UNIT 2 CLASSES OF CROPS

CONTENTS

1.0 INTRODUCTION

The grouping of crops probably evolved with their domestication from wild ancestors, and concurrent selection for various uses to satisfy man's needs for food and non-food purposes. This may account for their initial classification on the basis of their economic importance in terms of the consumable parts of the plant. Thereafter, the development of scientific agriculture gave rise to other methods, especially the classification based on nomenclature or binomial system. The use of botanical characteristics is of fundamental scientific significance in crop identification. However, grouping on the basis of economic (agronomic) role in human survival, ranging from food production, fibre supply especially for clothing, and industrial conversion of crops as raw materials to useful products and by-products, is by far the most popular basis for classifying crops, and also the most emphasized in the literature.

2.0 OBJECTIVES

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

- the various ways of grouping crop plants
- why cultivated plants are regarded as primary contributors to national GDP in Nigeria.

3.0 MAIN CONTENT

3.1 Classification Based on Nomenclature i.e. Binomial System

This scheme was formulated by Linnaeus, as a universally acceptable system of naming plants, animals and minerals. This scheme groups plants into divisions, sub-divisions, classes, orders, families, genera, species, subspecies and varieties. Plants are either seed-producing (division Spermatophyta) or non-seed producing (viruses, bacteria, algae, fungi, lichens, mosses and liverworts, ferns and horsetails). Spermatophytes are the most highly evolved and structurally complex plants and are separated into two classes, namely

3.1.1 Class Gymnospermae

These are plants that produce naked seeds, usually in cones which constitute the female organs. They often exhibit structural adaptations to reduce water loss. It comprises the others: Ginkgoales, Coniferales (the most important to horticulture), Cupressaceae and Taxaceae.

3.1.2 Class Angiospermae

These plants produce seeds that are protected by fruits and have flower structures as the means of sexual reproduction. Many of the families are important to horticulture, both as crop plants and weeds. The sub-classes are:

i. Sub-class Monocotyledonae- contains some horticultural families such as Liliaceae (tulips, onions), Amaryllidaceae (daffodil family), Iridaceae (Iris family), Graminae (all grass species).

ii. Sub-class Dicotyledonae- has many more families significant to horticulture, including the Compositae (e.g. chrysanthemum); Cruciferae (e.g. cabbage, Brussels sprouts); Rosaceae (e.g. apples, pear, rose); Leguminosae (Fabaceae, e.g. pea and bean family, pod-priducing and contain starchy seeds), Solanaceae (e.g. potatoes, tomatoes), Cocurbitaceae (e.g. cucumbers, marrows), Labiatae (mostly culinary herbs), Cactaceae and Crassulariaceae (widely used as ornamentals); and Aceracea (e.g. common sycamore, ornamental *Acers*); and Salicaceae (e.g. willows).

Generally, plants are identified by means of the composed *generic* and *specific* names viz. chrysanthemum as Chrysanthemum (*genus*) morifolium (*species*).

3.2 Classification Based on Botanical Characteristics

Crop plants are grouped into monocotyledonous species (species having only one seed-leaf or cotyledon) and dicotyledonous species (species having two cotyledons in their seeds). Typical examples of monocots are cereals (maize, barley). Dicot crops include legumes/pulse crops (cowpea, soybean, alfalfa).

3.3 Classification Based on Duration of Crop Growth

This scheme groups crops into:

i. annuals- crops which complete their life cycle in one year e.g. maize, cowpea, tomato, soybean, amaranthus okra and yam.
ii. biennials- crops which complete their life cycle in two years e.g. cassava, brassicas,
iii. perennials- crops which live for more than two years or year-in-year-out e.g. cacao, rubber, plantain/banana, oil palm, ginger and sugar-cane.

3.4 Classification Based on Economic/Agronomic Importance

This scheme groups crops variously by the use of the parts consumed directly, their food and non-food nutrients, or indirectly by man for the provision of food, fibre and other essential purposes. The groups include:

i. Starch Plants - These are crops grown primarily for their high calorific value in human diets as starch, carbohydrates and sugar. However, a larger part of the crop is processed into pure starch used in industries for sizing threads and cloth finishing, in pharmaceutical preparations, as powder in cosmetics and medicines, drying material, for glues (pastes), filter (as dextrin, sugar, dextrose, maltose and fructose syrup). Examples include cereals (maize, rice), pseudocereals (rye, oats), roots (cassava, Irish potato) and tubers (yams, sweet potato) and others (breadfruit, banana).

ii. Sugar Plants - These crops are essentially grown for the production of sugar. The sugar is used in sweetening drinks, baked foods, enhancing flavour in many food preparations, canning industry, and production of sweets. Examples are sugar-cane, sugar beet, and others such as sugar palm, sugar-rich *Sorghum* and agaves.

iii. **Oil Plants-** These are crops grown essentially for their oil supply. The production of oil plants ranks third in world production in terms of value, after starch plants and fruits, and higher than that for beverages and stimulants, and sugar. Over 90% of the plant oils are used as edible oil in human diets and the remainder for technical purposes. As edible oil, they supply vitamin A (e.g. carotenoids), vitamin E (tocopherol) and ergosterol (pro-vitamin D2), phospholipids and sterols, and are used for drying fat. Technically, they have varied uses including making soaps and detergents, as suppositories, and for lighting and burning. Plant oils include cooking oils (e.g. oil palm, soya oil), vegetable butter (e.g. cacao butter, sheabutter), salads and margarine (e.g. sesame), and technical oils (e.g. *Brassica juncea*, coconut, linseed).

iv. **Protein-Providing Plants-** These are crops desired for their protein value in human diets. Plant proteins mostly contain insufficient quantities of essential amino acids and therefore, inferior to animal proteins. However, they contribute a significant proportion of the world protein supply, especially cereals which contribute the largest proportion of the plant protein supply, followed by oilseeds especially soybean. The "true" protein plants, the pulses crops (cowpea, soybean, pigeon pea, lentils, lupins), contribute only a small portion.

v. **Vegetables-** This group of plants is found in a variety of crop species, including cereals, seasonings, roots and tubers, legumes, fruits, and oil seeds. Vegetables are of great significance in the tropics and subtropics as food (supplying minerals, vitamins, proteins) and as commercial products of market gardening. Leaf vegetables are important sources of protein in the tropics. Examples of vegetables are leaf vegetables such as jute mallow, cabbage, spinach, lettuce, fluted pumpkin), fruit vegetables (tomato, cucumber, melon, gourd, eggplant, calabash, peppers, okra) and root vegetables (carrots, turnips, radish, beetroot, clove, sweet potato). Other crops are sweet corn, asparagus, cauliflower, cocoyam, sweet potato, Irish potato, and seed legumes such as beans.

vi. **Fruits-** These are crops grown and then, eaten for their refreshing and aromatic taste which give pleasure to human, and even, animal consumers. They have a very important role in human nutrition and health. They contain substances which regulate and stimulate food digestion, organic acids which act as mild laxatives or diuretics, and pectins and phenolic compounds, which regulate pH in the intestine, thereby normalizing the

intestinal flora. The compounds also act bacteriostatically, virostatically and detoxify heavy metals. Examples are many fresh fruits (cashew, mango, grapes, avocado) and dry fruits (dates, figs, muskmelon, watermelon).

vii. **Nuts-** These are fruits with dry shells (hazel nuts), parts of fruits (coconuts, walnuts), or seeds (Brazil nuts), which, due to their pleasant flavour, are eaten raw, roasted or cooked. Thus, they are widely used in confectionery as aromatic agents and in other foods. They have a high nutritional value in respect of their energy and protein contents. Other examples are peanuts, chickpeas, sunflower seeds, cashew nuts, chestnuts, almond, macadamia and pecan nut.

viii. **Beverages, Masticatories and Stimulants-** These are plants which contain chemical compounds that increase the physical and mental effectiveness, quench thirst and hunger, break down psychic inhibitions, or produce fantastic dreams. Some stimulants are only for consumed their aroma (caffeine-free, coffee substitutes and nicotine-free tobacco). The active constituents (caffeine, theobromine, morphine, codeine, cocaine, arecoline, glucoside) of some stimulants are used in other areas of activity. Examples include coffee, tea, cacao, kola nuts, betel-pepper, tobacco, quinine and opium.

ix. **Spices-** These include all culinary herbs, seasonings and condiments of vegetable origin. They are used for improving the taste of foods in food industry, beverages industry and technical raw materials. They serve as medicinal plants (e.g. Cinchona spp.), stimulate the flow of saliva and the secretion of enzymes (protein and fat digestion) in the stomach-intestinal systems. Other examples are mustard, black pepper, onion, clove, pepper, vanilla, ginger, hop, sweet basil, garden thyme and nutmeg.

x. **Medicinal Plants-** To the agriculturalist, the most important medicinal plants are those containing active constituents which cannot be synthesized by the pharmaco-chemical industries (or only at very high cost), and which cannot be substituted by other compounds e.g. alkaloids (e.g. Cinchona, Datura, Papaver), Digitalis glycosides, flavonoids and mucilages. They include many spices and stimulants. However, they are of very little economic importance to the cultivator but of great importance to the pharmaco-chemical industries.

xi. **Essential Oils-** These are volatile substances. They, therefore, have distinct odours and thinness for paints (turpentine oil,

camphor oil). They are used in perfume industry and for cosmetic articles such as soap, ointments and powder; for technical purposes as solvents and floatation agents, for masking smells in plastics, artificial leather, rubber, floor wax and household sprays. Also, they are valuable in pharmaceutical preparations because of their specific effects (anise oil, fennel oil, camomile oil), their antiseptic properties and to improve taste (toothpaste). Examples are citrus oils (peel oils from lemon, lime, mandarin, grapefruit, bergamot), leaf oils (petitgrain oils), flower oils (orange flower oils, neroli oil from bitter orange), and grass oils (citronella oil, lemon grass oil, vetiver oil, palmarosa oil).

xii. **Fibre Plants-** These are plants grown for use in weaving a great variety of household and commercial materials. They are highly valued in textiles and curtains (flax, sunn hemp, cotton), packaging and paper materials (particle boards and composites), floor coverings (jute, kenaf, agave fibre, door mats from coir), making tear-proof paper (halfa grass), brooms, basket-work and building materials (piassava, sorghum, agave fibres, raffia and other palm fibres).

xiii. **Elastomers-** These are natural and synthetic polymers with rubber-elastic properties. The natural elastomers are polyisoproprenes which are either caoutchouc (with highly elastic properties or gutta-percha, with slight elasticity but having strongly thermoplastic properties (softening at high temperatures; and hardening at room temperature). Polyisoprene is concentrated in the vacuoles of cells, especially in the latex tubes. Elastomers are very useful in making tools (e.g. knife handles), natural rubber (vehicle tyres, packings, break pads, insulators, driving belts, golf balls), as a caulking material for boats and containers, and for making toys, chewing gum and wax. Like milk, elastomers are used for coffee, manioc diseases etc., and are of medicinal importance. Examples of plants are rubber (cautchouc), guoyule and gutta sundek.

xiv. **Resins and Gums-** Resins are complicated mixtures of diterpenes with volatile terpenes (e.g. pinene), coniferyl esters, gums and aromatic compounds. The resins are not always separable from gums but most burn well. In the plants, they are exuded in a liquid state into secretory ducts in the bark and the wood, but most often, the resin flow is stimulated by wounding the bark of the wood. Most resins are obtained from wild trees or shrubs. The cultivated plant sources are *Shorea robusta*, arar tree, copaiba balsam, rattan plam, grass-tree gum and sal tree. The resins and gums are used as solvents (turpentine oil), as aromatics

in perfumes, fumigation products , cosmetics (skin creams) and chewing gum, and technically for making colophony, putty, picture and photograph lacquers, in cheap paints, incense and salves and as flavouring in lemonade, bakery, soaps and sweets.

xv. **Tannin Materials-** These are complex phenolic compounds with a large number of oxygen functions. They can exist as hydrolysable tannins (oak gall, chestnut) or condensed tannins, made up of flavonoids, flavones and catechins (e.g. mimosa bark). They are found in the parenchymatic tissues of many plants, in usable concentrations especially in the bark, wood of the trunk, roots, fruits and galls. They are used for tanning leather through precipitation of protein which thereafter prevents swelling in water and resists rotting, medicinal benefits in pharmaceutical preparations (e.g. tara rubber), technically for reducing the viscousity of drilling slurry from deep-drilling projects and as a colourant (e.g. black colourant in *Caesalpinia spinosa* tara powder). Other examples are black wattle and brown mallet.

xvi. **Dyes and Colourings-** These include plant pigments found in the plant cells, either in the plastids or in vacuoles. They belong to a variety of chemical groups such as anthocyanins (red pigments), betacyanins (betamin), some carotenoids (bixin from annatto, capsanthin from paprika, zeaxan from tomatoes, carthamin from safflower), yellows from the carotenoids xanthophylls, zeaxan and azafrin; curcumin from *Curcuma longa* and chlorophyll. The uses of dyes and colourings are beautifying the body, clothing (e.g. indigo) and home decorations, as colourant additions in food (rice dishes, manioc, fatty foods, fat-free foodstuffs, gums, starch preservatives), drinks, confectionery and cosmetic industries, as aromatics for sweets, baking, lemonade and chewing gum, for producing ink (e.g. *C. sappan* in India) and for dyeing leather, hair and fingernails. Other examples are *Bixa orellana*, *Acacia catechu*, *Indigofera arrecta*, *Lawsonia inermis* and *Escobedia scabrifolia*.

xvii. **Pesticides-** These are plants that contain natural protective compounds (pyrethrins from pyrethrum, rotenone from derris and cube, nicotine from tobacco, anabasine from Anabasis aphylla; alkaloids such as wilfordine from Thundergod vine and ryanodine from ryania) against insect pests, ectoparasites, etc. Other plants have molluscicidal and nematicidal properties.

xviii. **Waxes-** These are fatty substances, characteristically containing esters of long-chain fatty acids with long-chain primary alcohols,

bivalent alcohols, hydroxyl fatty acids, paraffins and resins, as unwanted impurities. Most of the waxes of economic importance are exudates from the epidermis of leaves, stems and fruits. The most important sources are carnauba, candellia, jojoba and Japan wax. Wax is also extracted as a by-product from the processing of sugar-cane, rice and sorghum (sugar sorghum, grain sorghum) from the production of raffia fibres and from the bark of Douglas fir. Waxes are used for coating fruits (citrus, apples), in cosmetics (especially in lipsticks), textile, leather and paper industries, in making candles, matches, painting materials, carbon paper, chewing gum, polishing materials for floors, furniture, cars and shoes, and in pharmaceutical preparations.

xix. **Forage and Pasture Plants-** These are plants produced for feeding various domestic animals, including silkworms, bees and lac insects. The plants include tropical legumes and grasses, fodder melons (*Citrullus lanatus*), fodder gourds (*Cucurbita pepo*), fodder beets (*Beta vulgaris*), Japanese fodder radish (*Raphanus sativus*), fodder kale (*Brassica* spp.) and fodder sorghum and *Pennisetum americanum*. Tropical pasture fodder crops include Southern gamba (*Andropogon tectorum*), molasses (*Melinis minutiflora*), pigeon pea (*Cajanus cajan*), calopo (*Calopogonium mucunoides*) and centro (*Centrosema pubescens*). Other plants are maize, grain sorghum, cassava, cowpea, hyacinth bean, breadfruit and dates. Bees are fed on pawpaw leaves, and silkworms and lac insects on pigeon pea.

xx. **Ancillary Plants-** These are plants cultivated in agriculture and forestry not for direct benefits to man but for their capacity to encourage the growth and development of other plants. These benefits arise from soil improvement, ground covering, prevention of soil erosion, as wind-breaks, shade provision, support for climbing plants and "living fences". Examples of the plants are *Grevillea robusta*, black pepper, belch pepper, vanilla, *Centrosema pubescens*, Gliricidia, vetiver, acacia and cashew.

4.0 CONCLUSION

In this unit, you have learned that:

i. crops can be classified differently on basis such as nomenclature, botanical features, duration of growth and economic use; and
ii. several crop parts are highly valued for domestic and foreign exchange, leading to significant contributions to national development.

5.0 SUMMARY

Crops vary widely not only in their nomenclature, botanical features, duration of growth but also in their economic importance. The latter grouping is by far the most commonly appreciated due to the emphasis on direct and indirect uses of parts of the crops and the contributions of different crops to the national GDP.

6.0 TUTOR-MARKED ASSIGNMENT

1. Mention the four bases of grouping crops.
2. Why is binomial nomenclature the most universally acceptable basis for classifying crops?
3. State the difference between the following groups of crops:

a. Class Gymnospermae and Class Angiospermae; (b) biennials and annuals; and dicots and monocots.

7.0 REFERENCES/FURTHER READINGS

Adegbola, A.A., Are, L.A., Ashaye, T.I. and Komolafe, M.F. (1972).

Agricultural Science for West African Schools and Colleges. Nigeria: Oxford University Press.

Sparling, C.R. and King, S.R. (1990). 'Andean Tuber Crops. Worldwide Potential'. In: Janick, J. and Simon, J.E. (eds.). *Advances in New Crops.* Portland, OR: Timber Press.

Kays, S.J. and Silva Dias, J.C. (1996). *Cultivated Vegetables of the World*. Exon Press: Athens, GA.

O'Hair, S.K. (1990). "Tropical Root and Tuber Crops". P 424-428 In: Janick, J. and Simon, J.E. (eds.) *Advances in New Crops*. Portland, OR: Timber Press.

Rehm, S. and Espig, G. (1991). The Cultivated Plants of the Tropics and Subtropics. *Cultivation, Economic Value, Utilization*. CTA/Verlag Josef Margraf Scientific Books.

Brenan, C. (2006). *Barley: Genetics, Composition, Structure and Uses*. Lavoisier.

Alokan, J.A. (1998). *An Introduction to Pasture, Fodder Crop Production and Conservation.* Akure, Nigeria: Topfun Publications.