NATIONAL OPEN UNIVERSITY OF NIGERIA

CRP 304

Principles of Horticultural Crop Production

Module I

CRP304 (Principles of Horticultural Crop Production) Module 1

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Module 1 Principles of Horticultural Crop Production
Unit 1 Definition and History of Horticulture

1.0 Introduction

Agriculture is generally regarded as cultivation of crops and rearing of animals for man and industrial uses. Agriculture has many branches which interplay in achieving agricultural aims and these branches include, agronomy, animal Science, crop science, horticulture, agric economics, agric extension, plant breeding, crop protection etc. one of these branches, horticulture, forms the basis of this course and we shall discuss it in details as we progress in the course.

2.0 Objectives

At the end of this unit, you should be able to:

- define horticulture
- give examples of horticulture
- give a brief history of horticulture.

3.0 Main Content

3.1 Definition of Horticulture

The word horticulture is derived from two latin words "Hortus" meaning garden and "Culture" meaning the cultivate. Horticulture is therefore concerned with the cultivation of garden plants such as fruits, Vegetables, flowers and ornamental plants. Horticulture may be defined as the science and art of growing fruits, vegetables, flowers, plantation crops and ornamental crops for man, industrial and aesthetic uses. When horticulture is considered from both the science and business perspectives, horticulture can be broadly defined as the science and art of cultivating, processing and marketing of fruits, vegetables, flowers and ornamental plants. Horticulture is a branch of agriculture. Horticulture is subdivided into five; namely pomology, olericulture, floriculture, arboriculture and landscaping.

a. Pomology: - The science and practice of fruit production.
b. Oleiriculture: - The science and practice of growing vegetables.
c. Floriculture: - The science and practice of production of flowers and ornamentals.
d. Arboriculture: - The science and practice of growing and caring for ornamental trees.
e. Landscaping: - The science and practice of using plants outdoor for aesthetic and functional purposes.

3.2 History of Horticulture

Horticulture is as old as mankind since man cannot survive without food. The concepts of garden culture can be traced as far as 3, 000 BC or beyond in Egypt. Historical evidence shows that by this time crops such as grapes, dates, olives and onions have been brought

under cultivation by Egyptians and the technology such as land preparation, pruning, irrigation drying etc had also been used. The hanging garden of Babylon which was of flowers and fruits was hailed as one of the seven wonders of the ancient world. During the Middle Ages (500 – 1500 CA), horticultural plants were grown in protected areas surrounded by high walls or similar structures in temperate Europe. As society evolved, deliberate cultivation and domestication of edible plants replaced the less efficient food gathering habits of primitive societies. Agriculture, particularly horticulture, is therefore not a modern day invention but one that continues to be transformed as society advances technologically. The idea of intensive management of horticultural crops still holds today even though some of the vegetables like tomato are grown in the field like other filed crops. At present, the fields of horticultural crops are not only grown within the home gardens but also in large quantities as commercial enterprises. Many researches have been conducted aimed at solving the problems of growing horticultural crops and a comparatively large volume of scientific information on behavior of horticultural plants and products have been made available.

4.0 Conclusion

Horticulture is a branch of agriculture which compliments crops science or agronomy in production of crops such as fruits, vegetables and nuts and it apply agronomic practices in its production, processing and marketing.

5.0 Summary

In this unit, you have learnt that Horticulture is derived from two latin words "Hortus" meaning garden and "Culture" meaning cultivation Horticulture is defined as the science and art of cultivating, processing, marketing of fruits, nuts, vegetables and ornamental plants. You have also learnt that history of horticulture dates back to about 3, 000 BC onions, olives, grapes, etc. were brought under cultivation in Egypt and these ideas of cultivation of horticultural crop still holds today.

6.0 Tutor -Mark Assignment

1. Define horticulture
2. Give a brief history of horticulture
3. List 3 horticultural crops

7.0 References/Further Reading

George, A. (2004). *Horticulture- Principles and Practices*. (2nd ed.). Eastern Economy Limited. Pp 3-720.

Lawrence, K. O. (2005). *Tropical Commodity Tree Crops*. (2nd ed.). Spectrum Books Limited. Pp 1-70.

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Unit 2 Classification and Importance of Vegetables and Fruits in Nigeria

1.0 Introduction

Horticulture is the science and art of production, processing and marketing of Vegetables, fruits nuts and ornamental plants. All crops or plant that constitutes horticultural crops are classified or grouped according to their uses, production or their type of product they produced. The unit you are about to study deals with the classification of horticultural groups.

2.0 Objectives

At the end of this unit, you should be able to:

- classify horticultural crops based on their life cycle
- classify horticultural crops based on their climate requirement
- classify horticultural crops based on their growth habits
- state the importance of vegetables and fruits in Nigeria.

3.0 Main Content

3.1 Classification of Horticultural Crops

From time to time, horticultural crops have been classified into various groups depending on their growth habits, cultivation requirements, climate needs and uses. Horticultural crops are popularly classified into 3 broad groups of fruits and nuts, vegetables and flowers or ornamentals.

3.1.1 Classification Base on Use of Horticultural Plants.

A) Vegetables

i. Vegetables grown for the aerial edible parts (above the soil), include

a) Cole crops – Vegetables that have curled leaves e.g. Cabbage, cauliflower
b) Pulse crops – Vegetables that produce pods e.g. pea, bean or green bean.
c) Solanaceous fruits – Vegetables that produce fruits and tuber e.g. tomato, pepper, garden eggs, potato
d) Green of leafy Vegetables – Vegetables, that produce leafs e.g. Amaranth, bitter leaf, water leaf, spinach.
e) Salad crops – Vegetables that produce their product in vine e.g. melon, cucumber, pumpkin.
f) Corn vegetables e.g. popcorn, sweet corn.

ii. Vegetables or plants grown for the underground edible portion or parts.

a) Root crops e.g. carrot, potatoes, Irish, Cassava.
b) Tuber crops e.g. yam, cocoyam.
c) Bulbs crops e.g. onion, garlic.

B) Fruits
i. Temperate fruits – fruits from cooler regions of the world
a) Tree fruits e.g. apple, peach.
b) Small fruits e.g. grapes vine, straw berry.
c) Nut fruits e.g. peach, walnut.

ii. Tropical and subtropical fruits (Hot regions) of the world
a) Tree fruits e.g. citrus, mango, guava, cashew
b) Herbaceous perennial fruits e.g. banana, plantain, pineapple.
c) Nut fruits e.g. cashewnut, datenut, aracanut.

C) Flowers and Ornamentals
i. Flowers e.g rose flower, marigold, sun flower
ii. Lawns e.g. carpet grass, bahama grass
iii. Hedges e.g. gambogi, croton yellow
iv. Trees e.g. Christmas tree, umbrella tree, neem tree

Other classifications of horticultural crops are given below base on certain important criteria.

3.1.2 Classification Based on Growth Habit

This is according to the growth nature of the crops and this include.

a) Herbs e.g. Ageratum
b) Shrubs e.g. Hibiscus
c) Trees e.g. Mango, citrus
d) Climbers e.g. Bougainvillea
e) Creepers e.g. Bignonia, gracillis

3.1.3 Classification Base on Life Circle of the Crop

a) Annual or seasonal crops – Those that complete their life cycle within a year e.g. marigold, Amaranth, tomato, Irish.
b) Biennial crops – Those that requires two years or at least two growing season to complete their life cycle e.g. Cassava, yam.
c) Perennial crops – Any plant that lives for more than two years to 35 years e.g. mango, citrus, grape vine, guava.

3.1.4 Classification Base on Climatic Requirement

This is based on the temperature need of the crop and this are grouped into

a) Temperate crops – These are horticultural crops found in cold regions of the world e.g. apple, almond etc.
b) Tropical crops – These are horticultural crops that do not tolerate severe cold but can tolerate warm temperature e.g. banana, papaya, pineapple.
c) Sub-Tropical crops – They need warmth and humidity and can tolerate mild winter e.g. fig, mango, cashew nut.

Self- Assessment Exercise

i. Classify horticultural crops based on their edible aerial portion and give 2 examples each.
ii. Classify horticultural crops based on climatic requirements.

3.2 Importance of Vegetables and Fruits in Nigeria

The importance of vegetables and fruits in Nigerian economy cannot be overemphasised. Just as crops and animals play a vital role in the economy of Nigeria, so do vegetables and fruits play vital roles in individuals, community and the country at large. Vegetables and fruits provide the following;

1. Provision of Food – Vegetables and fruits are sources of food which provide carbohydrates, vitamins, minerals and water to humans and animals. Plant source of food are usually regarded as good and natural source of food for human and animals.
2. Provision of Income – Provision of income per unit area yield of horticultural crops is very high as compared to field crops. This high yield per unit area invariable leads to high returns per unit area which means that the income of the farmer is significantly increased. This therefore, helps reduce poverty.
3. Source of Raw Material – Vegetables and fruits provide raw materials for industries such as fruit juice industries, pharmaceutical industries as well as oil mills. This helps to reduce importation of the raw materials and hence reduce cost of production.
4. Provision of Employment – Those that are involved in the production, processing and marketing of vegetables and fruits are usually self employed or employed by industries that use these products as raw materials. This reduces idleness and level of unemployment in the country.
5. Uses Waste and Undulating Lands – Fruits and Vegetables can be grown in land where the gradient is uneven or where the land is undulating. Mango, cashew, Vegetables can be grown on large scale on hilly area.
6. Source of Foreign Exchange – When Vegetables and fruits are exported to other countries this serves as foreign exchange for the country and this increases the country's economy.

3.3 Importance of Vegetables in Human Diet

1. Vegetables supply most of the nutrients that are deficient in other food materials. This includes supply of minerals, especially calcium and iron.
2. Vegetables are acid neutralisers e.g. Okra, Corchorus Spp neutralises the acid produced from the some fruits.
3. Vegetables prevent constipation and promote digestion as a result of fibres/roughages obtained from Okra, Cucumber, Amaranthus, Lettuce and Cabbage.
4. Vegetables are rich sources of vitamins A, B, and C which helps to lower susceptibility to infection. e.g.: Carrots, Sweet Corn, Amaranthus And Celosia provide Vitamin A; Bitter leaf, Water leaf, Solanum and Celosia provide Vitamin B; Tomatoes, Carrots, Lettuce, Cabbage and Amaranthus provide Vitamin C.
5. Some vegetables are rich sources of carbohydrate e.g. Potatoes, Sweet Corn, Carrot etc.
6. Green beans and peas are cheap sources of protein. Vernonia (Bitter leaf), Amaranthus and Telfeira provide some amount of protein in human diet.
7. Vegetables are generally needed to have balanced diets and overcome nutritional deficiencies.
8. Vegetables make our staple food more palatable and enhance their intake.

4.0 Conclusion

In this unit, you have learnt that horticultural crops are as important as other field crops and that their production should be encouraged at all level of production. This would help in reducing poverty and create employment for the unemployed.

5.0 Summary

You have learnt that horticultural crops can be classified based on their uses, climatic requirement or growth habit. According to their uses, horticultural crops are classified as vegetables, fruits and flower and ornamentals. Based on climatic requirements, they are classified as temperate, tropical and subtropical while base on life cycle they are classified as animal, biennial and perennial.

You have also learnt that horticultural crops (vegetables and fruits) have the following importance;

- Provision of income
- Provision of food
- Provision of employment
- Provision of foreign exchange
- Provision of raw materials

6.0 Tutor- Mark Assignment

1. Explain briefly the importance of fruits and vegetables.
2. Give the classification of horticultural crops based on their life cycle and cite examples.

7.0 References/Further Reading

George, A. (2004). *Horticulture- Principles and Practices*. (2nd ed.). Eastern Economy Limited. Pp 3-720.

Lawrence, K. O. (2005). *Tropical Commodity Tree Crops*. (2nd ed.).Spectrum Books Limited. Pp 1-70.

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Unit 3 Scope and Distribution of Vegetables and Fruits Grown in Nigeria With Reference to Climate and Soil

1.0 Introduction

Horticultural crops are classified based on climatic requirements into temperate, tropical and sub tropical crop and this is based on temperature requirement of the crop. Some crops require low temperature and they are grown in temperature climate. Based on climate and soil, horticultural crops are dispersed and found in different part of the country. The unit you are about to study deals with the distribution of horticultural crops in Nigeria based on climate and soil.

2.0 Objectives

At the end of the unit, you should be able to:

- give the scope of horticultural crops in Nigeria
- explain the distribution of vegetables and fruits with reference to climate and soil
- state crops that are found in different climatic regions of Nigeria.

3.0 Main Content

3.1 Scope of Horticulture

Horticultural crops constitute a significant component of total agricultural production of any country. Environmental, soil and biotic factors such as diseases, pest and to a lesser extend of demand of horticultural crops determines the level of production. In Nigeria, horticultural crops are grown all over the country. Horticultural crops are found in an area depends on the suitability of the climate, culture and demand of the commodity. Fruits and nuts are scattered in the country with their concentration in the southern part of the country.

3.2 Environmental, Soil and Biotic Factors affecting Horticultural Crop Production

The successful production of any crop depends on the suitability of the environment. Climatic (a biotic), edaphic (soil) and biotic factors determine the distribution of horticultural crops in Nigeria and the world in general.

3.2.1 Climatic factors

a) Rainfall – This is basically a natural means of water supply to plants. Water is very important because 70 – 80% of the fresh weight of herbaceous plant is water. For woody plants, water constitutes about 50% of their fresh weight. Water acts as a medium for uptake of nutrients and also for transportation of substances within the

plant body. It is a primary raw material in the process of photosynthesis and it's also required for the maintenance of turgor pressure in plant stomata which controls its opening to permit exchange of gases between plants and the environment. Water is needed by the plants to replace the one lost by transpiration.

The plant losses about 98% of the water absorb through transpiration. The water requirement of plants varies with species and age of the plant. Irrespective of the species, the water needs increases as the plant increases in size. Lack of moisture makes the air less humid, thereby increasing its drying power. The rate of plant processes such as transpiration, diffusion and evaporation are affected directly by lack of moisture. Excessive moisture exposes plants to diseases and causes lodging (falling of plants). Horticultural plants grown indoors are sometimes given a misty spray of water (irrigation) to increase the humidity of the plant environment, especially in winter when the heaters are turned on to warm the building.

b) Temperature – The response of plants to temperature varies among species. For every plant species there is an ultimate temperature range within which it can grow and reproduce. In general, most horticultural crops grow and produce between 15°C. Horticultural crops can be classified according to their response to temperature as follows.

i. Hardy Plants – Plants that withstand low temperature but cannot grow under high temperature. These are basically temperate crops such as Carbage, Cole flower and apple.

ii. Tender or Tropical Crops – Plants that withstand high temperature but cannot tolerate low temperature. That is, they grow under warm to high temperature. E.g. Banana, Mango, Okra. Response of plants to temperature varies with the stage of growth of the plant. For example, the seedling of crops is more easily damage due to high temperature. Different parts of plant also response differently to temperature. For example the flowers are more susceptible to high temperature than the vegetative parts. Roots are more susceptible to low temperature than the aerial part. The response to temperature also depends on the duration and the degree of temperature extremes. High temperature especially night temperature has an adverse effect on plants because it increases respiration and hence, decreases food reserves. High temperature also prevents tuber initiation in crop such as potatoes and root formation e.g. in carrot.

There is also indirect effect of high temperature on plants. High temperature increases the activities of pest and disease organisms. It also has adverse effect on flowering and fruit formation e.g. in tomatoes, high temperature reduces the number of flowers and fruits formed. It has been shown that maximum fruit formation will require a night temperature of 21°C. Low temperature is undesirable since it reduces germination, slows growth and result in fruit damage.

c. Light – Light for plant growth comes primarily from the sun. The role of light in the growth and development of horticultural plants depends on its quality, quantity and daily duration. When plants are grown indoors, artificial lightening is required. The most readily recognised role of light is in photosynthesis, but it also has other important functions such as seed germination in some horticultural species. The responses to light also vary among plants species. The light factors have three aspects. These are quality, intensity and duration.

i. Quantity – This refers to the wavelength of light. This aspect is affected by cloud cover. When there is continuous cloud cover, the quality of light reduces and this result in poor fruit colour. The visible light ranges between about 390 – 735 nanometer

wavelengths and most of the radiation reaching the earth from the sun falls within this range.

ii. Intensity – This refers to the quality of light or quanta. Some plants grow under full sunlight e.g. maize, and tomato and they are called the sun plants while some plants like asparagus and chrysanthemum do not do well under bright light and are called shade loving plants. Some other plants need shade at certain stages e.g. seedling of cocoa. Sunlight intensity at midday is about 10,000 foot candles of this quantity, many plants can effectively utilize only about 50% of the light for photosynthesis.

a) Duration – This refers to the number of hours of light received on the basis of light requirement for flowering. Plants can be classified into three groups on the basis of light duration.

b) Longday Plants – These plants flower only under day length longer than 14 hours e.g. onion, peas, lettuce.

c) Short Day Plants – They flower at day length less than 10 hours e.g. citrus.

d) Day Neutral Plants – Many tropical crops are day neutral plants and they flower at day length of 12 hours e.g. tomato, maize.

e) Humidity – The water content of air is called humidity and is measured in units of relative humidity (RH) by using an instrument called a psychrometer. Humidity depends on vapour pressure (concentration of water vapour in the air) and temperature. Relative humidity decreases when temperature increases and water vapour remains constant. The amount of water needed by a plant for normal growth is directly related to the humidity or water content of the air. Relative humidity is a very important factor affecting the growth and development of horticultural plants as it is a products of rainfall and temperature. Some crops requires high humidity e.g. banana. Other plants require high humidity at one time and low humidity at another time e.g. mango requires high humidity for growth but for flowering, low humidity is necessary. Low humidity is required for drying crops like maize. High humidity has the disadvantage of encouraging attack by pests and diseases.

3.2.2 Soil

The soil is the primary medium for crop growth. The climate plays a significant role in determining the types of soils in which crop may be grown. This role comes from the fact that climate is a primary factor in the dynamic process of soil formation called weathering, which is the process by which parent materials (the rocks from which soils are formed) are broken down into small particles. The type of soil formed affects the kind of vegetation it can support, which in turn further impacts on the process of soil formation by influencing the organic matter and nutrient content of the soil. Soil formation is a continuous process.

The role of soil in horticultural crop production is to provide physical support and a source of nutrients and moisture for growing plants. In terms of nutrition, soils may be described as fertile, marginal or infertile. Soil nutrients are depleted with years of use and need to be replenished periodically. The soil may not be rich in native nutrients, but for it to be useful for crop production, it should at least be capable of holding water and nutrients for some time. If this condition does not exist, the grower or farmer should make provision to supply supplementary nutrition to prevent deficiency problems. To be of any use for crop production, the soil should be able to permit root development for good anchorage while supplying adequate nutrition.

3.2.3 Biotic Factors

Biotic stand for living organisms that causes either diseases or damage crops. Climate influences plant diseases and insect pests. For a disease condition to occur there must be a susceptible host, pathogen and favourable environment called the disease triangle. Disease will not occur unless all three factors are present. However, disease can occur to varying degrees. Local weather conditions may favour the development of certain pathogens or expose plants to diseases by lowering their resistance. Many insects have a short life span therefore; changes in the climate can adversely affect their population and effectiveness at any stage of their life cycle. Certain insects proliferate (increase in population) in specific seasons and occur in low populations in others.

The soil surface contains organisms that are microscopic and largely pathogenic to plants. Other large bodied organisms that occur in the environment can help or harm plants. For example birds help in seed dispersal and bees and butterfly in flower pollination. On the other hand, rodents e.g. rats harm plants in the field in a variety of ways. Seeds may be eaten before they have a chance to germinate. Mature fruits may be eaten before harvest; plant stems and foliage may be eaten by herbivores such as deer, rabbits, monkeys etc.

Self- Assessment Exercise

i. List the climatic factors that affect horticultural crop production
ii. Briefly explain light intensity as it affects horticultural crop production.
iii. List 3 biotic factors affecting horticultural crop production.

3.3 Distribution of Vegetable and Fruits Grown in Nigeria with Reference to Climate and Soil

In Nigeria, the rainfall is highest in the southern region, with a mean of about 3, 000mm per annum. As you move inland, the amount and duration of rainfall decrease. The northern part of the country records less than 400mm of rainfall per annum. The variation of temperature increases as you get inland, for example, in the southern part of the country, the mean maximum annual temperature is about 30°C while the mean minimum annual temperature is 22°C. In the northern parts of the country, the mean maximum annual temperature is 19°C. Generally, temperatures are higher in the south throughout the year than in the north. The cooler period of the year which corresponds with dry season of the north is between the month of November and February. During this cool season, temperatures are lower in the north and this is the best season for vegetables production. With regards to humidity, the southern part has relatively high humidity throughout the year while in the northern part; relative humidity could go below 10% especially during the dry season.

From the above discussion we can understand that the country is divided into two distinct parts southern or forest zone where rainfall is about 1500 – 3000 mm, the temperatures are high. The zone favours the production of tropical fruits such as banana, pineapple and vegetables like cassava and yams. Temperatures tend to be too high for certain crops even though the high rainfall is suitable. Cloud cover limits the intensity and duration of sunlight which limit the growth of certain vegetables that require bright sunlight. The major disadvantages of the forest zone to horticultural crop production are high rain fall, high

temperature and high relative humidity which encourage disease conditions. The savanna zone is more adaptable to horticultural plants such as citrus and many tropical crops but for many of temperate crops the temperature tends to be a limiting factor. These crops such as carrot, lettuce and cabbage can only be grown successfully during the cool, harmattan period. However, there is a general scarcity of water the during the dry or harmattan period as such the favourable condition established for vegetables during this season is not fully utilised except where irrigation facilities can be provided.

4.0 Conclusion

Horticultural crops are grown everywhere in Nigeria but the horticultural crop found in crop production depends on the climatic, soil and biotic factors which determine the growth and development of the crop. Before cultivation of any horticultural crop, the grower has to take these factors into consideration so as to choose the crop that will grow best in his environment.

5.0 Summary

In this unit, you have learnt that the success of horticultural crop production depends on climatic, soil and biotic factors. Environmental factors include rainfall, light, temperature humidity and wind while the biotic factors include all organisms that can cause disease or damage crops such as pathogen, pests, predators, bird etc. You have also learnt that the distribution of vegetables and fruits in Nigeria is characterised also by the above factors. While most tropical tree crops are found in the southern part of the country because of their high water requirement, most vegetables are found in the northern part of the country due to moderate rainfall in the area.

6.0 Tutor- Mark Assignment

1. Discuss the distribution of vegetables and fruits as affected by climate
2. Briefly explain biotic and soil factors of affecting horticultural crop production.

7.0 References/Further Reading

George, A. (2004). *Horticulture- Principles and Practices*. (2nd ed.). Eastern Economy Limited. Pp 3-720.

Edmond, J. B., Senn, T. L., Andrews, F. S. & Halfacre, R. G. (1975). *Fundamentals of Horticulture*.(1st ed.). McGraw-Hill Book Company. Pp 183-219.