Unit II

Pharmacognosy & Phytochemistry (BP405T)

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UNIT-II (Part 2)

Factors influencing cultivation of medicinal plants.

Factors affecting cultivation of medicinal plants

Cultivation of medicinal plants offers wide range of advantages over the plants obtained from wild sources. There are few factors to concern which have a real effect on plant growth and development, nature and quantity of secondary metabolites. The factors affecting cultivation are altitude, temperature, rainfall, length of day, day light, soil and soil fertility, fertilizers and pests. The effects of these factors have been studied by growing particular plants in different environmental conditions and observing variations. For example, a plant which is subjected to a particular environment may develop as a small plant which, when analysed shows high proportion of metabolite than the plants attained the required growth. Nutrients have the ability to enhance the production of secondary metabolites, at the same time they may reduce the metabolites as well.

Light:

Light is the only external source of energy for the continuation of life of the plant. It influences photosynthesis, opening and closing of stomata, plant movements, seed germination, flowering and vegetative growth like tuber formation. Dry sunny weather increases the proportion of glycosides in digitalis and of alkaloids in belladonna.

Temperature:

Temperature is the major factor influencing the cultivation of the medicinal plant. The sudden decrease in temperature caused the formation of the ice crystals in intercellular spaces of the plant. As a result, water comes out of the cells and ultimately plants die due to drought and desiccation. The ice crystals also mechanical injury to the cells temperature stimulates the growth of seedlings. Water absorption decreases at low temperatures. The rate of photosynthesis is affected by change in temperature. The rate of respiration increases with increase in temperature. Examples; Cinchona- 58-73°F; Tea- 75-90°F and coffee- 55-70°F

Atmosphere humidity:

It is present in the form of water vapours. This is called atmospheric humidity. Clouds and fog are the visible forms of humidity. The major sources of water vapours in the atmosphere are

evaporation of water from earth surface and transpiration from plants the major effect of humidity on plant life and climate. Evaporation of water, its condensation and precipitation depends upon relative humidity and humidity affects structure, form and transpiration in plants.

Altitude

Altitude is a very important factor in cultivation of medicinal plants. Tea, cinchona and eucalyptus are cultivated favourably at an altitude of 1,000–2,000 metres. Cinnamon and cardamom are grown at a height of 500–1000 metres, while senna can be cultivated at sea level. The increase the altitude, the temperature and atmospheric pressure decreases while the wind velocity, relative humidity and light intensity increases.

Thus, as the climatic conditions change with height, they also produce change in the vegetation pattern. The bitter constituents of Gentiana lutea increase with altitude, whereas the alkaloids of Aconitum nacelles and lobelia inflate and oil content of thyme and peppermint decrease. Pyrethrum gives the best yield and Pyrethrum at high altitude. Examples: Tea- 9500-1500 meters; cinnamon- 300-1000 meters and saffron- up to 1250 meters.

Rainfall

The rainfalls are most important factor influencing of cultivation of medicinal plants. The main source of water for the soil is rain water. Rainfall and snowfall have a large effect the climate condition. The water from rainfall flows into the rivers and lakes percolates into the soil to form ground water and remaining is evaporated. The minerals in the soil get dissolved in water and are then absorbed by plants. Water influences morphological and physiology of plant. Examples: continuous rain can lead to a loss of water- soluble substance from leaves and root by leaching; this is known to apply to some plants producing glycoside and alkaloids.

Soil

Soil is defined as surface layer of the earth, formed by weathering of rocks. The soil is formed as a result of combined action of climate factors like plants and microorganisms. The soil should contain appropriate amounts of nutrients, organic matter and other elements to ensure optimal medicinal plant growth and quality. Optimal soil conditions, including soil type, drainage,

moisture retention, fertility and pH, will be dictated by the selected medicinal plant species and/or target medicinal plant part.

The soil made of five components:

(i) Mineral matter.

(ii) Soil air.

(iii) Soil water.

(iv) Organic matter or humus.

(v) Soil organisms

Plants depend on soil for nutrients, water supply and anchorage. Soil influences seed germination, capacity of plant to remain erect, form, vigour and woodiness of the stem, depth of root system, number of flowers on a plant, drought, frost, etc.

Classification of soil particles:

S. No.	Type of particle	Size (mm in diameter)
1	Clay	Less than 0.002
2	Silt	0.002- 0.02
3	Fine sand	0.02- 0.2
4	Coarse sand	0.2- 2.0
5	Stone or gravel	2.0 and more

1. Clay

2. Loamy.

3. Silt loam

4. Sandy loam

5. Sandy soil.

6. Calcareous soil.

a. Clay soil:

Clay particle are very small. These fit together very closely and therefore, leave very less pore space. These spaces get filled up with water very easily. Hence, the clay soil becomes quickly waterlogged. Such soil have practically no air, therefore, the plants growing in these soil are not able to absorb water. This soil known as physiologically dry soil clay soil is plastic and forms a colloid when moist. It cracks and shrinks when conditions are dry the soil rich in nutrient elements and therefore, acts as a negatively charged colloidal system.

b. Sandy soil:

Sand particles are large sized. These leave large pore spaces which do not have capillary action and therefore, water is not retained by them. Most of the water is quickly drained off and reaches deep into the soil. As a result, roots spread and also reach a great depth. The sandy soil is poor in nutrient elements; it is less fertile and plants growing in this soil have less dry weight.

c. Loam soil:

The mixture of clay, silt and sand is known as loam. Loam is very useful for growth. It is fertile soil because it contains available nutrient elements in sufficient amounts. It has a high water retention capacity and appropriate amount of soil air is also present. The plants growing in loam are vigorous and have very high weight.

d. Sandy loam:

The amount of sand particles is more than other types of loam.

Silt loam:

Silt loam is considered to be the most fertile as it contains more amount of organic substances than others.

Fertilizers and Manures

Plant also needs food for their growth and development. What plants need basically for their growth are the carbon dioxide, sun-rays, water and mineral matter from the soil. Thus, it is seen that with limited number of chemical elements, plants build up fruits, grains, fibres, etc. and synthesize fixed and volatile oils, glycosides, alkaloids, sugar and many more chemicals.

(a) Chemical fertilizers

Animals are in need of vitamins, plants are in need of sixteen nutrient elements for synthesizing various com-pounds. Some of them are known as primary nutrients like nitrogen, phosphorus and potassium. Magnesium, calcium and sulphur are required in small quantities and hence, they are known as secondary nutrients. Trace elements like copper, manganese, iron, boron, molybdenum, zinc are also necessary for plant growths are known as micronutrients. Carbon, hydrogen, oxygen and chlorine are provided from water and air. Every element has to perform some specific function in growth and development of plants. Its deficiency is also characterized by certain symptoms.

(b) Manures

Farm yard manure (FYM/compost), castor seed cake, poultry manures, neem and karanj seed cakes vermin compost, etc. are manures. Oil-cake and compost normally consists of 3–6% of nitrogen, 2% phosphates and 1–1.5% potash. They are made easily available to plants. Bone meal, fish meal, biogas slurry, blood meal and press mud are the other forms of organic fertilizers.

(c) Biofertilizers

Inadequate supply, high costs and undesirable effects if used successively are the demerits of fertilizers or manures and hence the cultivator has to opt for some other type of fertilizer. Biofertilizers are the most suitable forms that can be tried. These consist of different types of micro organisms or lower organisms which fix the atmospheric nitrogen in soil and plant can use

them for their day to day use. Thus they are symbiotic. Rhizobium, Azotobactor, Azosperillium, Bijericcia, Blue-green algae, Azolla, etc. are the examples of biofertilizers.