

CHAPTER. 1

GROWING OF PLANTS

- Plant growth involves all activities of cells tissues and organs of plant. The differentiation of cells, tissues and organs in a growing organism, resulting in its characteristic pattern of organization, is referred to as development.
- This development considers as one aspect of growth of plant which increases size, weight or amount of protoplasm. After a seed germinates, the seedlings grows further slowly for a while and then enters a period of much more rapid growth that is maintained until the plant approaches maturity.

- Plants growth is not steady but varies diurnally and seasonally. Variations in seasonal growth variations are more striking in trees, shrubs and other perennials and in biennials. Many trees grow rapidly only during the spring and early summer, the growth of some species being limited to a few weeks during the spring. Sometimes plants growth continues as long as the plant lives.
- The growth pattern and the resulting structural organization of a plant depend on both its hereditary potentialities and its environment. The relation of these plant activities and the behavior, growth and development may be

Hereditary potentialities Environmental factors

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graph TD; A[Hereditary potentialities] --> B[Internal process and conditions]; C[Environmental factors] --> B; B --> D[Observable growth, development and behavior];
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Internal process and conditions

Observable growth, development and behavior

- This outline emphasizes an important point that heredity and environment exert their control over plant behavior, growth and development through their influence on many internal life processes such as photo-synthesis, respiration, protein-synthesis, chlorophyll synthesis, digestion, turgor pressure and mitosis.

- To become large, a plant must have a way for branches to get longer, it must develop a structure strong enough to hold it upright. All this is accomplished through its plumbing system to transport water and nutrients from the soil to the above ground part. All the plant parts are actively engaged in the above mentioned synthesis processes for the growing of plant.

Functions of different plant parts

■ Leaves

Manufacture food, and release water and oxygen into the atmosphere.

■ Chloroplast

are the chlorophyll bodies within leaf cells in which photo-synthesis takes place in order to manufacture carbohydrates for the plant .they give the leaf its green color.

■ Stomata

are specialized “breathing” pores through which carbon dioxide enters and water and oxygen are released. They close when water is limited.⁶

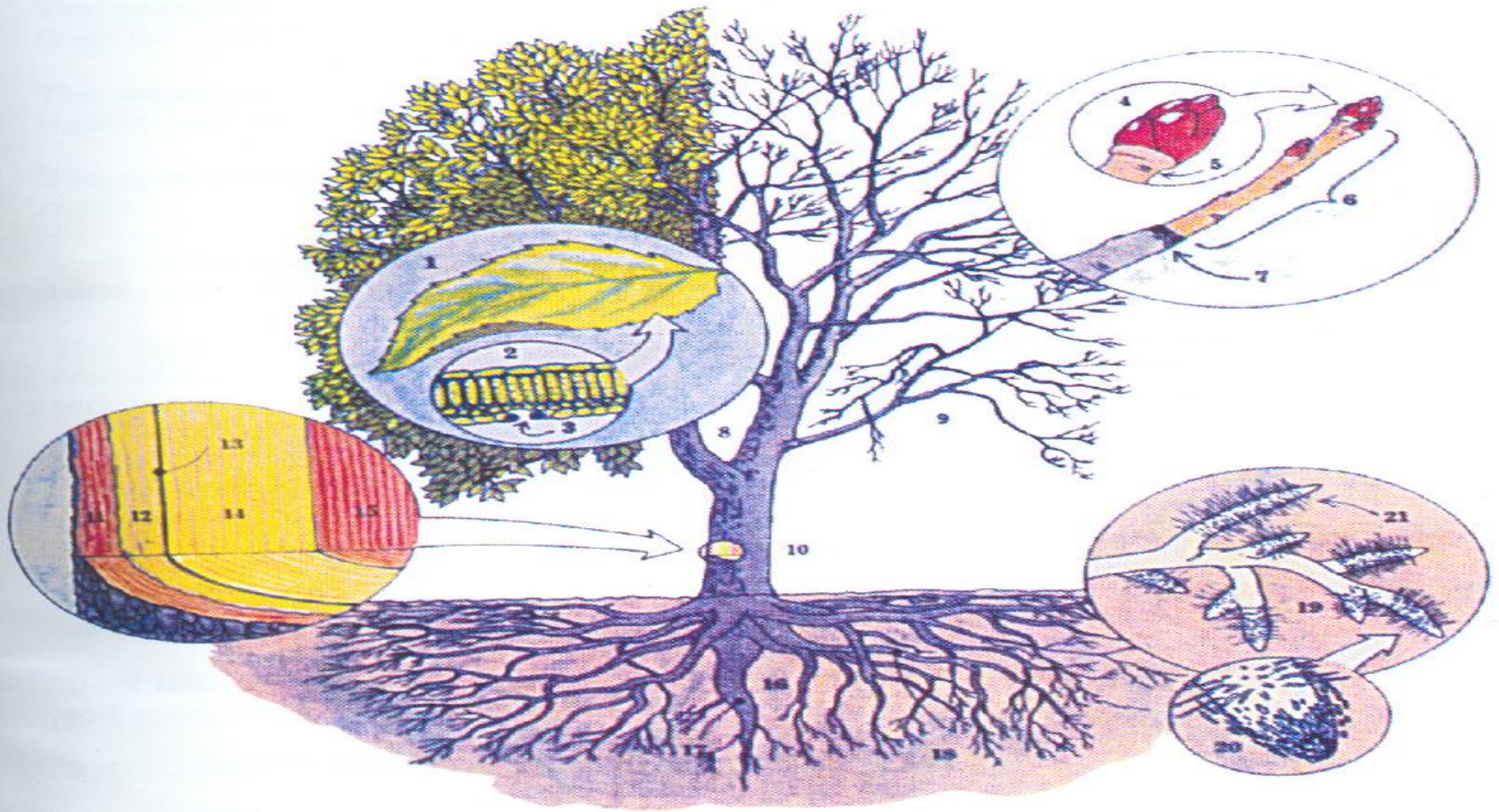


FIGURE 1. DIFFERENT PLANT PARTS

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- **Buds**

Occur at the ends of the shoots (terminal buds) and along the sides of the shoot (lateral buds). These buds contain embryonic shoots, leaves and flowers for the next growing season.

- **Lateral Buds**

Occur below the terminal bud at leaf axils, if terminal bud is removed lateral bud or two will grow to take its place.

- **Each years new growth** is marked by bark of a slightly smoother texture and lighter color which will darken and get rougher with time.

- **Bud scale**
scars mark where previous years terminal buds have been, and provide a means of measuring tree growth of many trees.
- **Scaffold branches**
are the large limbs that give the tree its basic shape and structure.
- **Lateral are secondary branches,**
mainly horizontal, that create the outline of the tree.
- **Trunk**
is the main stem that supports tree to better expose leaves to the sun

- **Bark**

is the “skin” an external protective layer.

- **Inner bark (Phloem)**

is part of the circulator system, carrying organic compound where needed.

- **Cambium**

is a layer only a single cell thick between the inner bark and the sapwood (xylem). It produces the cells that allow both the phloem and xylem to grow.

- **Sapwood**

is produced by the cambium and carried water and nutrients up from the roots to the leaves.

- **Heartwood**

is essentially inactive sapwood. It gives the tree strength and rigidity and serves as a depository for stored food and wastes.

- **Root system**

can be quite extensive depending primarily on soil texture and depth.

- **Taproot**

some trees may have an initial taproot, but as the tree matures , other more horizontally growing roots predominate.

- **Lateral roots**

develop at the base of the trunk and spread, forming an extensive network which serves to anchor the tree. They also provide storage for carbohydrates.

- **Feeder roots**

grow from the lateral roots and serve to transport water and nutrients absorbed by root hairs. They tend to be concentrated within the “drip line” (where the rain drips off the tree), but some may extend great distances.

- **Root caps**

produce a continuous supply of new cells that are ploughed the soil as it forages for water and nutrients.

- **Root Hair**

are microscope appendages to the feeder roots; root hair absorb water and nutrients the tree need in order to live.

Basic Requirements Of Plant Growth

The needs of plant growth remain constant throughout its life cycle, light, water, air, nutrients, temperature are the basic requirements for plant growth. Woody plants like trees, shrubs, palms and climbers have similar requirements because of their long persistence in the landscape. They usually need closer attention to their individual behavior during the establishment period, so that they may reach maturity with assurance and natural vigour. These needs are described in the

LIGHT

Light is essential to all plants. Without enough light, growth suffers and leaves become small and pale. Healthy growth depends on the process of photo-synthesis which produces carbohydrates and is triggered off by the action of light on the green pigment chlorophyll. The sun light is the natural source for the landscape plant. The majority of plants enjoy a maximum of sunshine throughout the year, some plants need reduced light during some part of the day.

However, it is important to know when the sunlight appears since the heat and light most productive to strong growth come b/w 10:00 a.m. and 3:00 p.m.

Normal growth of plant is sometimes noticeably affected by an increase in shading. Such plants often become less vigorous. Constant shaded soil often remains cold for longer in the spring ,can markedly affect plant behavior.

WATER

- Plants require great quantities of water for growth and development. Without sufficient water , plants die or become so mis-shaped and weak that they may lose their landscape appearance. Since water can be made available to plants only through the roots, the moisture content of the soil, especially in the active growing season is critical to continued good growth. A constantly moist (not wet) soil is ideal.
- Natural irrigation comes from rain which may be sufficient for plant growth and development. This may need to be supplemented by additional watering during prolonged summer drought. Deep penetration of water is desirable not to bring roots close to the surface.

AIR

- Air is required both by the roots and leaves. Carbon dioxide in the air enters through stomata and is incorporated in to simple carbohydrate manufactured by chlorophyll in the leaves. Air is essential for proper root activity because root hair development depends on the easy availability of oxygen in the soil for survival.
- Soil aeration is always helpful for the uptake of nutrients and the root growth. Roots prefer, loose, well drained sites because there are also oxygen rich. Poor soil aeration is one of the most critical soil factors faces by landscape contractor and maintenance personnel. Some plants are not tolerating tight heavy soils, poor aeration is the primary reason for their poor and weak growth and the lack of soil air is due to heavy soils water saturation and limited pore space.

NUTRIENTS

The natural nutrients for plant growth are found only in the soil as mineral dissolved by rain fall in weak salt solution available for quick absorption by the root hairs. If the soil is deficient, the supplementary nutrients are added in the soil. These are the fertilizers having different composition of NPK and other elements which are called micro and macro nutrients. Nitrogen is used by plants mostly for the stem and foliage development, Phosphorus (P) is involved with root enlargement and Potassium (K) provides the stimulation for

- Landscape plants have more stems and leaves, therefore, the soil nitrogen is quickly exhausted.

In

fertilizer formulas nitrogen usually represent high percentage of ingredients. Fertilizers are commonly available in organic and inorganic forms. Organic fertilizers are slow release in reaction and mostly in natural forms. Inorganic fertilizers are synthetic and quick acting chemical combinations. Even more specialized are the liquid and foliar nutrients which is ready made quick food for the plants growth and development

SOIL

- Soil consists of mineral particles (sand, silt, clay) organic matter, living or dead, water containing plant nutrients and air spaces. The proportion of the above components vary from soil to soil and in the depth in the same soil. Mineral particles give soil its textural qualities, and inorganic nutrients.
- Organic matter provides plant nutrients and influences soil structure tending to produce a good physical condition.
- Soil micro-organism help in the decomposition of organic matter and recycling of nutrients

- Soil may be loosely grouped according to the dominant constituents which affects its characteristics and the type of plants which will grow on them.
- For landscape plants, soil improvements should be limited to the minimum need to allow suitable plants to become established. Under natural condition nutrients are recycled by various biological cycles.
- In the natural ecosystem there is usually abundant vegetation even on poor soils as a result of slow growth over many years.

PLANT PROPAGATION

- Propagation is the creation of new plant or the multiplication of plants. This can be accomplished in numerous ways. Some plants regenerate themselves better to one method, others to another technique. Some methods of propagating plants are given below:

Sexual

A propagation by seed e.g. annuals, biennials, and many perennial plants.

Asexual (vegetative)

A. Propagation by apomictic embryos e.g. citrus

B. Propagation by runners e.g. strawberry

C. Propagation by suckers e.g. red raspberry,
blackberry

D. Layering

- Tip – trailing blackberry, black raspberry
- Simple – honeysuckle, spirea
- Trench – apple, pear, cherry
- Mound or stool – gooseberry, apple
- Air – rubber plant, litchi
- Compound or serpentine – grape, honeysuckle

E) Separation

- Bulbs – hyacinth, lily, narcissus, tulip
- Corns – gladiolus, crocus

F) Division

- Rhizomes – canna, iris
- Offsets – houseleek, pineapple, date
- Tubers – potato
- Tuberous roots – sweet potato, dahlia
- Crown – everbearing strawberry, phlox

G) Propagation by cuttings

➤ Root cuttings – red raspberry, horseradish

➤ Stem cuttings

Hardwood – fig, grapes, gooseberry, quince,
rose, forsythia,

Semi-hardwood – lemon, olive, camellia,
holly

Softwood – lilac, forsythia, weigela

Herbaceous – geranium, coleus,
chrysanthemum

➤ Leaf cuttings – *Begonia rex*, *Bryophyllum*,
Sansevieria, African violet

➤ Leaf- bud cuttings – blackberry, hyfrandrea

H) Grafting

- **Root grafting**

 - Whip or tongue graft – apple and pear**

- **Crown grafting**

 - Whip or tongue graft – Persian walnut**

 - Cleft graft – camellia**

 - Side graft – narrow-leaved evergreens**

- **Top grafting**

 - Cleft graft – various fruit trees**

 - Saw-kerfs or notch graft – various fruit trees**

 - Bark graft – various fruit trees**

 - Side graft – various fruit trees**

 - Whip or tongue graft – various fruit trees**

- **Approach grafting**

 - e.g. mango**

I) Budding

- T-budding – stone and pome fruit trees, rose
- Patch budding – walnut and pecan
- Ring budding – walnut and pecan
- I-budding – walnut and pecan
- Chip budding – grape, mango

J) Micro-propagation

- “Meristem” culture – orchid, carnation
- Tissue culture – tobacco
- Embryoids – tobacco
- “Embryo” culture – orchid

PLANT CLASSIFICATION

Scientific Classification

Plant classification starts by dividing the plant kingdom into major divisions., separated on an evolution basis. Some of these divisions include higher plants. This division is known as **Tracheophyta**, are plants with roots, stems, leaves and vascular systems. The emphasis is on landscape plants. Therefore, illustrating them further by using the example of ornamental tree. The red flowering gold mohur (Delonix regia) is described by each of the following categorization. The classification is given below:

KINGDOM	Plant
DIVISION	Tracheophyta
CLASS	Angiospermae
SUBCLASS	Dicotyledoneae
ORDER	Legumes
FAMILY	Leguminosea
GENUS	Delonix
SPECIES	Regia
VARIETY	D.R var rubra

- Gymnosperms and Angiosperms are the two classes in ornamental woody plants. Gymnosperms are primarily evergreen species of temperate zones. Gymnosperms generally also have narrow or needle like leaves. Gymnosperms are further divided on three orders. Conifer are most important for the landscape planting.

Landscape Classification

- General classification according to size:

Trees

Tall	18m and above
Medium	12 to 18 m
Small	8 to 12 m

Shrubs

Tall	6 to 8 m
Medium	4 to 6 m
Small	1 to 3 m

Bushes and Ground covers

Bush and border plants are less than 1 m.

Climbers

Creepers, climbers, timers, runners.

- **Classification according to nature of foliage**
 - Deciduous
 - Broad leaf evergreen
 - Coniferous evergreen
 - Palms
- **Classification according to climatic requirements**
 - Tropical
 - Subtropical
 - Temperate
- **Classification according to forms and shape**
 - Round, oval, spreading, compact,
columnar, fastigiata, pyramidal, arching,
clump and weeping

- **Classification according to Flower**

Season, color, lateral/terminal, single or double, showy/inconspicuous, flowering habit, pruning requirement and inflorescence

- **Classification according to fragrance**

Rich in fragrance, medium fragrance, light fragrance, flower fragrant or foliage or both.

- **Classification according to hardiness**

Extreme temperature resistant, drought resistant, soil conditions resistant, pest and disease resistant.

CHAPTER 2

APPEARANCE OF PLANTS

- Plants are the most important material that a designer can use in the landscape and the success of any planting scheme depends on the selection and arrangement of trees, shrubs and other ornamental plants.
- The visual quality of a planting design is vitally important because a person's first response is apt to be a reaction to its appearance.

- A planting design may successfully fulfill the other valuable functions such as atmospheric purification, modifying the air temperature, controlling the micro-climate and stabilizing soil, but it will nevertheless be ill received if it is offensive to the eye.
- Each visual plant has its own appearance, qualities and uses in the outdoor environment which are discussed next.

PLANT SIZE

Size is one of the most visually significant characteristics of plant and should be studied early in the selection of plants for a design.

Plant size directly affects the scale of a space, composition, interest and the overall framework of a design. Plant materials are categorized according to the following sizes:

Large Size Trees

Large trees grow 12 m tall and above at maturity. Examples of large trees include

- *Euclyptus camaldulensis*
- *Cedrala toona*
- *Casuarina equisetifolia*
- *Pinus roxburghii*
- *Azardiracchta indica*
- *Ficus bangalensis*
- *Ficus religiosa.*

This category of plant material are dominant visual element because of their height and

Medium Size Trees

Intermediate trees have a maximum height of 9-12 m.

Examples include

- *Ficus altisma*
- *Acacia farnesiana*
- *Bauhinia Veraigata*
- *Delonix regia*
- *Jacaraanada mimosifolia*
- *Melia azedarach*
- *Prospis chilensis*

Based on the size, the most significant plants from both a compositional and spatial standpoint with the landscape are intermediate trees, because of their reasonable height and forms. Maximum utilization of plant material in the landscape is from this category of trees.

Small Size Trees

Moving down the scale of plant size, the trees grow to a maximum height of 6-8 m. Examples are

Acer oblogum

Pongamia glabera

Callistamon lenciolatus

Cassia javanica

Citrus decomela

Ficus nittida

Punica granatum

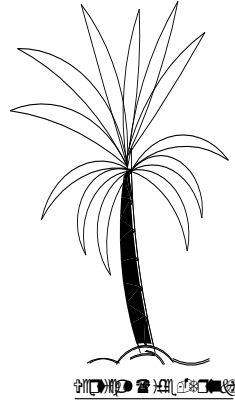
Ficus retusa

Salix babylonica

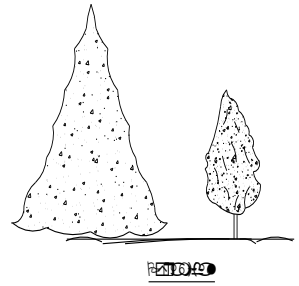
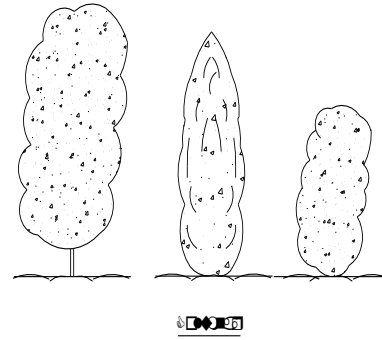
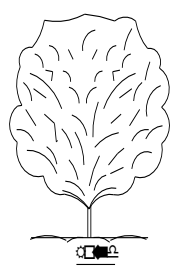
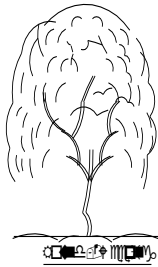
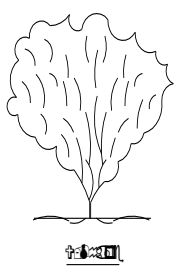
Malus becata

Small trees may serve as visual and composition accents in lawns and small gardens.

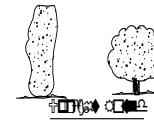
PALMS



TREES



SHRUBS



Tall shrubs

Plants that grow to a maximum height 4-6 m. In comparisons with small trees, tall shrubs are not only slightly shorter but also distinguished by the lack of a canopy. Typically, the branches of shrub extends to the ground when the small tree is located some distance above the ground, forming a canopy over an area. Tall shrubs may be used for screening, privacy and alongside the walks and paths. Tall shrubs examples are

Tecoma stans

Murraya exotica

Thevetia peruviana

Plumeria obtusa

Magnolia grandiflora

Cassia multijuga