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Introduction

The term "Horticulture" is probably of recent origin and it first appeared in writings of 17th century. This word is derived from the Latin word '**Hortus**' meaning **'garden'** and **'cultura'** meaning 'cultivation'. Today horticulture encompasses more than garden cultivation. The modern 'horticulture' may be defined as the crop science which deals with the production, utilization and improvement of fruits, vegetables, ornamental plants, spices and plantation crops including medicinal and aromatic plants.

The term 'agriculture' refers broadly to the technology of raising plants and animals. On the other hand 'horticulture' which is a part of 'agriculture' in the present context is concerned with raising of so called 'garden crops'. Horticulture deals with enormous number of crops. Garden crops traditionally include fruits, vegetables, spices and plantation crops, ornamental crops including medicinal and aromatic plants.

Horticultural science can be distinguished from agricultural or forestry science in one or more ways.

1. Horticultural produces are utilized in the fresh state and are highly perishable. In contrast, field and forestry crops are often utilized in the dried state and they are usually high in dry matter content.
2. Horticultural crops generally require intensive cultivation warranting a large input, capital, labour and technology per unit area of land, whereas agricultural crops require only extensive cultivation.

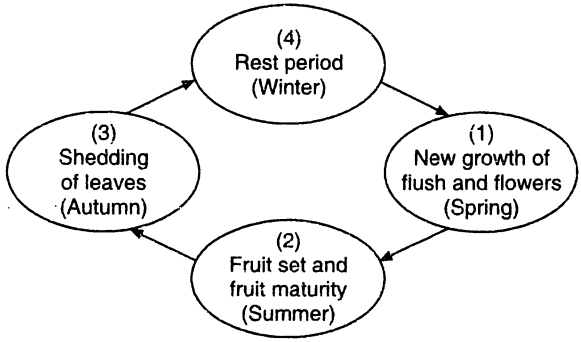
3. Cultural operations such as propagation, fertilizer application, training, pruning, harvesting, post harvest handling and marketing are skilled operations and are specific to horticultural crops.
4. Horticultural crops are the richest sources of vitamins and minerals whereas agricultural crops are generally rich in carbohydrates or proteins.
5. Aesthetic sense or gratification is an exclusive phenomenon of horticultural science.

DIVISIONS OF HORTICULTURE

Scientific horticulture consists of the following divisions:

A. Pomology

Pomology refers to the study of fruit crops. A fruit in horticultural science represents a plant, the product of which is edible on ripening. Fruit crops are classified as 'woody plants' and 'herbaceous plants'. The woody plants may be trees, shrubs or vines. Fruits borne on herbaceous perennial plants may be further classified as those with prostrate growth and upright growth. The woody plants may be either **deciduous** or **evergreen**. Deciduous plants are those which have a distinct 'rest period' during which all growth activities stop. The plants normally shed their leaves before entering into the rest period. This period of inactivity coincides with 'winter'. After the 'rest' (at the end of winter) they produce new growth and flowers. There is a definite cyclic growth in such plants coinciding with a particular season as shown below:



Under South Indian conditions, the plant produces new growth, flowers and fruits in February to June. After July, there is a gradual stoppage of growth and the leaves are shed by October, November and the plants enter into rest.

Evergreen plants do not have any distinct rest period. They retain leaves always. But in such plants there may be a period of comparative inactivity. The plants will not shed their leaves during this period. This period of comparative inactivity generally occurs just before flowering. Based on temperature requirements also, the fruit crops can be classified as temperate, sub-tropical and tropical fruits. Generally the temperate fruits are deciduous and the subtropical and tropical fruits are 'evergreen'. Based on the tolerance to the relative humidity of the atmosphere, the fruit crops can be also classified as arid, semi-arid and humid zone crops. The arid/semi-arid regions have peculiar eco-climatological features and they can exist in tropics, sub-tropics as well as temperate zones also. In these zones, a deficiency of moisture restricts but not necessarily inhibits plant growth. The rainfall in this zone is very low (0-250 mm) and is confined to 2 to 4½ months and the remaining are dry months. Besides, in these regions, higher solar radiation incidence (450-500 cal/cm2/day) and high wind velocity (20 km/hr) results in a high potential evapotranspiration (6 mm/day). The soils are of poor quality, with low fertility level and poor water holding capacity (20 to 25%) and with high infiltration rate (9 cm/hr). Ber, annona, date palm, phalsa are typical examples of arid or semi-arid crops. Mangosteen, litchi and mandarin oranges are examples for humid zone fruits.

An outline of fruit crops with some typical examples are given below.

I. Fruits borne on woody plants:

(i) *Tree fruits*

1. Deciduous (temperate)
   (a) Pome-Apple, Pear, Quince
   (b) Drupe (stone fruits): Peach, Plum, Apricot
2. Evergreen
   (a) Sub-tropical: Mangosteen, Litchi, Sweet Oranges
   (b) Tropical: Mango, Sapota, Guava

(ii) *Small fruits*

1. Deciduous: Raspberry, Blackberry
2. Evergreen: West Indian Cherry

II. Fruits borne on herbaceous perennial plants:

(a) Prostrate growth: Strawberry
(b) Upright growth: Banana, Pineapple

B. Olericulture

It refers to the study of vegetables. Vegetable in horticultural science is an edible herbaceous plant or part their of which is commonly used for culinary purposes or as salads.

C. Floriculture

It is the art of growing, selling, designing and arranging flowers and foliage plants. It includes the following sub-divisions.

1. **Commercial floriculture:** It deals with the cultivation of economic flowers like jasmine, roses, chrysanthemum, production of cut flowers and gift plants.
2. **Arboriculture:** It refers to the growing of trees for aesthetic or scientific or education purpose.
3. **Landscape gardening:** It consists of planning and arrangement of home grounds, public area and business establishments. It involves not only the use and placement of horticultural plants, but also the placement of buildings and other accessories in an aesthetic manner.
4. **Ornamental floriculture or gardening:** It refers to the study of various groups of ornamental plants which are used to decorate indoor and outdoor gardens.

D. Spices, Plantation Crops, Aromatic and Medicinal Plants

Spices are those plants, the products of which are made use of as food adjuncts to add aroma and flavour (e.g. pepper, cardamom, clove and nutmeg etc.). Condiments are also plants, products of which are used as food adjuncts to add 'taste' only (e.g. coriander, cumin etc.). Both spices and condiments contain essential oils which provide the flavour and taste. They are of little nutritive value.

The crops like coconut, arecanut, tea, coffee and rubber are known as plantation crops which are grown in extensive scale. Aromatic plants are those plants, the part of which yields aromatic essential oils on steam distillation or solvent extraction (e.g. Geranium, Patchouli and lemon grasses). The plants yielding alkaloid and steroid principles which have got preventive and curative properties are known as medicinal plants (e.g. *Catharanthus*, Periwinkle, pyrethrum and fox-glove).

Other branches of horticulture include fruit nurseries, seed production in vegetables and flowers, processing in fruits and vegetables, and marketing.

Importance of Horticulture

1. Horticultural crops contribute to **national income**. This can be well judged from the total value of the produce available annually from these crops. Horticultural crops occupy only 13 per cent of the cropped area but their contribution to the national income is roughly 28 per cent of the total value of the agricultural produce. The value of the Horticultural produces has been also increasing steadily. For instance, during a period of 15 years (i.e. from 1970–71 to 1984–85), the average increase in the value has been 336 per cent, while the value of the total agricultural produce has gone up only by 268 per cent during the same period.

   The contribution of horticultural crops to the national income is also perceptible by the annual foreign exchange earnings achieved through their export. The agriculture sector accounts for about 25 per cent of our export basket. Of this, horticultural crops alone account for over 56 per cent. These crops fetch 20–30 times more foreign exchange per unit area than cereals due to higher yields and higher prices available in the international market. In India, horticultural products including fruits, vegetables, their processed products, spices and plantation crops, cut flowers and live ornamental plants and the planting materials such as seeds of vegetable crops and flowering plants are being exported. Since these horticultural crops bring money/ gold to farmers, the development in horticulture is often called as 'Golden Revolution'.

S. No.	*Particulars*	*Exports (Rs. In cross)*
1.	Fruits	143.70
2.	Vegetables	195.00
3.	Spices	240.00
4.	Plantation crops	1,600.00
5.	Flower crops (cut flower, cut foliage, life plants, seeds, tubers, corms)	33.00
6.	Medicinal and Aromatic plants	171.00

2. Fruits and vegetables are regarded as 'protective foods' since they supply minerals such a Calcium, Iron and Phosphorus and Vitamins like A, B Complexes and C in adequate quantities. They also contain a variety of polyphenols which are increasingly regarded as protective agents against chronic diseases. These are required to keep our health in good condition. Iron from fruits are better absorbed and become easily available than the iron from meat. Fruit and vegetables also serve as good laxatives.

For the predominantly vegetarian Indians, the Nutrition Expert Group prescribes daily a minimum of 2400–3900 calories of energy, 55 g proteins, 0.4–0.5 g calcium, 20 mg Iron, 3000 mg of β Carotene for the supply of Vitamin A, 1.2–2.0 mg thiamine, 1.3–2.2 mg riboflavins, 16–26 mg nicotinic acid, 50 mg ascorbic acid, 100 mg folic acid and 1 mg vitamin B12. To obtain this, Dietitians recommend 300 g of vegetables (i.e. 125 g of green leafy vegetables, 100 g of roots and tubers and 75 g of other vegetables) and 90 g of fruits per day. But the per capita availability works to about 30 g of fruits and 92 g of vegetables. This gap has to be bridged by increasing the production and productivity of fruits and vegetables. Recent recommendation from FAO/WHO shows that men and women should respectively consume atleast 800 and 400 g of fruits and vegetables daily to reduce the burden of diseases like diabetics, cardiovascular diseases, obesity and even cancer.

Nutritive value of common fruits and vegetables are furnished in table 1.

Horticultural crops are also good sources of carbohydrates, proteins and fats as indicated below:

(a)	**Protein rich sources**	**Protein content (g/100 g)**
	Agathi (pods and tender leaves)	8.4
	Cluster beans (pods)	3.2
	Peas (green seeds)	7.2
	Curry leaves	6.1
(b)	**Fat rich sources**	**Fat content (g/100 g)**
	Cashewnut	46.9
	Almond	58.9
	Coconut (fresh)	41.6
	Walnut	64.5
(c)	**Carbohydrate rich sources**	**Carbohydrate (g/100 g)**
	Potato	22.6
	Sweet Potato	28.2

3. Horticultural crops yield more produces per unit area compared to cereals

Crops	*Yield (t/ha)*
Fruits (average)	8.4
Banana	40–60
Pineapple	45
Grapes	40
Vegetables (average)	12.2

Table 1. Nutritive value of important fruits and vegetables (per 100 g of pulp).

S. No.	Name	Moisture (g)	Protein (g)	Fat (g)	Minerals (g)	Fibre (g)	Carbo-hydrate (g)	Energy (K. cal)	Calcium (mg)	Phosp-horus (mg)	Iron (mg)	Carotene (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Vita min C (mg)
FRUITS																
1.	Apple	84.6	0.2	0.5	0.3	1.0	13.4	59	10	14	1.0	0	–	–	–	1
2.	Avocado	73.6	1.7	22.8	1.1	–	0.8	215	10	80	0.7	–	–	–	–	–
3.	Banana	70.1	1.2	0.3	0.8	0.4	27.2	116	17	36	0.9	78	0.05	0.08	0.5	7
4.	Ber	81.6	0.8	0.3	0.3	–	17.0	74	4	9	1.8	21	0.02	0.05	0.7	76
5.	Dates (fresh)	59.2	1.2	0.4	1.7	3.7	33.8	144	22	38	–	–	–	–	–	–
6.	Grapes	82.1	0.6	0.4	0.9	2.8	13.1	58	20	23	0.5	3	0.04	0.03	0.2	1
7.	Guava	81.7	0.9	0.3	0.7	5.2	11.2	51	10	28	1.4	–	0.03	0.03	0.4	212
8.	Jack	76.2	1.9	0.1	0.9	1.1	19.8	88	20	41	0.5	175	0.03	0.13	0.4	7
9.	Mango	81.0	0.6	0.4	0.4	0.7	16.9	74	14	16	1.3	2143	0.08	0.09	0.9	16
10.	Orange	87.6	0.7	0.2	0.3	0.3	10.9	48	26	20	0.3	1104	–	–	–	30
11.	Papaya	90.8	0.6	0.1	0.5	0.8	7.2	32	17	13	0.5	666	0.04	0.25	0.2	57
VEGETABLES																
12.	Agathi	73.1	8.4	1.4	3.1	2.2	11.8	93	1130	80	3.9	5400	0.21	0.09	1.2	169
13.	Arakeerai	87.0	2.8	0.4	2.4	–	7.4	44	364	52	38.5	–	–	–	–	–
14.	Ashgourd	96.5	0.4	0.1	0.3	0.8	1.9	10	30	20	0.8	0	0.06	0.01	0.4	1
15.	Cabbage	91.9	1.8	2.1	0.6	1.0	4.6	27	39	44	0.8	1200	0.06	0.09	0.4	124
16.	Carrot	86.0	0.9	0.2	1.1	1.2	10.6	48	80	530	2.2	1890	0.04	0.02	0.6	3
17.	Drumstick leaves	75.9	6.7	1.7	2.3	0.9	12.5	92	440	70	7.0	6780	0.06	0.05	0.8	220
18.	Chillies (green)	85.7	2.9	0.6	1.0	6.8	3.0	29	30	80	1.2	175	0.19	0.39	0.9	111
19.	Field beans	86.1	3.8	0.7	0.9	1.8	6.7	48	210	68	1.7	187	0.10	0.06	0.7	9
20.	Onion	88.6	1.2	0.1	0.4	0.6	11.1	50	47	50	0.7	0	0.08	0.01	0.4	11
21.	Potato	74.7	1.6	0.1	0.1	0.6	0.4	22.6	97	10	40	0.7	24	0.10	1.2	17
22.	Sweet potato	68.5	1.2	0.3	1.0	0.8	28.2	120	46	50	0.8	6	0.08	0.04	0.7	24

Crops	*Yield (t/ha)*
Potato	20–25
Tapioca	30–40
Tomato	10–14
Spices (average)	10–00
Paddy	5–6
Wheat	4–5

4. Horticultural crops generate more employment opportunities, especially in the rural sector, uplifting the rural economy (Table 2).
5. Horticultural crops are also highly remunerative and profitable than cereals. Case studies conducted in many parts of India showed than the net income per ha and the cost benefit ratio for horticultural crops are always higher than the cereals. Globally, fruits and vegetables occupy 7.0 per cent of total arable area while in India, they occupy 13.0 per cent of the total arable area. Similarly, the plantation crops in our country occupy only 2.0 per cent of the total cultivatable land, but they account for about $3/4^{th}$ of total export earnings from all the agriculture commodities.

Table 2. Labour requirement in certain horticultural crops.

Crops	*Labour requirement (Man days/ha)*
(a) Fruits	860
Grapes	2500
Banana	1000
(b) Vegetables	200
(c) Plantation crops	
Tea	875
Coffee	250–390
Cardamom	190
Cereals	143

6. Fruits yield more calorific value. An adult normally requires 11,00,000 calories per year through the food he consumes. This can be obtained from 0.44 hectare of wheat. But the same quantity can be obtained from 0.03 hectare of fruits like banana or 0.06 hectare of mango. Thus, fruits can go a long way to reduce the pressure on food grains such as wheat and rice.
7. Many horticultural produces and their by-products are the important raw materials for many industries, thus providing more employment opportunities e.g. rubber, coir and sago industries. Major developments are taking place in this direction since last few years involving several multinational companies seeking collaboration for setting up fruit and vegetable processing units in India.

8. Social importance: It is a part of civilization, wherever civilization is highly advanced, horticulture is widely developed. Flowers are being used for worshipping Gods in temples. Every woman in our country considers her adornment complete only when her hair is decorated with aromatic and attractive colorful flowers. Flower offering is a symbol of affection in other countries. Often in hotels and business establishment, keeping the cut flowers in vases is becoming very common in India.
9. Horticultural Therapy: In some parts of the U.S.A., people who are unhappy and do not have mental power and balance are given horticultural therapy, a treatment by means of which their attention is diverted to ornamental gardening, flower decoration etc. and thus they are made free from their unhappy mood. Also, by making them to be with flowers of particular colour, the mental stress or depression can be removed.

    Flower therapy or aroma therapy is the art and science of using essential oils from plant sources for keeping us healthy. Although this is well mentioned in early civilization, nowadays, it is gaining scientific, medical and popular recognization. It helps to eliminate stresses and improve overall health without using chemical drugs. The essential oils, found in petals, leaves, roots and heartwood of plants act as anti-bacterial, anti-viral and anti-fungal agents besides help to cure many ailments.
10. Orchard tourism: This new concept is slowly developing in many countries. Visiting orchards for recreation has become an important tourist activity for urban citizens where the tourists are encouraged to hands-on involvement in activities like planting, pruning, grafting and harvesting fruits in order to freely engaged in agricultural production activities, which is now a different experience from their urban life.
11. Government of India is also attaching much importance for development of horticulture by allocating more funds now as evident below:

Plan	*Rs. (in millions)*
Fifth (1973–78)	76.1 (actual)
Sixth (1980–85)	91.3 (actual)
Seventh (1985–90)	241.9 (actual)
Eighth (1992–97)	10,000
Ninth (97–02).	14,000

Recognizing the importance of horticulture sector in the growth of Indian agriculture, Government of India has launched National

Horticulture Mission with the objective of doubling the horticulture production, i.e. to achieve a production of 300 million tonnes by 2011–12, establishing convergence and synergy among various on-going and planned programmes in the field of horticulture development and to promote the development and dissemination of technologies by blending traditional wisdom and frontier knowledge. To meet this objective, a sum of Rs. 6500 crores has been allotted during X Plan.

Agro-climatic Zones for Horticultural Crops

The Horticultural crops show repetitive wider adaptation and therefore exact delineation of the agro-climatic areas specific to each crops is not possible, except for the typical temperate and tropical species. However, our country can be broadly divided into seven zones for horticultural crops as indicated below:

1. **Temperate Northern region:** Comprising of states of Jammu and Kashmir, Himachal Pradesh, hilly areas of U.P., West Bengal. Temperate fruits, cool season vegetables are the important Horticultural crops in this zone.
2. **North Western arid region:** Comprising of the entire Rajasthan states, Gujarat and parts of Punjab and Haryana. Arid fruit crops like Ber, Pomegranate, Aonla, Date palm, wood apple and seed spices like coriander, cumin, fennel occupy major area in this zone.
3. **North Eastern sub-tropical humid regions:** Comprising of states and union territories like Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. Fruits like Banana, Pineapple, Citrus, Jack besides plantation crops like tea and large cardamom are also grown here.
4. **North Central sub-tropical region:** Includes parts of U.P. Bihar, entire M.P. and parts of Maharashtra. Mango, Sapota, Sweet Oranges, Guava are grown here.
5. **South Central tropical region:** Includes the central area bordered by the Western and Eastern ghats in the states of Tamil Nadu, Andhra Pradesh, Karnataka and parts of Maharashtra. Mango, Guava, Sapota, Pineapple, Turmeric etc. are chiefly grown here.
6. **Coastal tropical humid region:** The entire coastal region stretching along the Bay of Bengal in the east and Arabian sea in the west comprises of this region. Bananas, Mango, Cashew, Coconut are the major crops.
7. **Southern hilly zone:** Comprising of Western ghat and Eastern ghat hills above 800 m MSL, where Coffee, Tea, Cardamom, Pepper, Oranges, Pineapple etc., are extensively grown.