COURSE CODE:	**PCP 503**
COURSE TITLE:	**Farming Systems**
NUMBER OF UNITS:	**3 Units**
COURSE DURATION:	**2 Hours of Lecture, 3 hours of Practicals per week**

COURSE DETAILS:

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COURSE CONTENT:

Concepts, Definitions and Classification of farming Systems. Factors determining farming systems: physical, biological and socioeconomic. Characteristics of the small- scale tropical farming systems Nomadic farming, shifting cultivation, fallow rotation, permanent cultivation, ley farming etc. Intercropping, mono-cropping, sole cropping, sequential cropping, relay cropping, strip cropping. Important crop based farming systems: lowland rice-based, upland cereal-based, root crop - based, small – scale mixed farming, irrigated small-holder farming, small holder farming with plantation (perennial) crop – based, and agro-forestry. Farming systems research: descriptive and prescriptive

COURSE REQUIREMENTS:

READING LIST:

LECTURE NOTES

Topic 1

1.0 Concepts, Definitions and Classification of Farming Systems

1.1 A system is a set of inter-related, interacting and interdependent elements acting together for a common purpose and capable of reacting as a whole to external stimuli. It is unaffected by its
own output and it has external boundaries based on all significant feed backs.

1.2 Farms are systems because several activities are closely related to each other by the common

use of the farm labour, land and capital, by risk distribution and by the joint use of the farmer's management capacity. The analysis of farms is quite important to the subject of development. Relevance of the farming systems approach: Choosing policies for agricultural development requires the use of information about the existing farming situation. A farming system results from a complex interaction of interdependent and interrelated components of elements that bear upon the agricultural enterprises of the rural household. At the center is the farmer who takes decision in an attempt to achieve his aspirations, goals and desired objectives within the limits of technologies available to him. He uses inputs to get outputs in response to the technical elements which is the natural resource endowment in any given location restricting what the farming system can be. The human element provides the framework for development and utilization of a particular farming system.

1.3 Definition of Farming system

Farming system is a unique and reasonably stable arrangement of farming enterprises that a household manages according to well defined practices in response to the physical, biological and socio-economic environment and in accordance with the household goals preferences and resources. These factors combine to influence the output and production methods. More commonalities will be found within system than between systems. Farming system belong to a larger system and itself can be subdivided into subsystems

1.4 Characteristics of farms:

1.4.1 *Goal orientation*

A farm is taken to be an organized decision-making unit in which crop and/or livestock production is carried out with the purpose of satisfying the farmers goals and preferences. On large scale, market production and profits are the main objectives whereas for the small-holder farmer who farm most of the tropics the farm is a multi-objective system that provides food for the household, raw materials for building huts, accumulation of wealth and capital in form of animals or plantations.

1.4.2 *Boundaries*

The farm as a system has boundary that separates the system from the environment. The system embraces all workers and resources (elements of the system) which are under the management of the farmer. All land used wholly or partly for agriculture belongs to the farm. Processing units are part of the farm wherever they are if they are under the management of the farmer.

1.4.3 *Activities*

The farm is characterized by activities that turn input into output including crop and livestock production, as well as processing, marketing maintenance, and procurement.

1.5 Classification of farming system

Farm as a unit transfers input into agricultural output and which undergoes changes over time. In the process of adapting cropping patterns and farming techniques to the natural, economic and socio-political conditions of each location and the aims of the farmers, distinct farming systems

are developed. For the purpose of agricultural development it is advisable to group farms with
similar structures into classes

1.5.1 Collecting
This is the most direct method of obtaining plant products. It includes regular and irregular harvesting of uncultivated plants. Hunting goes hand in hand with collecting. It is still being practiced to provide additional to the normal subsistence food supply. It is only in few cases like
wild oil-palm in some parts of west Africa and gum Arabic in Sudan and wild honey in Tanzania
that collecting is a major cash earning activity.

1.5.2 Cultivation

a) *Classification according to type of rotation*
Cultivation alternates with an uncultivated fallow which may take the following forms Forest fallow made up of woody vegetation with trunks, a bush fallow comprising of dense wood without trunks A savanna fallow comprising of a mixture of fire resistant trees and grasses and
in which grasses are dominant 4. a grass fallow comprising grass without woody vegetation, Ley
systems describes where grass is planted or establishes itself on previously cropped land. The grass is allowed to grow for some years and used for grazing. \wild and unregulated ley are common in the savanna. In regulated ley, the swards are established during fallow the non cropping period. This is rare in the tropics but are found in some highlands (Kenya) and in Latin
America. Field systems occur where arable crops follow another and where established fields are clearly separated from each other. System with perennial crops (field and tree crops)

b) *Classification according to the intensity of rotation between cropping and fallow period*
Considerable variation and degree of intensity exists between cropping and fallow period within
one cycle. The symbol R is the number of years of cultivation divided by the length of the cycle
of land utilization multiplied by 100. If 20% of available land in one holding is cultivated, then R
is 20% The larger R becomes, the more stationary is farming. When is < 33% , it is shifting cultivation : When R> 33% and< 66% it is Fallow systems:while it is permanent cropping when
R > 66%. Permanent cropping can again be classified according to the degree of multiple cropping. An R value of 150 would indicate that 50% of the area is carrying two crops a year. and three crops a year for a value of 300

c) *Classification according to water supply*
This is in terms of whether it is irrigated farming or rain-fed farming

d) *Classification according to the cropping pattern and animal activities*
This classification is according to the leading crops and livestock activities of the holdings. Each
activity has different requirements as to climate, soils, markets and inputs e.g. coffee-banana holdings or rice-jute holdings

e) *Classification according to the implement used for cultivation*
In different parts of the world, land is cultivated by methods that requires no implement or simple tools. In the Sahara desert nomads sow millet without fire-farming or soil preparation, shifting cultivators frequently sow in ashes without touching the soil. Rice growers in Thailand
make use of water buffalo to trample on moist fields. The main divisions vary from hoe-farming
or spade farming to farming with ploughs and animal traction to farming with ploughs and tractors

f) *Classification according to the degree of commercialization*
Farms are classified into three groups based on the destination of the agricultural output
1. Subsistence farming –if there is virtually no sale of crop and animal products,
2. Partly commercialized farming-- if more than 50% of the value of the produce is for home consumption
3. Commercialized farming--- If more than 50% of the produce is for sale.

1.5.3. Grassland utilization
Low yields in grassland area of in the arid and semi-arid areas necessitated nomadic life, or semi-nomadic life, or development of ranching
a. Total nomadism – the animal owner do not have a permanent place of residence. They do not practice regular cultivation and their families move with the heards tended by herdsmen
b. Semi-nomadism where the animal owners have a semi-permanent place of residence near which supplementary irrigation is practiced. However they travel with their herds to distant grazing areas
c. Transhumance in which farmers with a permanent place of residence send their herds tended by herdsmen for long period of time to distant grazing areas
d. Partial nomadism is characterized by farmers who live continuously in permanent settlements with their herds remaining in the vicinity
e. Stationary animal husbandry occurs where the animals remain on the holding or in the village through the entire year

Topic 2

2.0 Factors Determining Farming Systems: Physical, Biological and Socio-economic

The determinants of farming system can be grouped into the natural and the socio-economic factors. The natural factors are comprised of the physical and the biological factors

2.1. Physical factors

These include all external conditions and influences affecting the life and development of an organism.

2.1.1 Climate

a) Solar radiation
Solar radiation is essential for photosynthesis, when crops utilizes visible light to produce dry matter from water and Carbon dioxide. Therefore dry matter production depends on incoming solar radiation and the type of plant that is exploiting it under normal conditions. Solar radiation is an essential determinant of the final yield of some crops in areas of adequate water supply e.g. sugar-cane and lowland rice.

b) Rainfall

Rainfall is the most important climatic variable its roles in agricultural production include the following:

1. Main source of moisture supply to the soil for the activation of plant growth,
2. Replenishment of water in rivers to allow irrigation operation,
3. Build-up of underground water reserves which are later tapped by wells in dry area through seepage and percolation, and
4. Influences soil/water/plant relationships;

The amount, incidence, variation and reliability of rainfall determine differences in cropping pattern in various ecological zones

Excessive rainfall adversely affects crop production through high run-off, soil erosion, leaching, nutrient losses, water-logging, vigorous vegetative growth or weed infestation, and general disruption of agricultural activities. On the other hand, inadequate rainfall prevents crop growth

Crop growth is only sustainable for varying periods in different ecological zones because The seasonality, duration and regimes of the wet season and the number of months of inadequate rainfall per month are more important to agricultural activities than total rainfall.

Variation in the duration of the wet season determines the variety of crops grown in different zones. The onset of rains varies with ecological zones, viz. March in the interior part of southern Nigeria, April in a large part of the Middle Belt and May/June in the Sudan zone.

c) Temperature

Temperature affects evapo-transpiration, photosynthesis and soil warming. The effects of high temperature include:

1. Rapid soil organic matter (SOM) decomposition due to high microbial activities and increased rates of biochemical reactions,
2. Rendering built-in fallows ineffective,
3. Enhance the incidence of pests and pathogens,
4. Enhances high respiratory rates and exhaustion of plant assimilates in the night, resulting in low net assimilate accumulation and crop yield,
5. Affects seed germination, pollination, flowering, fruiting, ion uptake, leaf growth and cell enlargement.

d) Relative humidity

This is the ratio between the amount of water vapour actually held in the air and the maximum possible amount that can be held at a particular temperature. It is a measure of the dampness of the atmosphere. Differences in relative humidity are more critical to the unpleasant climate of Nigeria than high temperature. High relative humidity increases disease incidence on cropped farms and reduces the crop's ability to intercept solar radiation.

Contrarily, low relative humidity leads to high evapotranspiration and transpiration which eventually cause wilting of crops.

e) Winds and Ocean Currents

The predominant air masses in West Africa are the equatorial maritime air mass (moisture-laden south west monsoon winds, SWM) and the tropical continental air mass (dry and dusty north-east trade/harmattan winds, NET). The meeting point of these two air masses is called the Inter-Tropical Front (ITF), whose relative dominance brings in rain (northward movement) and harmattan (southern movement). Rain falls only in areas lying south of the ITF. The northward movement of the ITF occurs in February when the NET starts to retreat

and being replaced by the advancing SWM. In July, most areas south of latitude 200N fall under the influence of rain-bearing wind from the south. In August, the ITF reaches its inland limit and remains stable for a few weeks before moving coast-ward. In January, the ITF is near the coast once more while the NET again becomes the dominant winds. Other winds of importance to agricultural production include sea breezes, land breezes and ocean currents. The ocean currents are three, namely the Cold Benguella current, Guinea counter-current and the Cool Canary current. The currents influence climatic conditions through the winds blowing over an area; winds blowing over a warm current are usually moisture-laden while those blowing over a cold current usually have a cooling effect on the coast,

2.1.2 Soils

Crop productivity is strongly dependent on physical, chemical and biological conditions of the soil.
a) Physical Soil Factors Affecting Crop Production
These include the soil's texture, structure, porosity and bulk density.

i) Soil Texture
Soil texture is the relative proportions of sand, silt, and clay particles in the soil. This proportion of solid soil particles provides a useful guide to a soil's potential for agricultural crop production, because it exerts a major influence on soil characteristics. The soil texture influences the water-holding capacity (through the clay type and content and capillary conductivity), temperature, drainage and nutrient retention capacity of the soil. Also, soil texture influences the efficacy of soil-applied pre-emergence herbicides and other pesticides. Soils are classified into light (sandy, workable), medium (loamy, most workable) or heavy types (clay, unworkable) on the basis of soil texture, due to its close relationship to the workability (the ease of working the soil with machinery) of the soil.

ii) Soil Structure
This is defined as the arrangement of the particles (sand, silt, clay) in the soil. It influences the soil tilth, root growth and development, gaseous exchange/aeration, drainage, water infiltration into the soil, and efficiency of water and nutrient uptake by plants (through capillary conductivity). "Structural stability" is the ability of the soil to resist deformation when wet. It is influenced by the clay content, presence of lime, iron oxides and humus. However, soil structure is not a stable soil property, and therefore changes with time and weather. Poorly stable soil aggregates slake (collapse) easily while good aggregate structure maintains the shape when wetted for a short time and gradually piece off thereafter. A good structural stability is essential to prevent soil degradation and limited crop growth. Soil structure can be improved by addition of decomposable OM (e.g. farmyard manure, FYM), crop roots and crop residues. Heavy machinery causes damage to soil structure in wet soil, especially heavy clay soils.

iii) Soil Porosity
This is defined as the percentage volume filled with air when the soil is fully drained of saturated water. The pore sizes include micropores (smallest pores containing only water which rarely dries out and is unavailable for crop uptake); mesopores (middle-sized pores containing water available to plants and which allow free aeration of the soil); and macropores (pores greater than 0.1 mm in diameter, can drain easily to allow in air after full wetting of the soil). Soil porosity influences the infiltration of water into the soil, water-holding capacity, drainage and aeration of the soil aggregates; these properties have significant influence on the SOM status. Ecologically, soil aeration plays a significant role in organic residue decomposition; oxidation-reduction of
elements, especially nutrients; plant growth; nutrient and water uptake soil compaction; soil structure; and soil cultivation. Aeration capacity is very high in sandy soils, optimal in loamy

soils and very low in clay soils. However, organic matter additions (which increase the number of meso- and macro-pores) can improve the aeration capacity of clay soils.

iv) Soil Bulk Density

This is mass of soil per unit volume of the soil. It is determined by the volume of pore spaces in the soil; the more the pore spaces, the lower the bulk density, and vice versa for high bulk density or soil compaction. Soil bulk density affects the workability of the soil, especially with respect to mechanical cultivation, and especially in dry weather. Notillage or minimum tillage is also strongly affected by soil compaction.

v) Soil Water

Water is held in the soil in three forms, namely:

i) capillary water (water held by surface tension forces as a continuous film around the particles and in the capillary pore spaces of the soil)

ii) gravitational water (water held to the soil particles against gravitational forces and suction force of the roots, and which drains under the influence of gravity);

iii. hygroscopic water (water adsorbed from an atmosphere of water vapour as a result of attractive forces in the surface of the soil particles and aggregates)

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Soil water is very critical to root absorption of essential nutrients from the soil, soil temperature, microbial and microbial soil activities, organic matter decomposition, etc. The farm soil needs to be at field capacity always to ensure optimal growth and development.

b) Chemical Factors of Soil Affecting Crop Production

The soil chemical characteristics are of primary importance in crop nutrition. They include

i) Soil Organic Matter (SOM)

This is the proportion of the fresh organic material and humus (partly decomposed and synthesized organic material). These materials exert a profound influence on crop nutrients (through slow nutrient-release mechanism), soil structure and cultivation. Organic matter serves as the soil granulator, being largely responsible for particle aggregation through its efficiency on cohesion and plasticity. It is a rich source of important plant nutrients, particularly nitrogen which is entirely derived from organic matter. Organic matter influences the colour, temperature

(by minimizing evaporation from soil surface), water-holding capacity,water retention, nfiltration, pH and exchangeable capacity of the soil. It is the main source of energy for heterotrophic soil microorganisms, which stimulates their reproduction and growth, thus acilitating their capacity to make the nutrients in SOM available to the plants. Organic materials in the soil are decomposed by primary decomposers (insects, earthworms, fungi) and secondary decomposers (bacteria, fungi). This, in addition to cultivation and bush burning reduce SOM content.

ii) Soil pH

This indicates the degree of acidity or alkalinity of the soil. It is significant in determining the soil chemical reactions.

iii) Available plant nutrients

Soil minerals are derived from rock weathering; the primary minerals re derived directly while the secondary minerals are derived from the primary minerals by weathering and synthesis. Plant nutrients are of three main forms, namely macro-, meso-and micro-nutrients. The macro nutrients (nitrogen, phosphorus, potassium) are primarily important in crop growth, because they are required in large quantities. The meso-nutrients are calcium, magnesium and sulphur. The micronutrients are required in minute quantities but are also important for the normal growth of some crops and certain physiological processes, namely enzyme systems, protein and carbohydrate metabolism, nitrogen fixation, chlorophyll

formation, pod maturation and production, growth hormones and starch forms. They include copper, molybdenum, chlorine, boron, manganese, zinc and iron. A knowledge of the available nutrients not only guides in determining the suitability of the site (soil) for a particular crop but also in formulating soil fertilizer requirements.

c) Topography
Position of farm on the toposequence whether on the crest or valley bottom

d) Biological Factors of Soil Affecting Crop Production
These include soil fauna and flora,

i) Soil Fauna
Includes are the beneficial and damaging animal organisms. Beneficil organisms are those which break down and incorporate crop residues, and further aid in water movement and aeration e.g.
earthworm. The damaging organisms consist of the larval stages of beetle, fly, grubs, worms and nematodes.

ii) Soil Flora
Pathogens such as bacteria, fungi and viruses are important as sources of soil infections in crop lands.

2.2 Biological factors
Included are crop and livestock species, pests, diseases and weeds

2.3. Socio-economic Factors

2.3.1 Endogenous factors
These are factors within the control of the rural household they are as follows:

a Family composition
b. Health and nutrition
c. Education
d. Food preferences
e. Risk aversion
f. Attitude/goals
g. Gender relations

2.3.1 Exogenous factors
These are factors that are not within the influence of the rural household. They are as follows:

a. Population
b. Tenure
c. Off-farm opportunities
d. Social infrastructure
e. Credit
f, Markets
g. Prices
h. Technology
i. Input supply
j, Extension
k. Savings opportunities

Topic 3

3.0 Characteristics of the Small-Scale Tropical Farming Systems

3.1 Very small farm size

Farm size is very small in the tropics. The mean farm size is often less than four hectares. Farms are generally smaller in the forest agro-ecological zone than in the savanna. It is relatively easier to clear savanna vegetation than that of the rain forest. Farm sizes are influenced by ecological and socio-economic factors. Increased human population results in smaller farms; an example is Taiwan where human the average farm size is 1.6 ha. There is flexibility of labour on small farms. It is easier to take decision on what is to be done. It may also be difficult for the extension and marketing agents to transmit knowledge since most farmers are on their own and are not organized into cooperatives. In Africa, experiences have shown that small farms could be more productive than large ones in the long run. As a result of small farm size, the use of tractor and their maintenance could be quite expensive. There is high cost of tractor equipment in Africa
than in Europe because of shorter life span due to lack of spare parts and unskilled maintenance manpower.

3.2 Predominance of hand labour

Small scale farming is largely dependent on hand labour to about 60-80%. Animal power is about 20% while use of tractor is negligible..On most soils in the tropics water infiltration and low level of microorganisms are problems. With increased cultivation yield decreases from hand hoe>oxen>tractor. Tools utilized are usually inexpensive and readily available and the skill required are already there. There is no need for special training unlike in use of machines Disadvantages include problem of efficient utilization of the labour force. Timeliness of operation is a problem since the use of hand labour is time consuming. It also brings about drudgery.

3.3 Predominance of mixed cropping or intercroppig

Mixed cropping or intercropping is a widespread cropping practice in the tropics. It is only flooded rice and wheat that are not grown in crop mixture. The advantages include efficient utilization of environmental resources particularly when crops of different maturity cycle complement each other. Provision of favourable microclimate through shading.. Stability of yield as it minimizes risk against crop failure. It reduces erosion as well as preventing the spread
of diseases and pests. It has high labour requirement than for sole crop and labour utilization is
spread through the season. A major disadvantage is difficulty in mechanization of operations like weeding and harvesting.. Spraying of the lower growing component crop in the mixture is
often difficult.

3.4 Priority for subsistence food crops

It is characteristic to produce first food for home consumption before any consideration for cash crop. A food crop can become cash crop when produced in surplus

Topic 4

4.0 Nomadic farming, Shifting Cultivation, Fallow Rotation, permanent Cultivation, Ley farming etc.

4.1 Nomadic farming

Nomadic farming refers to the practice in which livestock farmers move around for a least part of the year, usually in search of water and grazing for their animal for their primary

products of meat and skin, and their secondary products such as wool or hair, milk, blood, dung, traction, and transport;

Because of the different climates and environments of the areas where nomadic pastoralism is practiced and because of the ecology of their herd animals, this management includes daily movement and seasonal migration of herds;

The majority of the members of the group are in some way directly involved with herd management, the household therefore moves with these seasonal migrations; and 4) while the products of the herd animals are the most important resources, use of other resources, such as domesticated and wild plants, hunted animals, goods available in a market economy, is not excluded.

4.1.1 Geographic distribution

Nomads north inhabiting north and north-east Africa includes Afar, Beddouin, Berbers and Tuaregs among others. In west and central Africa examples include the Fula or Fulanis and the Toubou of Niger and Chad. Nomads are also found in East Africa, Afghanistan, Turkey, as well as south and central Asia including southern and northern Europe

General Characteristics of nomadism

a. It takes place mainly in marginal areas where crop cultivation is not possible

b. Animals (cattle, sheep, goat, camel or horses etc.) feed on the forage of lands which humans cannot directly utilize and convert the energy into sources available for human consumption: milk, blood and sometimes meat.

c. The common conception that pastoralists exist at basic subsistence is not true as groups often accumulate wealth and can be involved in international trade. Complex exchange relationships exist with horticulturalists, agriculturalists and other groups; pastoralists rarely exist exclusively with the products of their herd.

d. Important components of the pastoralist adaptation include low population density, mobility, and dynamism, and complex information systems.

e. Nomadism is well adapted to the environments where it exists;

f. Lands long used for pastoralism have evolved under the pressures of regular grazing on one hand and, fire was a method of rejuvenating pasture land and preventing forest re re-growth.

g. Nomads have deep knowledge of their environment as they operate a well developed traditional information network.

4.2 Shifting Cultivation

Shifting cultivation is used for a system that involves an alternation between cropping for a few years on selected and cleared plots. A few years of cropping is followed by a lengthy period of fallow when the land is rested to regain its original soil fertility. It is a technology that has been practiced in thinly populated regions across the world. It is particularly popular in forested and derived savanna areas of tropical Asia, Africa and Latin America.

4.2.1 Types of shifting cultivation

a. Vegetation systems

The system could be practiced in the forest, savanna or in forest/savanna transition where the fallow land are dominated by forest, bush {thicket) or grassland respectively. The low population density , humid and forested areas of Peoples Democratic Republic of Congo, Borneo in Indonesia are examples.

b. Migration systems
Whenever new land is cultivated, there is a tendency for the farming household to move with their household if transportation of produce (e.g. root crops) is becoming problematic. This results in gradual migration.. Usually the huts are always due for repairs every 2-3 years under forest condition and it is often easier to build a new hut than repairing an old one . The frequency of movement and the distances covered seem to increase with rainfall. The Amazon Basin in Brazil and Philippines in Asia are areas where examples are found

c. Rotation systems
For sedentary cultivators, a definite number of fallow years often follow a definite number of years of cropping in a regular sequence. However it may have an irregular character. In the forest zone, 2-4 years of cropping may be alternated with one or three decades of fallow.. In the savanna of Africa, it could be more complicated when short term fallow period of 1-2 years, medium fallow period of 3-5 years or long fallow period of 6 years or more alternate in a single cycle of land use. short fallow periods are often associated with lack of labour during the cultivation period while decreasing soil fertility and increasing weed growth are associated with long fallow period

d. Clearance system
The mode of land clearing depends on the following: rainfall distribution, vegetation to be cleared, crop grown, cultural background of the population and available tool.

4.2.2 Advantages of shifting cultivation
Easy to cultivate quickly, environmental friendly because is organic farming. It is a form of weed control, it can play a part in weed management and it may reduce incidence of soil borne diseases and insect pests. It promotes biodiversity. It is a highly adaptive means of production

4.2.3 Disadvantages of shifting cultivation
This system is not for long term. Not good for land that is used for only one type of crop. It does not produce enough food. It is not cost effective. It is troublesome for farmers to always move around. It is highly susceptible to high increase in population. It requires a large land area because of inadequate cultivable land. It .wastes farmers energy resources in frequently slashing vegetation..

4.3 Fallow systems

Fallow systems refers to when the period of fallow is not long enough for the original soil fertility to be restored after cropping and not short enough for stationary farming. This is typified by R value of 50 when 3, 6 or 10 years of cropping is followed by 3, 6 or 10 years of fallow. This is often caused by increased population pressure and expanding cash crop production..

4.3.1 Characteristics of fallow system
a. The land holding is permanently and clearly defined
b. Most of the farmers practice hoe cultivation
c. System is labour demanding
d. Area under cultivation are larger than under shifting cultivation
e .Yields of produce are lower because of the lower soil fertility but the overall output is higher

because of the larger area

f. There is priority for subsistence food crops although cash crops are prominent

4.4 Ley systems

Ley system involves alternating a field planted with crops for a number of years with a planted fallow used for growing hay for another number of years, after which it is again used for cropping

The benefits include improved soil fertility and structure, reduction of erosion and land degradation improved weed, insect and disease control

4.5 Permanent cultivation system

As cropping of the field becomes more intensified and the period of fallow more shortened or eventually absent, farming becomes permanent. This is particularly the case in densely populated areas of Kano (north Nigeria), and the Ibo and Ibiobio.

Because of the strong leaching of the nutrients permanent upland cultivation of annual crops may result in a severe decline in soil fertility and in very low yields. In the humid areas of West Africa, perennial crops like oil palm, cacao, and coffee have long been cultivated on the uplands. If these crops are intensively cultivated, the requirements of fertilizer, management, capital, and technical knowledge are high. In West Africa, these crops are produced for the export market.

Topic 5

Intercropping, Sole Cropping, Sequential Cropping, Relay Cropping, Strip Cropping etc.

Intercropping - The cultivation of two or more crops simultaneously in the same field.

Sole cropping – Growing one crop alone in pure stand, either as a single crop or as a sequence of single crops within the year.

Sequential cropping – Growing two or more crops in a sequence, planting the succeeding crop after the harvesting of the previous one.

Relay cropping – Growing two or more crops in a sequence , planting the succeeding crop after the flowering but before the harvesting of the preceding crop.

Strip cropping - Growing two or more crops simultaneously in alternative plots arranged in strips that can be independently cultivated

Adaptive research - research designed to adjust new technologies to specific set of environmental conditions

Basic research - research undertaken to generate new understanding of systems and processes

Commodity research – research focused on the improvement of a particular commodity

Component technology research – disciplinary oriented research on specific physical and biological production factors.

Cropping pattern – the yearly sequence and special arrangement of crops on a given land area

Crop rotation – the practice of following the crop located on a particular site with a different crop the following season

Farm - any tract of land or waste consisting of one or two parcels devoted to the cultivation of plants and animals under the management of the owner or tenant. The cultivation of aquatic life forms can also be included in this definition. A farm is a productive unit whose primary objective is to increase productivity, profit and the well being of the farm household.

Interdisciplinary – is a multidisciplinary team whose members work jointly on a set of problems within a common framework and expected to cross disciplinary boundaries.

Land equivalent ratio - the land area needed under sole cropping to produce the same amount of crop yield as from one ha of intercropping. It is computed as:

$$LER = \frac{\text{Maize yield in intercrop (2.5 t/ha)}}{\text{Maize yield in sole crop (3.0 t/ha)}} + \frac{\text{groundnut yield in intercrop (1.2 t/ha)}}{\text{groundnut yield in sole crop (1,8 t/ha)}} = 1.50$$

Multidisciplinary – this is where representatives of different disciplines work towards a common goal but within the confines of their own discipline

On.- farm research with a farming systems perspective – research based on the assumption that in order to develop appropriate technologies for small farmers, it is necessary to understand the circumstances of the farmers and to test proposed technologies in farmer's fields.

On-farm trials - experiments carried out in farmer fields or with their livestock.

Rapid rural appraisal – an informal method of rural data gathering selected to be quicker and more cost effective than the traditional survey methods

Recommendation domain – a group of roughly homogenous farmers with similar circumstances for whom we can make more or less the same recommendation

Strategic research – research aimed at solving specific problems of strategic importance

Systems approach – a scientific method which seeks to understand the complexity of systems
through studying their interrelationships rather than their constituent components

Topic 6

Important crop based farming systems: lowland rice-based, upland cereal based, root crop - based , small scale mixed farming, irrigated small-holder farming, small-holder farming with plantation (perennial) crops and agro-forestry

Crop based farming system is synonymous with cropping system. It refers to the crop production
activity of the farm. It describes all the cropping pattern grown on the farm and their interaction
with farm resources, other household enterprises, the physical, biological and socio-economic factors of the environment

6.1 Lowland rice-based system

Lowland rice based farming system is an age long practice in Asia. Rice is the staple food crop
for millions of people. Fertile alluvial soils abound in the river flood plains and estuaries. This farming system has remained stable over years. This system is gradually becoming important in Africa and Latin America. In Asia the objective is to be self sufficient. New technologies are available

6.2 Upland cereal-based system

The upland-cereal-based system is very popular in the seasonally humid and semi-arid areas of Africa. Sustainability is a major problem since it evolved from shifting cultivation.the system is widely practiced in Africa and drier areas of Asia.. Considerable research has been done to improve the system

6.3 Small-scale mixed farming

The small-scale mixed farming involves the complete integration of crop and livestock production. Animals provide manure for crops and crop residues are fed to animals. Although the system is very sound ecologically little surplus is produced. The system is popular in highlands of Asia, Africa and Latin America

6.4 Irrigated small holder farming

The irrigated small-holder farming is an age old system in the middle-east. Maintenance of irrigation canals and health problems are challenges. Cash crops are as important as subsistence crops. The systems thrives in India, Pakistan, Kenya, Lake Chad etc. The level of technology tends to be high, but there is too much government interference

6.5 Smallholder farming with plantation and perennial crops

The smallholder farming with plantation crops usually have a dominant cash crop. There is high dependence on external prices for farmers produce. Middle men charge excessive profit. Land tenure is a problem. The system is found in all climatic regions. Sri Lanka, Kenya, Ghana, Colombia and Malaysia are examples of locations where they are found..

6.6 Agro-forestry system

Agro-forestry is a land use or farming system in which trees are grown on the same land as crops and/or animals either in a special arrangement or in a time sequence and in which there are both ecological and economic interactions between the tree and non-tree components. Major agro-forestry practices include

6.6.1 Home gardens
This involves simultaneous cultivation of trees, shrubs, medicinal plants and livestock tended within a multistory structure around the homestead which is carefully managed over time

6.6.2 Taungya system
In areas where tree plantation is to be established, farmers are invited to cultivate food crops alongside the seedlings until the canopy close.. Teak plantation has been established in Nigeria, Thailand and Indonesia using this system

6.6.3 Shade tree based system
In establishment of cash crops like coffee or cacao, shade trees species such as *Leucaena leococephala* is cultivated. Aside from providing shade to the developing seedling, nitrogen is added to the soil

6.6.4 Fodder tree based system. .
Livestock production can be made more sustainable by cultivating fodder trees or shrubs that can be browsed by animals

6.6.5 Dispersed trees in annual crop field
Inside cultivated fields economic trees are often planted in a dispersed fashion and protected to provide fuel wood, fodder, edible fruits, nuts, medicines and other products. *Acacia albida* is an example.

Topic 7

7.0 Farming systems research: descriptive and prescriptive

7.1 Background of agricultural research in Nigeria

Agricultural research in Nigeria was started by colonial government with the aim of promoting export crops for colonial industry. Research on food crops came on board after independence in 1960. It was not until the 1970's that concern was raised about the relevance of research to needs of farmers. Agricultural Research was not strongly linked to extension.

The farming systems research approach came into being in the early 1980's because farmers were not adopting improved technologies during the era of green revolution. The innovations did not fit the technical and socio-economic circumstances of the farmers

Framework for farming systems research includes the descriptive or diagnostic stage, as well as the Prescriptive farming systems research (design, testing and extension stages)

7.2 Diagnostic stage

It is during this stage that the constraints that the farmers are having , the flexibility and missed opportunities that exist in the farming systems are determined by the research team. These are prioritized with possible solutions identified and scrutinized.

7.3 Prescriptive stage

Improved technologies needed to overcome identified constraints are tested on-station before they are taken on-farm. This is necessary if the number of variables is large. In the testing stage, farmers and extension agents are involved as partner