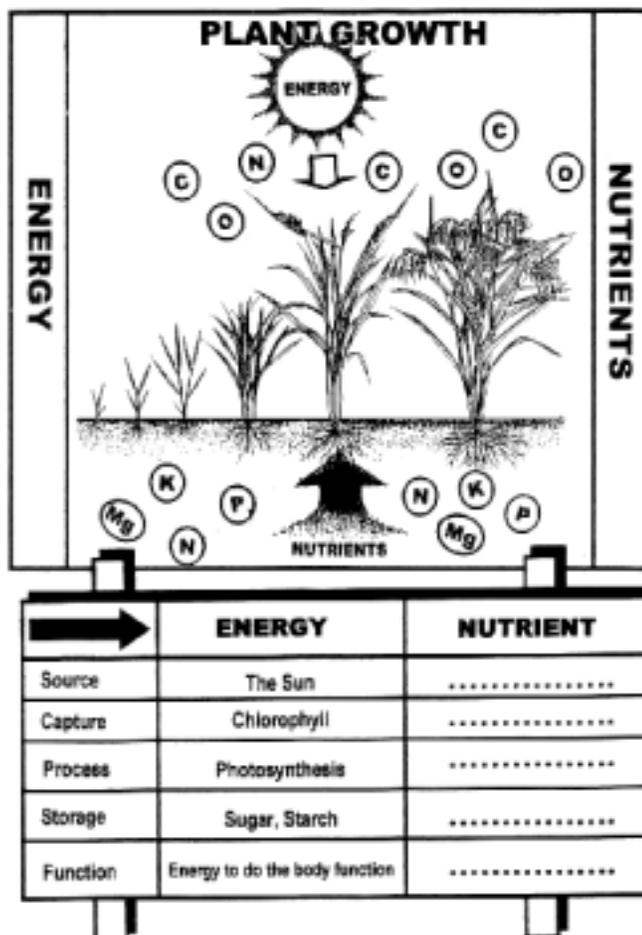


PLANT GROWTH, ENERGY, AND NUTRIENTS

Background

All living organisms need energy to do the work of growth and development. We can feel the heat from the sun. But only plants have developed the ability to capture and store this energy from the sun. All other creatures depend, either directly or indirectly on plants for this reason. Plants capture energy and then store it in the form of energy-rich molecules like sugars and starches.

In addition to energy, living organisms require input of matter to maintain their life functions. The matter in the form of nutrients containing a variety of important molecules for life is used to build cells and tissues and even more complex organic molecules, like hormones, required for cell and body functioning.



Objective

We should be able to explain the relationship among growth, development, energy and nutrients.

Time: 120 minutes

Materials: Rice plant, cricket, bamboo, black cloth, pot, box, large papers, pen.

Procedures

□ Preparation

Start with an open discussion about ;

- What is characteristic of living organisms?
- What is the meaning of growth and development
- What is the living organism need to growth and develop?
- Where does energy for life on earth come from?

□ Action

- Grow a rice plant in the pot and cover with the black cloth (make it look like a insect zoo)
- Rear a cricket in the box (plastic jar); give some dry leaves for food and then cover with the black cloth.
- Wait two days and observe the rice plant and cricket. What has happened to the rice plant and what has happened to the cricket?
- Discuss in small group about source, capturer, process, storage and function of energy and nutrient (the format see example below)

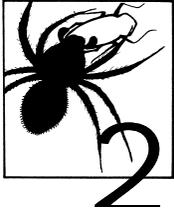
	ENERGY	NUTRIENT
➤ Source
➤ Capturer
➤ Process
➤ Storage
➤ Function

□ Discussion

- Why can only plants capture energy from the sun?
- How about other living organisms?
- What is the function of energy to plant growth?
- What is the function of nutrient to plant growth?

□ Follow up

- Observe and compare texture of plant leaves that grow in an open place and in shadowed place.



PHOTOSYNTHESIS - ENERGY FLOW - NUTRIENT CYCLES

Background

We have started that energy comes from the sun and that only plants have developed the ability to capture and store this energy. The process whereby energy from the sun is captured and converted to sugar is called "*PHOTOSYNTHESIS*".



Energy flow in one direction only through ecosystems from the sun to producers (plants) to consumers (animals that eat plants or animals that eat other animals). At each subsequent stage (Trophic level), some energy is captured through feeding, some is lost through waste and some is lost as heat and respiration. Finally, when a plant or animal dies that has not been eaten by a higher trophic level, its body goes into the soil and becomes part of a pool of energy stored in dead organic matter.

In contrast to the one way flow of energy in ecosystems, nutrients move in cycle through the biotic (living) components of an ecosystem to the abiotic (non-living) components, back again to the biotic and so forth.

Objective

We should be able to understand the photosynthesis process, energy flow and nutrient cycles

Time: 120 minutes

Material: Rice plant, plastic glass, food coloring, large papers, pen

Procedures

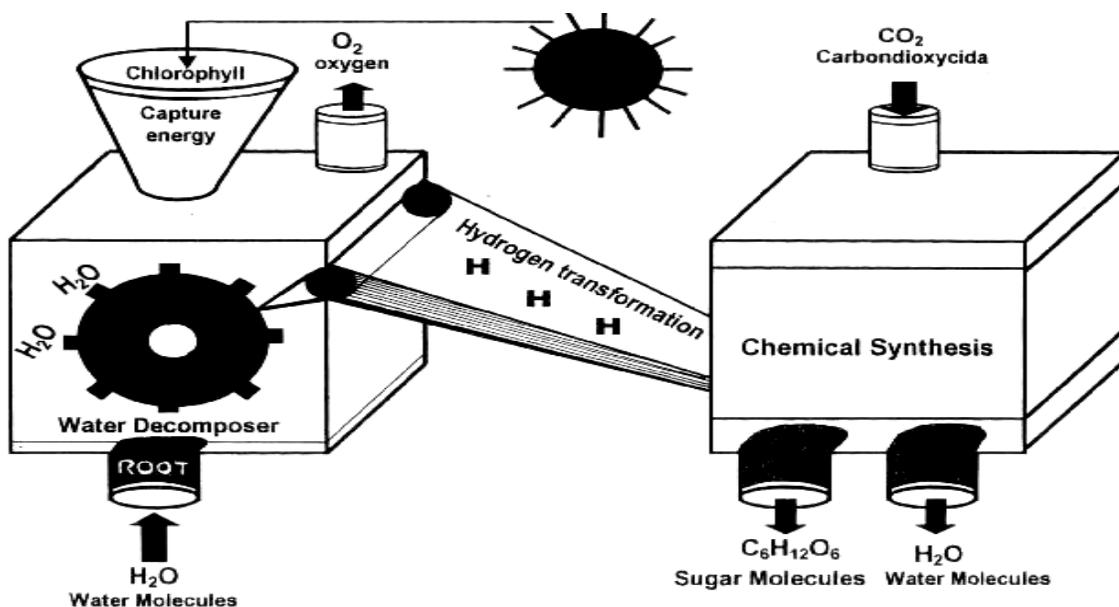
□ Preparation

Start with an open discussion about;

- The photosynthesis process
- What is the meaning of energy flow?
- What is the meaning of nutrient cycle?

□ Action

- Add water to the plastic glass and place several drops of food coloring. In the water should be dark red.
- Put sand in another plastic glass and place a rice plant with root and stems in the sand. Set it in open place.
- Wait three hours and observe the rice plant. What has happened to the color of the leaves? How has the red coloring moved in the rice plant?
- While we are waiting, discuss in small groups about the energy flow and nutrient cycle.
- Try to draw an energy flow and nutrient cycle diagram for the village. Try to be general, but as complete as possible. For example ;
 - Make a pattern of energy flow between electric source, lamp, egg and chicken
 - Make a pattern of nutrient cycle between soil, grass, cow, grass roots, cowdung.
- Draw a photosynthesis mechanism through imagine the plant like machine that produces sugar (see illustration below).

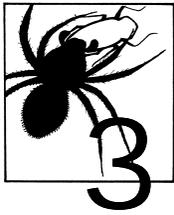


□ Discussion

- When a sheep or cow eats grass, what types of things does it take from the grass that is useful?
- What happens to dung in the soil?
- Does energy captured by the plant go on forever or does it eventually wind down to zero?
- What happens to the crop yield after harvest and what happens to the remainder of the plants after harvest?

□ Follow up

- Try to draw an energy flow and nutrient cycle diagram for rice ecosystem.



PLANT PARTS, FUNCTION, AND BIOMES

Background

Plant anatomy and the function is closely related. Every plant has a unique nutritional process. The composition, texture and function of each principal part of the plant contributor to this process. The chlorophyll within leaves and green stems captures energy from the sun, roots take nutrients from soil and vessel transport water and nutrient to all body of plant.

This the physiological process creates energy and nutrients that help the plant to grow. The body of the plant stores energy and nutrient so that the plant can grow to be bigger and bigger body. All body of the plant still has energy and nutrients up to harvesting. But is not all part of plant are consumed by humans.



Objective

We should be able to promote discussion on the general topic of plant nutrition and the composition, texture and function of each principal part of the plant.

Times : 120 minutes

Materials: Rice plant, soybean plant, large papers, pen

Procedures

□ Preparation

Start with an open discussion about ;

- The physical parts of the plants?
- The function of each part?
- What is the meaning of biomes?

□ Action

- Collect a rice and a soybean plant that are almost ready to harvest.
- Take a representative specimen of the plant and do an initial drawing.
- Decide on what constitutes the principle sections or components of the plant (roots, stems, leaves, panicles or fruits, etc) and then cut and separate them.
- Count the relative proportions for each parts of plant (if the entire plants is 100%)
- Discuss in small groups about functions of plant parts, proportion, texture etc. To get easy discussion we can follow the format (see illustration below).

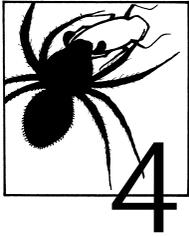
	Plant Parts	Textures	Proportions	Functions	Decompose Time
	Leaves				
	Stems				
	Panicles				
	Roots				

□ Discussion

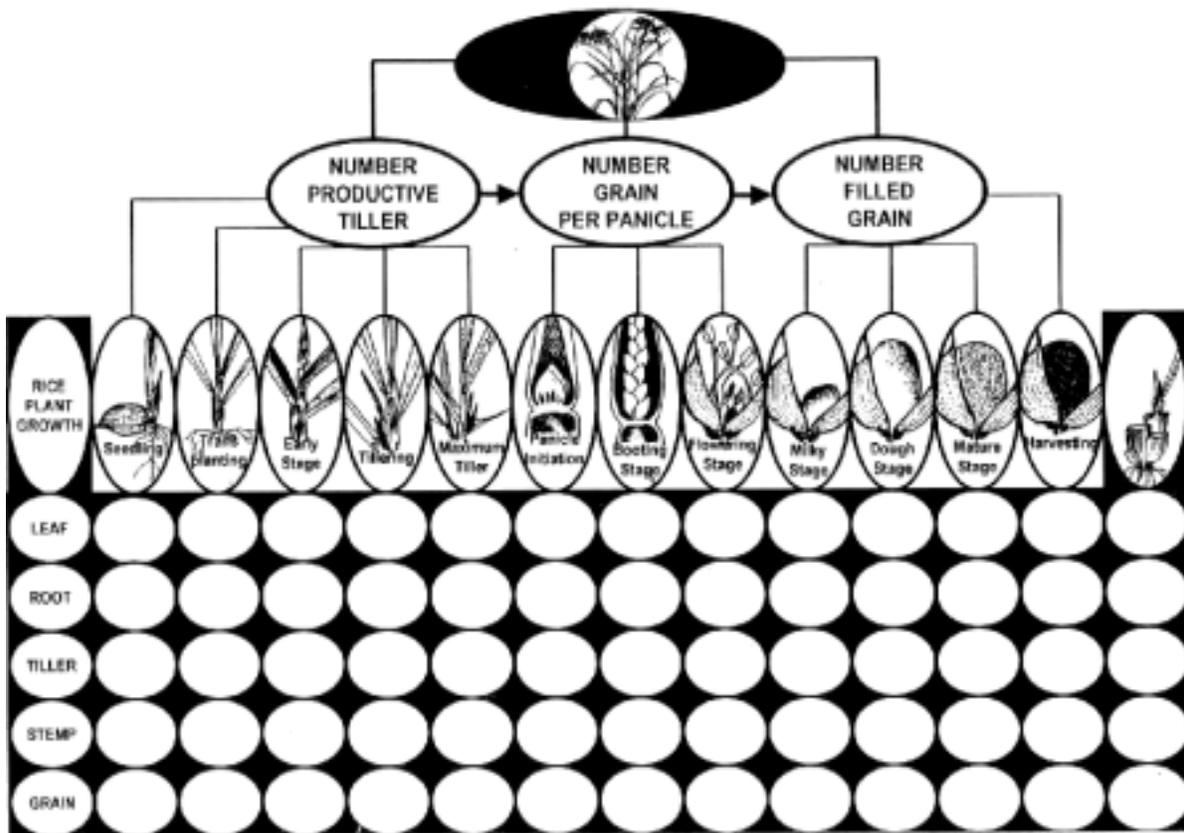
- What are the relative proportions for each section?
- What are the textures associated with each section? (fibrous, fleshy, starchy, etc)
- What are the functions of each section in regard to the life of the plant? (Capture energy, water and nutrient transport, structural, storage, reproductive, etc).
- How might the textures be related to the functions?
- What percent would we harvest from the plant?
- Which parts would decompose most quickly and which parts would take longer? Why?

□ Follow up

- Compare wet plant weight and dried plant weight or dried yield weight and dried plant weight.



RICE PLANT COMPENSATION IN RELATION TO GROWTH STAGE



Background

A fundamental aspect of rice IPM is *“Plant Compensation”*. When the rice plant is damaged by a pest, the rice plant can compensate for the damage in a number of ways so that it will not effect rice production. A healthy crop has a considerable ability to compensate for damage by pests. So it’s correct, the first principle of IPM is *“grow a healthy crop”*.

The capacity of a plant to compensate depends on the growth stage (vegetative phase has better compensation than generative phase), crop health and injury level (at vegetative phase, 30 % of rice plants leaves can be damaged without affecting rice production).

Objective

We should be able to explain how plant compensation works, how it is linked with each growth stage and why it is important to grow a healthy crop.

Times : 120 minutes

Materials: Rice plants (different stage), large papers, pen, ruler

Procedures

□ Preparation

Start with an open discussion about:

- How a plant responds to various types of damage by pests.
- The important physical components which determine overall rice production.
- The growth stages of rice and the potential for plant compensation in each stage in relation to the physical components of rice production discussed above.
- The physical parts of rice plant.

□ Action

Discuss in small groups about the compensation ability of each part of the rice plant at each growth stage. (See the format below.)

Rice plant part	Early stage	Tillering	Etc
Leaves
Roots
Tillers
Stems
Grains

□ Discussion

- How can the rice plant compensate if;
 - During Tillering stage, some tillers are damaged by pests?
 - During Booting stage, some leaves are damaged by pests?
 - During milky stage, some grains are damaged by pests?
- What is the meaning of plant compensation? Which growth stages have less capacity to compensate for damage? What can we do to ensure that rice plants have good compensation ability?

□ Follow up

Continue to observe the anatomy of rice plants at each stage.