MODEL ANSWER

B.Sc. FORESTRY (Second Semester)

Paper – Fundamentals of Horticulture

Question 1a: Multiple choice question-
i. Nitrogen fertilizers are used in plants for -
   a. Rooting   b. **Green leaves**   c. Flowering   d. Fruiting

ii. Golden revolution is related to production of-

iii. Plastic Mulches are used in horticulture because it helps in the following--
   a. Weed control   b. Moisture conservation   c. Microbial growth   d. **All of these**

iv. *Trichoderma viride* is a biofungi used to control-
   a. Bacterial disease   b. Virus disease   c. **Fungal disease**   d. Insect control

v. The contribution of Indian mango in world production is about-
   a. 15%   b. 25%   c. **54%**   d. 72%

b: Give two names of the given items:
   a. Nitrogenous fertilizer 1.Urea 2.Diammonium phosphate
   b. Biofertilizers 1.Phosphorus solubilizing Bacteria 2.Rhizobium
   d. Growth hormones 1. NAA 2. IAA
   e. Insecticides 1. Dimethioate 2. Monocrotophos

Question 2. What is Horticulture? Describe the importance of horticulture in the economy of the country.

ANSWER: Horticulture is a science as well as art of production, utilization and improvement of horticulture crops such as fruits, vegetables, ornamental plants, spices and plantation crops including medicinal and aromatic plants.

1. National income- Contribute in GDP 24.5% from 8.5% area
   IInd largest producer after China,
   Vegetable- 129 million tones contribute 14.4% of global production
   Cauliflower-Ist, onion- IIIrd, cabbage- IIIrd position
The agriculture sector account for 25% of our export basket in which Horticulture alone account 56%. These crops fetch 25-30 times more foreign exchange per unit area than cereals.

2. Protective foods and nutritional value- Today when all the facilities and modern amenities are easily available at door step our food habit are also being changed. Now we are more dependent on junk food and other non traditional Indian foods. This results into poor immunity system, deficiency of nutrients and vitamins in our body causing many health problems.

Vegetables are chief source of nutrients and vitamins easily available to Indian. Vegetables being rich in vitamins and minerals are known as protective food. Supply vitamin and minerals such as calcium, phosphorus, Vitamin A,B complexes Vitamin C. Also contains polyphenols which protect against chronic diseases.

3. Horticulture crop yield more.
   - Paddy 5-6 T/ha
   - Wheat 4-5 t/ha
   - Fruit 8-9 t/ha
   - Vegetable 12 t/ha
   - Banana 40-60 t/ha
   - Tomato 10-14 t/ha

4. Generate more employment: In Agriculture 143 labour man days/ annum, In horticulture 860 man days/annum. This crop require utmost care in cultivation, harvesting, processing, marketing and storage. Highly remunerative and profitable: Horticulture crop may fetch income Rs. 10000/ha to 5lac /ha

5. Diversification in existing farming: sustainable land management

6. Waste land development : Fruit plants can be modifies wasteland into productive land with less care than agriculture system. Less water is needed.

7. Industrial development : Directly or indirectly constitute raw material for many industries.
   - Rose (rose oil and gulkand)
   - Potato (Chips), Coconut (Oil)
   - Tea, coffee, rubber, medicinal plants.

8. By product also give important product – coir, rubber, food processing etc
9. Social importance and religious value: use of flower in temple. Flower in women hair, buckeyes in parties. Festunes of mango leaves, entrance gate of banana, coconut fruit etc. have their own significance in celebration.

10. Horticulture therapy – Unhappy person diverted his attention to gardening, flower decoration. Aroma therapy, flower bath. Orchard therapy (Visit of orchard)

11. Aesthetic value: Landscape, parks etc

12. Export Value: UAE, USA, Europeans
   Spice and condiments, flowers, Mango, grapes, onion, potato, okra, chillies MAP.

**Question 3. How the climatic and soil condition determine the growth and development of horticulture plants. Explain the horticulture zone indentified in India.**

**ANSWER :**

Climatic factors such as rainfall, temperature, humidity and soil condition affect the growth and development of plants. In area with high rainfall and high humidity the types of vegetable, fruit crops and plantation crops differs with the area of scanty less fall with high temperature. Similarly in temperate zone the main fruit crop is Apple while in tropical climate Mango, grape, Guava, Aonla are very commonly grown.

Horticulture best suited soil is deep alluvial soil with neutral pH. But soil also varies due to variation in climatic conditions, the growth and plants also varies pertaining to soil conditions.

**CLIMATE**

It denotes average condition of weather prevailing over a large area. Temperature, humidity, rainfall, solar radiation and wind are principal constituents of climate. In India there is variation in climatic conditions. Depending upon the prevalence of various constituent factors, the climate is broadly classified into :-

Temperate climate – Altitude 1800-3500m, winter snow fall and low temperature
Subtropical climate - The area receives less rain and temperature range 17 to 24oC.
Tropical climate - The temperature ranges 25oC to 27 oC.

**Role of soil condition for growth of horticulture crops**

1. Source of nutrients
2. Provide support
3. Adhere soil moisture
4. Supports soil microbes and fauna
Ideal soil should contain:

i. It should be fertile and well drained.

ii. Sufficiently deep especially for fruits.

iii. The water table should be approx. 4m deep from ground level.

iv. It should be retentive of nutrient and water.

v. Neutral pH ranged 6.5-7.5 is best.

vi. Free from high water table, high salt concentration and hard pan.

HORTICULTURE ZONES IN INDIA

India having diverse climatic condition and soil types favour different types of horticulture crops in different areas. The country is divided in different horticulture potential zones.

1. Temperate Zone
2. Subtropical zone
3. Tropical zone

1. Temperate zone:
   - This zone is characterized by the fall of temperature below freezing point in winter.
   - The plants sheds off their leave for survival during winter.
   - Frost is regular feature of this area.
   - This type of climate is observed at 1800 to 3500 m height from ground level.
   - The temperate region covers J&K, HP, part of Arunanchal Pradesh, Uttarakhand and in southern India it covers Nilgiri and Palni hills of Tamilnadu.
   - The main crop in upper elevation are Apple, Pears, Walnut, Almond, Cherry, Saffron, potato, mushroom, rose, cole crops.
   - In lower elevation Peaches, Plum, lettuce, cole crops, peas apricot, lily and vegetables.

2. Subtropical Zone
   - Hot and dry summer and less severe winter are the characteristics of this climate.
   - There is clear cut distinction between summer and winter seasons.
   - It is found in 900m to 1800m height from ground level.
   - The temperature ranges between 17 to 24°C.

a. North Western subtropical zone: RJ, PB, HR, WB, MP, CG and Part of UP: Mango guava, Peas, Ber, Bael, P phalsa, Pomegranate, beans, cucurbits (riverbed cultivation), tomato, brinjal, chillies, cole crop, rose, tuberose

b. North eastern Subtropical zone (BR, JH, Assam, Meghalaya, Tripura, Part of Arunanchal Pradesh and part of WB) : Mango, litchi, guava, sapota, papaya, date potato, rose, cole crops, tomato, brinjal, makhana, Orchids etc.

3. Tropical Zone
Hot and humid summer and mild winter is hallmark of tropical climate. There is no much fluctuation in day and night temperatures. The temperature varies from 25 to 27°C Further divided in 3 zone

a. Central tropical zone: Part of MP, CG, MH, GJ, OR, WB, AP and KTN comes under this zone. Citrus, grape, Mango, Guava, Banana, Pomegranate, and Jack fruit, Coconut, gladiolus, onion, chilli, and medicinal plants, rose etc.


c. Coastal tropical zone: Coastal part of MH, Kerala, AP, OR, TN, WB, Tripura and Part of GJ, Andaman and Nicobar island. Coconut, Banana, dates, cucurbits, marigold, seed species

Question 4. Write short notes on the following: (Any four)

a. Essential plant nutrients
b. Use of weedicides in horticulture
c. Medicinal wealth of India
d. Methods of Budding
e. Float gardening

ANSWER:

a. Essential plant nutrients: Sixteen nutrient elements are recognized as being essential to all plants for their normal growth and development. The nutrients are called macro, secondary and micronutrients based only on the quantity required by the plant for its normal growth and not based on their essentiality. The plant cannot complete its life cycle in the absence of even any one of these elements.

<table>
<thead>
<tr>
<th>Essential elements used (in large amounts)</th>
<th>Essential elements used (in small amounts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mostly from air and water</td>
<td>From soils</td>
</tr>
<tr>
<td>Macronutrients</td>
<td>Secondary nutrients</td>
</tr>
<tr>
<td>Carbon</td>
<td>Calcium</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Magnesium</td>
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<tr>
<td>Oxygen</td>
<td>Sulphur</td>
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<td></td>
<td>Boron</td>
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<td></td>
<td>Molybdenum</td>
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<tr>
<td></td>
<td>Copper</td>
</tr>
<tr>
<td></td>
<td>Zinc</td>
</tr>
<tr>
<td></td>
<td>Cobalt</td>
</tr>
</tbody>
</table>
b. Use of Weedicides in horticulture

Plant growing where it is not desired. These are the plant out of their place. These weeds occupy the main crops and affect the growth and development of crop. Therefore weed control is one of the important aspect in Horticulture.

There are four method of weed control

i. Cultural
ii. Mechanical
iii. Biological
iv. Chemical

In modern agriculture and horticulture there is increasing use of chemical weedicides due to very effective, selective in nature, and lack of labour availability. Weedicides are available in pre-emergence, post-emergence, systemic and contact types.

Some common weedicides are given below:-

Examples- Pendimethlene (preemergence), Glyphosate (Post emergence), Nomino gold (Selective herbicides), 2,4, D- Dichlоро phenoxy acetic acid (Broad leave).

c. Medicinal wealth of India:

India is very rich in medicinal plants and knowledge. Our vaidya and rishies has identified many medicinal plants and mentioned in Rig-Veda and other ayurvedic books. In our country about 49000 plants are reported which contributes 10% in world biodiversity. The most used and exploited medicinal plants of India is Aswagandha (Withania sominifera). Aloe Vera, Satavar (Asparagus racemosus), Isabgol (Plantago ovata), Kalmegh (Andrographis paniculata), Butch, Sarpagandha (Raulwolfia serpentine), Emblica officinalis etc. The conservation of these medicinal plants from overexploitation is urgent need. Therefore government is promoting cultivation of medicinal plants to farmers field to reduce the pressure on forest.

d. Method of Budding:-It is a method in which only one bud is inserted in the rootstock. This method is very easy and fast. This method is generally employed during spring and rainy season. The common methods of budding are T-budding, patch budding, and chip budding. T-Budding: This is also known as shield budding.

A horizontal cut about 1/3rd the distance around the stock is given on the stock 15-20cm above the ground level. Another vertical cut 2-3 cm in length is made down from the middle of the horizontal cut and flaps of the bark are loosened with ivory end of the
budding knife to receive the bud. After the ‘T’ has been made in the stock the bud is removed from the bud stick. To remove the shield of bark containing the bud, a slicing cut is started at a point on the bud stick about 1.25 cm below the bud. A second horizontal cut is then made 1.25 to 2 cm above the bud, thus permitting the removal of the shield piece. The shield is then pushed under the two raised flaps of bark until its upper horizontal cut matches the same cut on the stock. The shield should fix properly in place, well covered by the two flaps of bark, but the bud itself exposed. The bud union should be wrapped with polythene strip to hold the two components firmly together until the union is completed.

In most fruit trees it is performed either in the spring (March-April) or in rainy season (July-September) period. This is the most common method of propagation of citrus plants.

e. Float gardening: Especially practiced in Dal lake in Kashmir. Leaf of typha grass is used as a base for raising vegetable. The typha grass growth naturally floating in lake. Vegetables are grown after composting over leaf of grass. In our country large area is under water lodging which is not taken for any crop. These type of land can be used for the cultivation of Makhana, Singhara

**Question 5. What is nursery? Discuss the essential operations of nursery in order to produce different plants in nursery area.**

**ANSWER:**

Definition: A nursery is a place where young plants are raised under intensive management for later transplanting into the field. Many horticultural crops can be grown in-situ but, experience has shown that raising seedlings in the nursery has a number of advantages.

**Advantages**

- The area being small, it is convenient and easy to grow large number of seedlings per unit area.
- The nursery allows for a better medium of growth for the plants when directly seeded on the field.
- Intensive care for the seedlings by regular watering and manuring.
- Raising seedlings in the nursery affords selection of vigorous and disease-free seedlings for transplanting into the field.
- Nursery affords ease of carrying out propagation techniques like, budding, grafting and even cutting / air-layering.
Ensures easy and cheap availability of plant

**Essential Operation Nursery**

Nursery crops require a lot of careful management from sowing time to eventual transplanting into the field.
1) Shading:
2) Watering: continuous and regular watering to young seedling after sowing
3) Weeding: eradication of weed from seed bed
4) Thinning – removal of excess seedlings for better development
5) Pricking – Shifting of seedling in other bed
6) Root and shoot pruning:
7) Nursery soil management: Soil working and loosening of soil
8) Maintenance of soil fertility: FYM, Chemical fertilizer
9) Soil conservation: mulching
   - Mulch maintains moisture during seed germination
   - Prevent damage by birds
   - Minimizes splash damage by water and avoid flow of seeds

**Question 6. Define PGPR? Give different hormones and its role in growth and development of horticulture crops.**

**ANSWER:** Plant growth regulators are hormones are chemicals that regulate plant growth. Plant hormones are signal molecules produced within the plant, and occur in extremely low concentrations. Hormones also determine the formation of flowers, stems, leaves, the shedding of leaves, and the development and ripening of fruit. Now manmade compound is used in horticulture called plant growth regulator.

**AUXIN**

Auxin compounds that positively influence cell enlargement, bud formation and root initiation. They control the growth of stems, roots, and fruits, and convert stems into flowers.

**FUNCTION**

- Stimulates cell elongation
- Stimulates cell division in the cambium and, in combination with cytokines in tissue culture
- Stimulates differentiation of phloem and xylem
- Stimulates root initiation on stem cuttings and lateral root development in tissue culture
- Mediates the tropistic response of bending in response to gravity and light
- The auxin supply from the apical bud suppresses growth of lateral buds
- Delays leaf senescence
- Delays fruit ripening

**CYTOKININ**
Cytokinin is a compound which promotes cell division and have other similar functions to kinetin. Kinetin was the first cytokinin discovered to promote cytokinesis (cell division). Though it is a natural compound, it is not made in plants, and is therefore usually considered a "synthetic" cytokinin. The most common form of naturally occurring cytokinin in plants today is called zeatin which was isolated from corn (Zea may)

**Function**

- Stimulates cell division.
- Stimulates morphogenesis (shoot initiation/bud formation) in tissue culture.
- Stimulates the growth of lateral buds-release of apical dominance.
- Stimulates leaf expansion resulting from cell enlargement.
- Promotes the conversion of etioplasts into chloroplasts via stimulation of chlorophyll synthesis

**ABSCISIC ACID**

ABA is one of the most important plant growth regulators. It was discovered and researched under two different names before its chemical properties were fully known, it was called dormin and abscisin II. Once it was determined that the two compounds are the same, it was named abscisic acid. The name "abscisic acid" was given because it was found in high concentrations in newly abscissed or freshly fallen leaves.

**Function**

This are produced in the leaves of plants, originating from chloroplasts, especially when plants are under stress. It acts as an inhibitory chemical compound that affects bud growth, and seed and bud dormancy. In plants under water stress, ABA plays a role in closing the stomata. Soon after plants are water-stressed and the roots are deficient in water, a signal moves up to the leaves, causing the formation of ABA, which then move to the roots. The roots then release ABA, which is translocated to the foliage through the vascular system.

**Gibberellins**

The gibberellins are widespread throughout the plant kingdom, and more than 75 have been isolated and numbered for example, GA1, GA2, and so on. Gibberellic acid three (GA3) is the most widespread and most thoroughly studied. The gibberellins are especially abundant in seeds and young shoots where they control stem elongation by stimulating both cell division and elongation (auxin stimulates only cell elongation). The gibberellins are carried by the xylem and phloem.

**Function**

Experimentation with GA3 sprayed on genetically dwarf plants stimulates elongation of the dwarf plants to normal heights. Normal-height plants sprayed with GA3 become giants.
Ethylene

Ethylene, unlike the rest of the plant hormone compounds is a gaseous hormone. It is produced in all higher plants and is usually associated with fruit ripening.

Function
Helps in fruit ripening and increase respiration during fruit maturation.

Question 7. Write brief notes on the following (Any Four)
   a. Market gardening
   b. Export potential of Horticulture
   c. Drip Irrigation
   d. Use of horticulture tools
   e. Temperate horticulture

ANSWER:-

a. Market Gardening:-
Vegetable farming is done to supply in the market of nearby city.
• It is developed with the urbanization with easy transportation facilities.
• Practiced in suburbs of cities by small size farmer and poor people.
• Too intensive cultivation is practiced.
• Early maturing as well as off season vegetables receive priority.
• Sailing is arranged by the grower.

b. Export Potential of Horticulture: India is IInd largest producer of vegetable and fruit crop next after China. There are many vegetables and fruits which are exported to different countries. Export Fruit: apple, Banana, Citrus, Grape, Mango, walnut
Export vegetable: Cucumber, Garlic, Onion, tomato

Export potential

<table>
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<tr>
<th>S.No</th>
<th>Particular</th>
<th>Export (Rs crores)</th>
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<tbody>
<tr>
<td>1</td>
<td>Fruits</td>
<td>247</td>
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<tr>
<td>2</td>
<td>Vegetables</td>
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</tr>
<tr>
<td>3</td>
<td>Spices</td>
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<tr>
<td>4</td>
<td>Plantation crop</td>
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</tr>
<tr>
<td>5</td>
<td>Flowers</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>Medicinal and aromatic plants</td>
<td>171</td>
</tr>
</tbody>
</table>

c. Drip Irrigation:- Drip means drop by drop. Drip is a system of irrigation in which the water is delivered at or near the root zone of plants drop by drop. This is most water-efficient method of irrigation and is also the means of delivery of fertilizer.
Drip irrigation offers the following specific advantages:
• Proven water savings
• Improved crop yields
- More efficient use of fertilizers
- Used to administer pesticides, improving resistance against pests
- Reduced weed growth
- Energy savings from less pumping and reduced labour costs
- Suitable for marginal lands and those with lower water quality
- Maintained soil quality and improved land productivity as a result.

**Irrigation Methods for Horticultural Crops**

![Irrigation Diagram]

**d. Use of horticulture tools**: Modern day is so advance when farmers are using tools and implements for performing various operations in horticulture. Due the use of suitable implements farmers are getting higher income, timely work and efficient farming.

There are manual and power used implements available for various operations viz. tillage, weeding, soil working.

**Implements used in horticulture** :-

- **Plough** – Used for tillage operation
- **Scekatier** – Used for pruning branches, propagation etc
- **Sowel** – Weed management, soil working, mixing of soil mixture.
- **Pick axe** – Digging of soil, seed bed preparation
- **Garden rake** – Collection of leafs, straw from bed
- **Sprayer** – Spray of chemical and pesticides
- **Power saw** – Used for cutting of branches of fruit crops.
- **Khurpi** – Useful in soil digging, mixing of soil

**e. Temperate Horticulture**: This zone is characterized by low temperature and snow fall during winter months and confined at 1800 to 3500 m altitude. The temperate region covers J&K, HP, part of Arunanchal Pradesh, Uttarakhand and in southern India it covers Nilgiri and Palni hills of Tamilnadu. Only such type of horticulture crop which is resistant to frost and low temperature generally are grown in these area. Example: Apple, Pears, Walnut, Almond, Cherry, Saffron, potato, mushroom, rose, cole crops. In lower elevation Peaches, Plum, lettuce, cole crops, peas apricot, lily and vegetables.