

Tech Study

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REVISION NOTES

CLASS – VII

BIOLOGY

NUTRITION IN PLANT

- Living organisms such as plants and animals survive on food.
- The food gives them the energy to perform several activities in their life and helps in the growth.
- Nutrients - Certain substances are present in the foods that help in the survival of the organisms. These special substances are called nutrients for example, proteins, carbohydrates, fats, vitamins, minerals, water and roughage.
- Some living organisms like green plants synthesize their food by themselves while others such as animals depend upon the plants and other animals for their food. The mode of nutrition in which organisms make food themselves from simple substances is called autotrophic nutrition (auto = autotrophic self; trophos = nourishment). Therefore, plants are called autotrophs. Animals and most other organisms like bacteria and fungi take in ready made food prepared by the plants. They are called heterotrophs (heteros = other, trophos = nourishment).

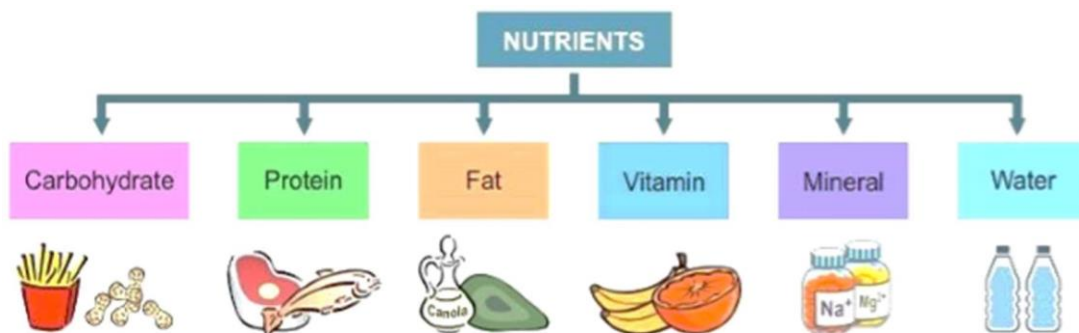


Figure: Different Nutrients

Mode of Nutrition in Plants

Definition of Nutrition: Nutrition can be defined as a process by which organisms take in the food and utilize it in order to survive. Based on the mode of nutrition organisms can be divided into two categories:

- Autotrophic Organisms - They can prepare their food by themselves such as green plants, algae and Cyanobacteria.

- Heterotrophic Organisms - They depend upon other organisms for their food such as animals, fungi, bacteria and non-green plants

FOOD PREPARATION BY PLANTS

How do plants prepare their food?

Plants prepare their food with the help of certain raw materials (inorganic) that they obtain from their surroundings like from soil and air. These raw materials are:

- Water and minerals
- carbon dioxide
- sunlight
- chlorophyll

Plants convert carbon dioxide and water into simple carbohydrates in the presence of sunlight and chlorophyll. The process by which plants prepare their food (carbohydrates) by using these raw materials is called Photosynthesis. Carbohydrates are made up of carbon, oxygen and hydrogen.

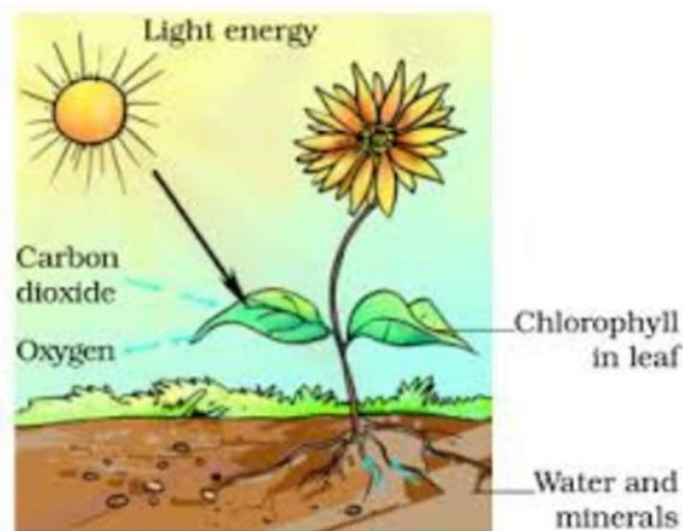


Figure: Photosynthesis

Site of photosynthesis in green plants:

- Leaves are also known as the Food Factories of the plants as they are the places where food is prepared.
- Different parts of the plants like roots absorb the raw materials from the soil and then transfer them to the leaves where photosynthesis takes place.
- Transportation of water and Minerals and food in plants - The roots of the plants absorb water and minerals from the soil by osmosis and then transport them to the leaves via stems and branches. Through xylem, water and minerals are conducted through out the plant parts. Through phloem plants translocate food from leaves to various parts of the plants.

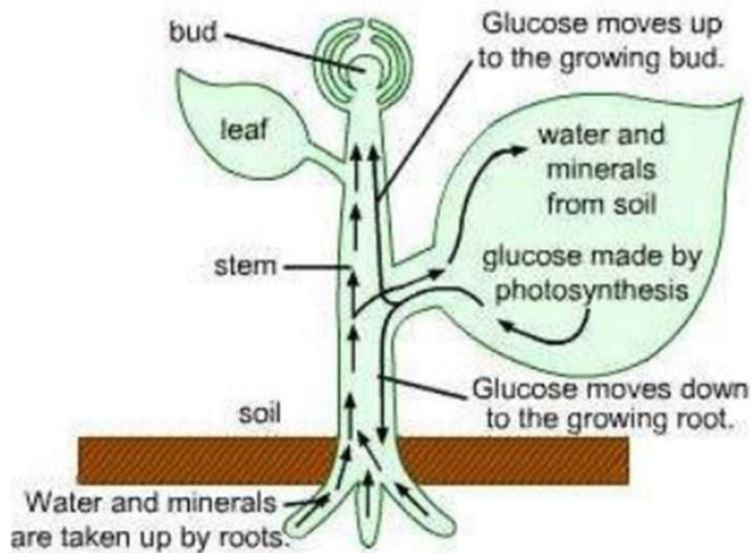


Figure: Transportation of water and Minerals and carbohydrates in plants

- Intake of Carbon Dioxide - There are tiny holes or pores present on the surface of the leaves called Stomata that take in the carbon dioxide present in the atmosphere and release out oxygen and excess water as water vapor(transpiration) by diffusion .Thus, stomata help in gaseous exchange and transpiration.

Each stomata is surrounded by at least two guard cells that regulate their opening and closing throughout the day in land plants except desert plants. In desert plants stomata open during night.

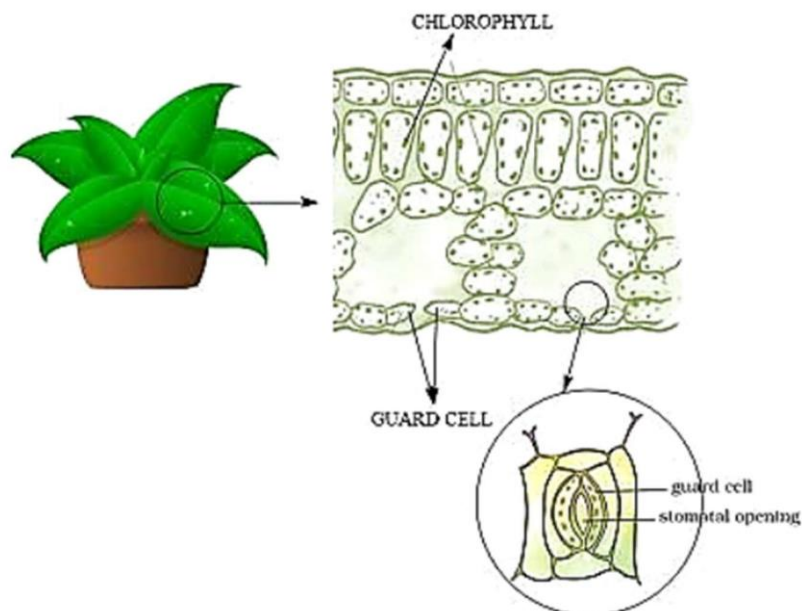


Figure: Stomata on leaves and the Chlorophyll in cells of leaves

- Stomata are found on young stem and young branches too. These are not found in roots.
- Presences of Chlorophyll in the Leaves - A pigment called Chlorophyll is present in the leaves of the plants. The chlorophyll not only provides green colour to the leaves but also helps in the process of photosynthesis. Chlorophyll captures the sunlight and generate ATPs .These ATPs are energy

providing molecules in cells ,hence plants use this energy to convert available raw materials(carbon dioxide and water)into food ,in the leaves.

You should remember that all the green parts of the plants have chlorophyll like stem and branches of herbaceous plants(e.g.tomato plant, mustard plant etc.) ,raw fruits that are green in colour.

- This process of photosynthesis only occurs in the daytime in the presence of Sunlight hence it is called Photosynthesis, 'photo' means light.

Opening and Closing of Stomata

The opening and closing depends upon the turgor pressure in the guard cells. The swelling of guard cells due to absorption of water causes opening of stomatal pores while shrinking of guard cells closes the pores. Opening and closing of stomata occurs due to turgor changes in guard cells.

What is turgor pressure?

It is the pressure that is exerted by water to the wall of a cell. Think of a balloon that is being filled up with water as a turgor pressure example. The balloon swells as more water draws in. The pressure that the water exerts against the walls of the balloon is similar to the turgor pressure exerted against the wall.

Why sun is called the ultimate source of energy for all living organisms?

We know that the plants use solar energy in the process of photosynthesis to make their food. The herbivores animals depend upon the plants for their food. Animals (carnivores) that do not eat plants depend upon the herbivores animals. Omnivores consume both plants and animals as food. Therefore, all of the living organisms directly or indirectly receive their energy from the Sun.

Cells in Living Organisms

All living organisms are made up of tiny structures called cells. Some organisms (microscopic) contains only one cell e.g.bacteria , Amoeba, Chlamydomonas while others plants and animals contain many cells of different kinds. Parts of a cell are:

- The Nucleus - Every cell has a nucleus present in the centre that performs various functions of the cell. It is spherical in shape and can be nick named as brain of the cell because it controls and regulates the functioning of cell.
- The Cell Membrane - Every cell has an outer boundary made up of lipids and proteins. It is flexible in nature and protects the cell, called the Cell Membrane. This membrane regulates the entry and exit of substances , within and out of the cell, because of this feature it is called selectively permeable membrane.
- The cytoplasm - Every cell has a gel-like structure present in it called the Cytoplasm. In cytoplasm all the cell organelles are found floating.
- Cell organelles: These are membrane bound structures found within a cell in the cytoplasm. The cell organelles have special function associated with them. Main cell organelles found in the cell are:
 - Mitochondria – Produces energy for the cell so are called power house of cell.

- o Endoplasmic Reticulum – These are of two types. Rough Endoplasmic Reticulum(RER) and Smooth Endoplasmic Reticulum(SER) which produce proteins and lipids in cell in the cells respectively.
- o Golgi apparatus – Helps in processing the materials produced by Endoplasmic Reticulum and export them out of cell as well as are used within the cell also.
- o Lysosomes – These are small spherical structures produced by Golgi Bodies and are filled with enzymes. These work in different ways, help in digesting worn out cell organelles or even worn out cells so, are called suicidal bags . Also kill harmful substances found inside the cells so, are named as digestive bags.
- o Chloroplast- These cell organelles are found in plant cells .Later in the chapter you will study its structure.
- o Cell wall- It is a rigid layer found outside the cell membrane in plant, bacterial and fungal cells only. It is not found in animal cells. In plant cells it is chiefly composed of cellulose.

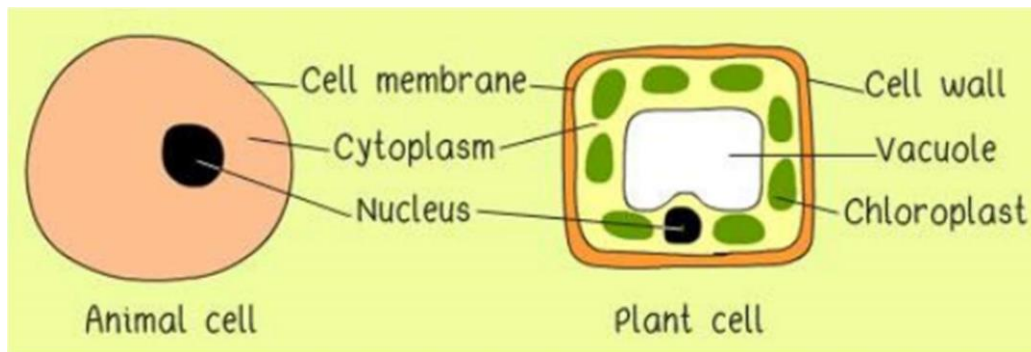


Figure 5: Structure of Cell in Animals and Plants

Can photosynthesis take place in other parts of the plant?

Yes, green stems and branches of the plants can also undergo the process of photosynthesis. For example, plants in the desert area like cactus do not have leaves but they still exist there because their stem produces the food for the plant.

You must know that in cactus(like Opuntia) leaves convert into spines to prevent water loss ,now these spines cannot do photosynthesis so the stem modifies into flat ,green, leaf like structure . This stem performs photosynthesis and the cacti are able to survive in the absence of leaves.

Why is the process of photosynthesis important?

- There will be no food if the plants would stop conducting the photosynthesis process.
- The plants take in carbon dioxide and produce oxygen during the process of photosynthesis. Thus, plants help in maintaining oxygen and carbon dioxide level in the environment.
- In the absence of photosynthesis there would not be any plants. The survival of almost all living organisms directly or indirectly depends upon the food made by the plants. Besides, oxygen which is essential for the survival of all living organisms is produced during photosynthesis. In the absence of photosynthesis, life would be impossible on the earth.

Production of Oxygen and Carbohydrates by the Plants

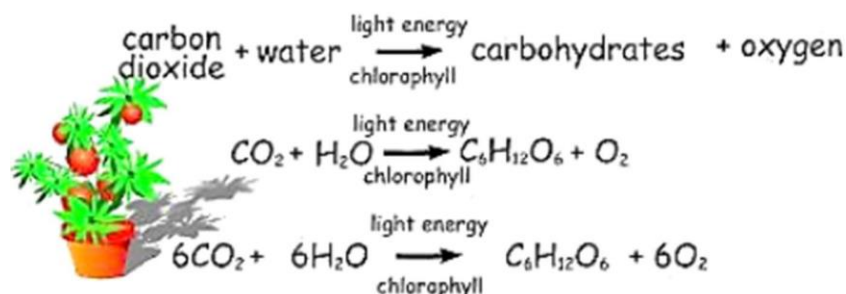
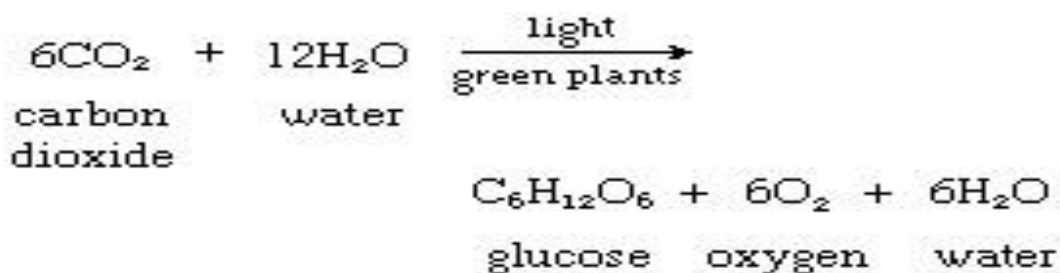


Figure : Production of Oxygen and Carbohydrates

Plants use carbon dioxide and water in presence of the sunlight and chlorophyll to produce chiefly carbohydrates and oxygen which is also released is called the by- product of photosynthesis. The carbohydrates thus produced by the plants are converted into starch.



Balanced chemical equation of photosynthesis can be written as given above because plants release lots of excess water in vapour state hence, along with oxygen , water vapour is also released in the atmosphere during photosynthesis.

□ To test the presence of Starch in leaves of the plants:

Take two potted plants of the same kind. Keep one in the dark (or in a black box) for 72 hours so that all the starch in leaves is consumed up and the other in the sunlight. Perform iodine test with the leaves of both the plants to find out the presence of starch in the leaves.

Now leave the pot which was earlier kept in the dark, in the sunlight for 3 – 4 days and perform the iodine test again on its leaves.

For performing starch test on leaves the following procedure is followed:

First we boil the leaves in water.

Then we remove chlorophyll from the leaves by boiling them in alcohol so that colour change after iodine test can be visualised.

Take out the leaves from alcohol and wash with water, now put two drops of iodine solution. If the leaves show blue- black colour that indicates the presence of starch. If the colour of iodine(yellow) doesn't change then this is an indication of no starch present.

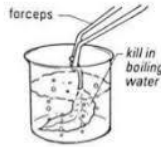
Leaves of the plant kept in sunlight show the presence of starch in them.

Leaf of the plant kept in dark does not show any colour change that indicates the absence of starch but when this experiment is repeated after keeping the plant in sunlight for few hours presence of starch is indicated in the leaves.

Test for starch

Method

Step 1: Put a leaf in boiling water for about 5 minute, until it is soft.



Reason

To break down the cell walls so chemicals can enter the cell.

Step 2: Put the leaf in a test tube with ethanol for a while.



To remove the green pigment (chlorophyll). This is for us, to more clearly see a colour change when we add iodine.

Chloroplast and the Process of Photosynthesis

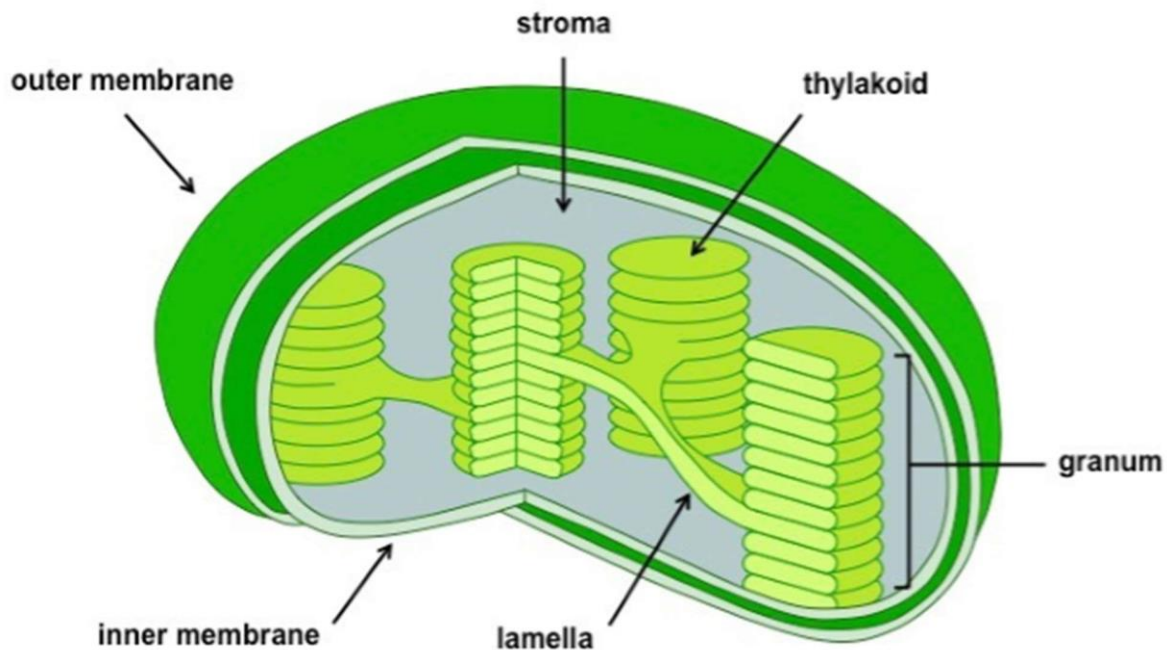


Figure: Structure of Chloroplast

- Chloroplasts are special cell organelles that are found only in plant cells. They are called the food producers of the plant cells.
- The chloroplasts are surrounded by two membranes called the Inner and Outer Membrane. The inner membrane surrounds stroma and thylakoid stacks.

- The chlorophyll molecules are present on each of the thylakoids. The chloroplasts convert the sunlight into sugars that are used by the plant cells.
- Hence, chloroplasts allow the conduction of the process of photosynthesis. The chlorophyll that can absorb the sunlight is present inside the chloroplasts.
- When the light of the sun hits the chloroplasts and the chlorophyll, the light energy is converted into chemical energy found in compounds such as ATP and NADPH.
- Then these energy molecules move into the stroma where carbon dioxide is attached to them. As a result of the molecular reactions, oxygen and glucose are created.

Can leaves which are red or Brown or violet in colour conduct photosynthesis?

Yes, the chlorophyll is also present in leaves that are not green in color. They are of different colours because the other colour pigments are more than the green colour pigments in such leaves. The large amount of red, brown and other pigments mask the green colour. Like the red colour is caused by pigments called anthocyanins in leaves or even stems of herbaceous plants.



Red Leaves in Coleus Plant

Algae contain chlorophyll

We see slimy, green patches in ponds or in other stagnant water bodies even near the open gutters where water flows continuously. These are generally formed by the growth of organisms called algae. They contain chlorophyll which gives them the green colour. Since they have chlorophyll in them they are capable of conducting photosynthesis.

Algae are simplest plants on the earth and the plant body is not differentiated into roots, stems and leaves, the whole structure is green. Hence, such a structure is called thallus. For example Spirogyra is an alga found in ponds, it is also called water silk or pond silk as the plant body consists of long, thin, green strands. Chlamydomonas is an unicellular green alga.



Spirogyra Algae in Water

What Is Nitrogen Fixation?

Nitrogen fixation is the essential biological process and the initial stage of the nitrogen cycle. In this process, the free nitrogen available in the atmosphere is converted into ammonia (another form of nitrogen) by certain bacterial species like Rhizobium, Azotobacter, etc. and the complete process is carried on by natural phenomena.

How do plants generate proteins?

- Along with carbohydrates, plants produce other components of food like proteins which are formed with the help of Nitrogen along with carbon, oxygen and hydrogen.
- Nitrogen is present in large amounts in the air but plants cannot consume the nitrogen directly from the atmosphere.
- The soil often contains some bacteria that are capable of converting the nitrogen into compounds of nitrogen that mix up with the soil water and are absorbed by the plants. Azotobacter is free living nitrogen fixing bacteria. The second kind of bacteria comprises the mutualistic (symbiotic) bacteria; example include Rhizobium, associated with the roots of leguminous plants (e.g., various members of the pea family like gram, chick pea etc.)
- Also, fertilizers used by farmers and gardeners contain a high amount of Nitrogen which mixes into the soil and is used by the plants. For example urea is one such fertilizer.

Nutrition in Plants that do not contain Chlorophyll

Many plants do not contain any chlorophyll. Hence they are unable to prepare their food by themselves. Therefore, they rely on other plants for their food.

1. Parasitic Plants - Some plants live on another plant for their nutrition. These are called parasitic plants. The plants on which these parasitic plants survive are called the host. For Example, Cuscuta doddar is a parasitic plant.

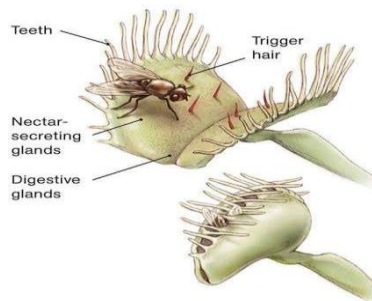
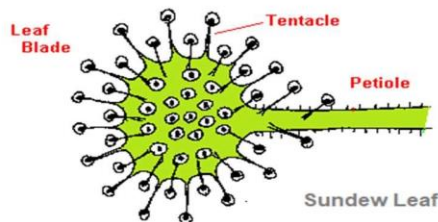
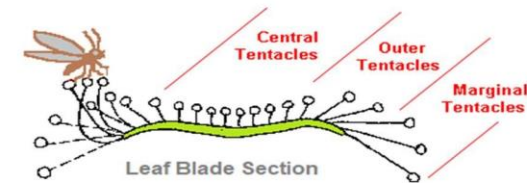
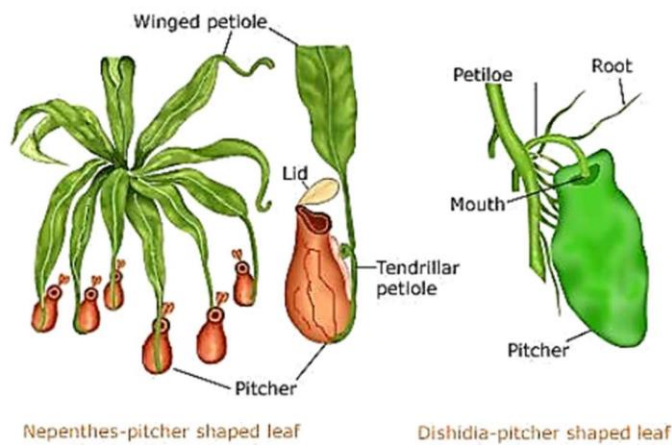
Cuscuta is more often called doddar plant in English speaking countries and in Hindi is called Amarbel. Other names include hellweed, beggar weed etc. Cuscuta is leafless plant that has no chlorophyll and cannot make its own food. The seeds of Cuscuta germinate like other seeds. The stem begins to grow and attaches itself to nearby plant, once its haustoria (parasitic roots) insert into the vascular system (xylem and phloem) of the host plant then original roots of Cuscuta withers off. Thus, it sets a permanent attachment with the host plant and cuts off its connection with the soil for ever. Parasitic roots, haustoria penetrate into the stem and branches of the host plant and absorb nutrients. In due course of time it weakens the host plant. In agriculture this plant is a matter of concern as it infests crops too.



Figure: Yellow color Cuscuta plant growing over green plants

2. Insectivorous Plants - Some plants depend upon insects for nitrogen compounds thus, are called Insectivorous. The leaves of one such plant called pitcher plant (*Nepenthes*) are modified into a pitcher like structure. The top part of the leaves acts as a lid which can open and close the pitcher. The rim and interior of the pitcher is wax coated making it slippery and pitcher contains hair in a downward direction which traps the insects. The pitcher on capturing the insect secretes some digestive juices which help in the digestion of the insect and the nutrients are absorbed. Other Examples are *Drosera*, commonly known as the sundews and Venus flytrap plants.

You should remember that insectivorous plants can do photosynthesis as they have chlorophyll. During photosynthesis as you already know plants manufacture only carbohydrate. For protein synthesis they require nitrogen from the soil, which is deficient. Hence, these plants extract nitrogen from insects or small animals.



Venus flytrap

Figure: Insectivorous Plants

3. Saprotrophs - Some organisms survive on decaying food and organisms. This mode of nutrition is called saprotrophic nutrition and the organisms that survive because of the saprotrophic nutrition are called Saprophytes. Fungi are chiefly saprotrophs and are multicellular except yeast, which is unicellular.

How do saprophytes obtain their nutrition?

- The saprophytes secrete digestive juices on the decaying and dead matter.
- These juices convert the matter into a solution that consists nutrients in soluble form.
- The saprophytes then absorb the nutrients from the solution.

- For Example, Fungi (Rhizopus and mushrooms) are saprophytes that can be found on stale food and pickles which are exposed to the hot and humid environment for a considerable time.



Rhizopus A Fungus growing on Bread

- You are aware that Button Mushrooms are edible and are cultivated Fungiculture is the cultivation of mushrooms and other fungi.
4. Symbiotic Relationship - Sometimes organisms live together to share shelter and food with each other. In such relationships both the partners are benefitted. So the organisms are said to have a symbiotic relationship.

Examples of organisms living in a symbiotic relationship:

- Some fungi live in the roots of the trees. These fungi take food from the trees and in return help the trees in absorbing water and nitrogen or phosphorus nutrients from the soil.
- Sometimes an organism that contains chlorophyll such as algae lives in association with a fungus (together called as Lichens). The algae being green in colour provides food and nutrition to the fungus while the fungus provides water, minerals and shelter to the algae.

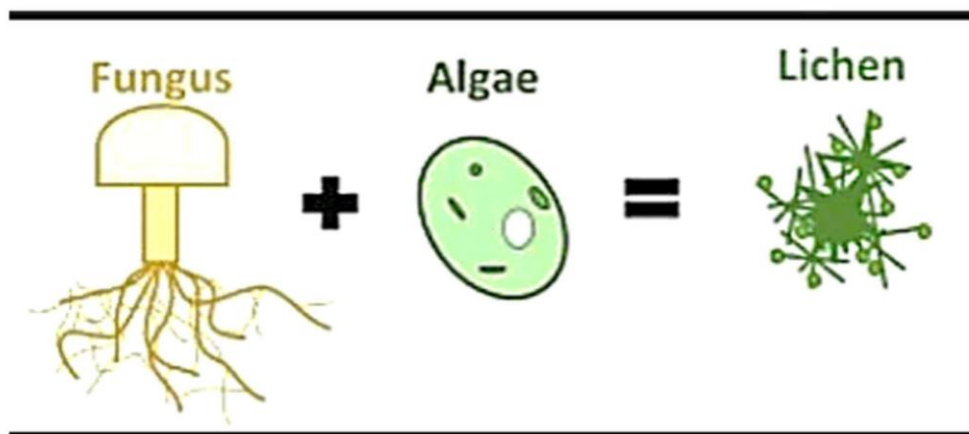


Figure : Lichens

Replenishing the Soil with Nutrients

- Plants get their nutrients from the soil mainly hence there is a need to replenish the soil again with nutrients so that the plants can survive on it.
- Fertilizers and manure are often used to replenish the soil with the nutrients. They contain potassium, phosphorus and nitrogen all of which are important for the plants.
- Rhizobium is a bacteria found in soil that helps in fixing nitrogen in leguminous plants. It attaches to the roots of the leguminous plant and produces nodules. These nodules fix atmospheric nitrogen and convert it into ammonia that can be used by the plant for its growth and development. Thus, it develops symbiotic relationship with the plants.
- The Rhizobium bacteria generally lives in the root nodules of the pulse plants such as peas, beans, grams and legumes and provides nitrogen to these plants. This again is an example of a symbiotic relationship. The farmers often do not need to use fertilizers while growing such crops.

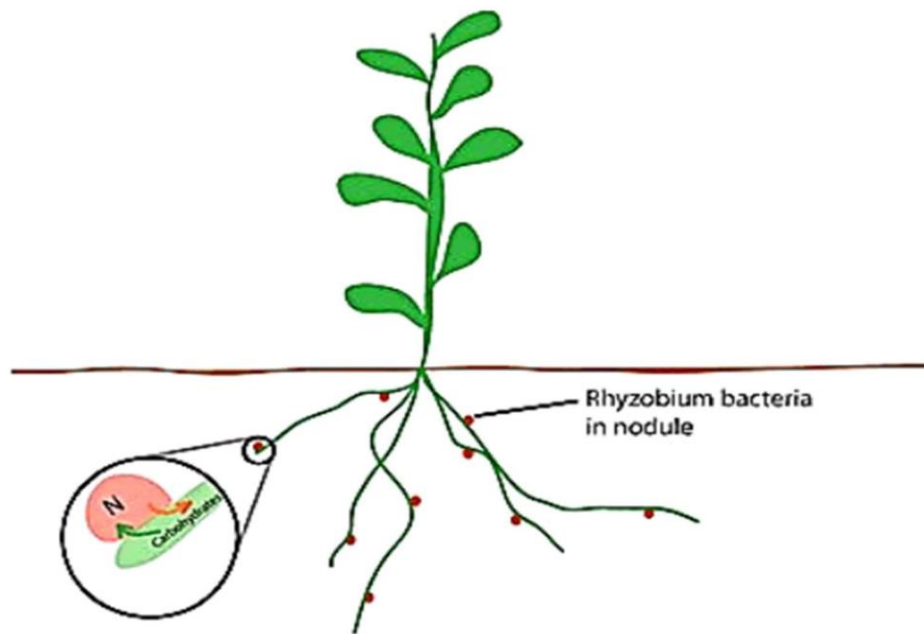
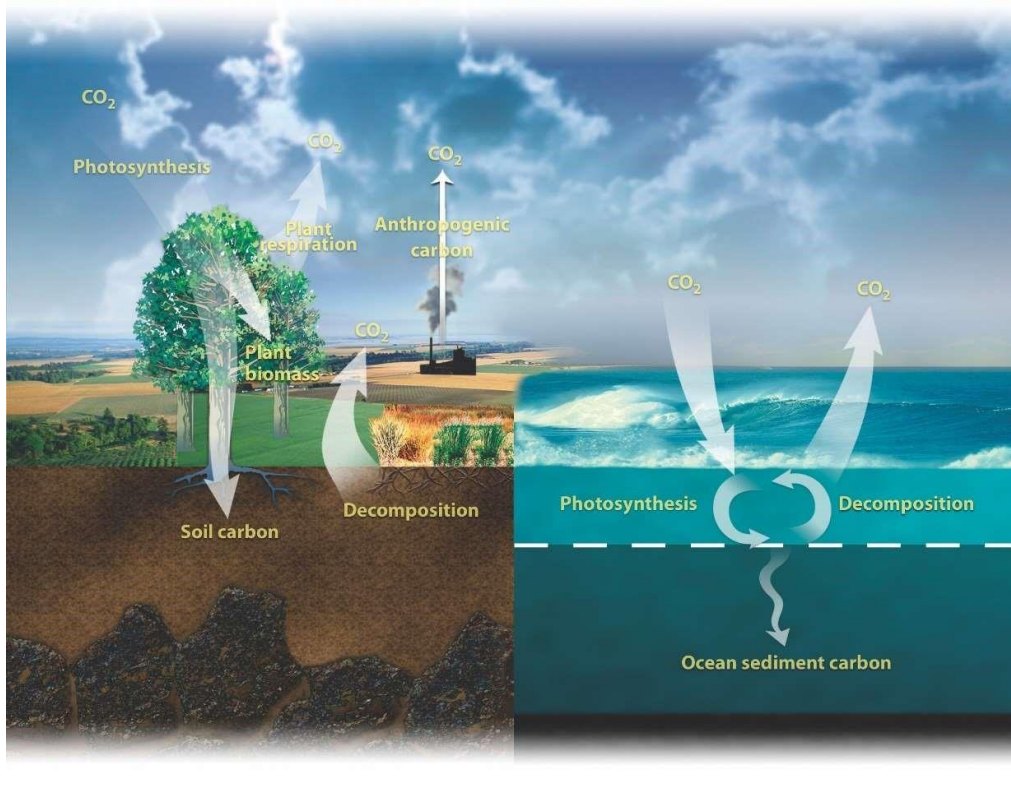


Figure: Rhizobium Bacteria in Soil



Carbon Sink

- You might be aware of the term carbon sinks. Plants absorb lots of carbon dioxide from the atmosphere to do photosynthesis thus, these reduce level of carbon dioxide from the atmosphere so plants on road side, in our neighbourhood, dense forests are major areas that act as carbon sinks.
- Lots of emphasis is on reforestation and planting drives because plants on earth are the only living beings that absorb carbon dioxide. High levels of this gas results in global warming hence, plants are of utmost importance. In the above figure you can see that oceans too act as carbon sinks because marine plants too consume a considerable percentage of carbon dioxide for photosynthesis.

Terms to remember:

Osmosis: Movement of water molecules through cell membrane from higher water concentration area to low water concentration area. It takes place in plants and other living cells.

Diffusion: Movement of solute from high concentration area to low concentration area.

Xylem: Special tissue in plants for transporting water and minerals from roots to the shoot.

Phloem: Special tissue in plants for translocating carbohydrates from leaves to various parts of the plants.

You can find explanation of this Chapter at youtube channel “Tech Study”

Link is given below

https://www.youtube.com/channel/UCUaBcKy9RZlmCtdm4D_UKvA