

<b>COURSE CODE:</b>	EMT 403
<b>COURSE TITLE:</b>	Environmental Aspects Of Farming Systems
<b>NUMBER OF UNITS:</b>	3Units
<b>COURSE DURATION:</b>	3 hours per week

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### **COURSE DETAILS:**

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<b>Other Lecturers:</b>	

### **COURSE CONTENT:**

Farm systems and farming systems. The relevance of the farm-system approach, classification of farming systems, difficulties of farming systems, problems and peculiarities of shifting cultivation. Characteristics and problems of permanent upland cultivation, irrigation farming, environmental and health implication of irrigation, perennial crop farming, ranching, institutional and environmental requirements of site-related systems, impacts of farming systems on the environment.

### **COURSE REQUIREMENTS:**

This is a compulsory course for all level students in the Department. It is compulsory that students should participate in all the course activities and have minimum of 75% attendance in order to be qualify to write the final examination.

### **READING LIST:**

1. Karl, M., Muller-Samann and Johannes Kotschi. 1994. Sustaining growth: Soil fertility management in tropical smallholdings

## LECTURE NOTES

### FARMING SYSTEM

Farming system can be defined as the distribution of plants and animals in space and time and combination of inputs believed to give maximum production in socio-economic, cultural and political context as dictated by the environment.

A farming system can be described as a system beginning with land clearing of pre-existing vegetation and subsequently involving land preparation, planting, fertilizer application, weeding, harvesting and finally storing of the harvested produce.

The method deployed in accomplishing the above operations in a given crop production system depends on the available technical know-how and the climatic factors prevalent in such areas.

Cropping system is the arrangement of crops in time and space as dictated by the prevailing ecological situation. The predominant farming system in Nigeria is Crop-based.

### WEATHER, CLIMATE AND CROPS

Weather is the term used to describe the state of the atmosphere at a given point in time over a given area or location.

Climate denotes a summary of weather over a long period of time (usually 30-35yrs) over a given area.

Information about weather is derived from weather observation. Whereas, climate represent a generalization of the characteristics of the atmosphere over a period of time.

Weather is about the specific atmospheric characteristic at a given time.

Agriculture is perhaps the most weather sensitive of all human socio economic activities. In spite of recent technological and scientific development, weather remains a key variable in agricultural production. Weather and climate affect agriculture and determine the adequacy of food supplies. Climate determines whether or not rain-fed agriculture would be feasible and the type of crops that can be successfully cultivated in a given area. All stages of agricultural product

from land clearing and preparation through crop growth and management to harvesting, storage, transportation and marketing of agricultural products are subject to the influence of weather and climate.

Weather and climate act as both a resource and a constraint to Agric production. The resource value of weather has to be optimized while the hazards posed by weather has to be managed.

### **Climate - crop relation**

An agricultural system is basically a man made ecosystem which depends on weather and climate to function just like the natural ecosystem. Crops like wild plant require moisture, heat, light as well as nutrient for their growth and development. All crops consequently have their climatic limit for economic production. This limit can be extended to some extent by plant breeding and selection, irrigation and other cultivation methods that modify the natural micro-climate under which the crop grows.

### **Solar radiation and crops**

Solar radiation is of vital importance to crops. An agricultural system though a largely man-made ecosystem, is powered by solar radiation. Solar radiation determines the thermal characteristics of the environment namely air and soil temperature. Solar radiation is also linked to the amount of sunshine, daylength or photo period in an area. Photosynthesis, the basic process of food manufacture in nature and photoperiodism, the flowering response of crop to daylength are both controlled by solar radiation. Assuming unlimited amount of  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  and soil nutrients, the maximum amount of plant tissues that can photosynthesize within a crop depends on the availability of solar radiation. The visible rays are the most effective in photosynthesis, although UV-rays can influence the germination and the energy and quality of seeds. The intensity of radiation is also important, not just the wavelength.

The optimum light values for normal crop growth and development are generally around 8-20 kilolux. Insufficient radiation is harmful to crops. The root system of the crop is under-

developed, the foliage becomes yellowish and there is tendency for the stalk to grow at the expense of the foliage.

Some plants are light-loving (e.g pine, birch and larch trees) while some are shade-loving (e.g beech and spruce). This does not imply that shade loving plants do not require solar radiation.

Plants can be categorized into 3 groups based on their photoperiodism.

1. Long day plants: - This flower only under day length longer than 14 hours e.g Barley, Clover, Mustard, Date, Rye and Wheat.
2. Short day plants: - This flower with less than 10hours of daylength e.g Beans, Millet, Cucumber, Cotton, Corn and Sweet potatoes.
3. Day-neutral plants: - This flower under any period of daylength e.g Carrot, Tomatoes and Celery.

### **Temperature and crops**

The temperature of air and soil affects all the growth processes of crops. All crops have minimal, optimal and maximal temperature limit for each of their stages of growth tropical crops such as Cocoa and Date requires high temperature throughout the year. Low temperature kill or damage crop, prolonged chilling of crops at temperature above freezing retards crop growth and may kill those crops adapted only to warm conditions. Although chilling may not directly kill plant cells, it reduces the flow of water from the roots and so interferes with plant transpiration and nourishment.

When temperatures are below freezing, the living matter of cells may freeze and cell dehydration may occur and this will eventually kill up the crops.

High temperature are generally not as destructive to crops as low temperature. Provided the moisture supply is adequate to prevent wilting and the crop is adapted to the climatic zone.

Excess heat may however destroy plant protoplasm; it has a desiccating effect on crops as a rapid rate of transpiration may lead to wilting.

Temperature determines the growing season in the temperate region while the growing season in the tropics is determined by rainfall conditions and evapotranspiration rate which are temperature dependent.

Soil temperature is widely recognized as an important control of crop growth and development. In many cases, it is of greater ecological significance to crop life than air temperature. Soil temperature affects the germination of seed and later influences the root development and the growth of the entire crop. Soil temperature apart from influencing seed germination also affects physical, chemical and biological processes in the soil that determines overall crop growth and development.

### **Moisture and crops**

Moisture plays a vital role in crop growth and development. It is the medium by which chemicals and nutrients are carried from the soil to various parts of crops. Moisture is also the main constituent of plant tissues and a reagent for photosynthesis. Soil moisture is the source of moisture of importance to the soil. The state of soil moisture is controlled by rainfall, evaporation rate and soil characteristics. The supply of soil moisture may vary from wilting point (when no water is available for crop use) to field capacity (when the soil is fully saturated with moisture but it is still when drained).

When soil moisture is excess, all the soil pores are completely filled with water and water logged condition prevails. In such a situation, free movement of air within the soil is impeded. At the other extreme is the condition of drought in which the amount of water required for evapotranspiration exceeds the amount available in the soil unless this water deficit is made good by rainfall or irrigation, crops will wilt and eventually die. Thus, extremely low or high temperature, too much or too little water is not good for agriculture.

### **Wind and crops**

Wind, air in motion, affects agriculture in diverse ways. On the positive side, wind is an effective agent for dispersal of plants. The CO<sub>2</sub> intake of crops and their rate of transpiration tends to increase with increasing wind speed up to a certain level. On the negative side, wind may cause physical damage to crops. Wind also helps in the transport of pollens and seeds of undesirable plants such as weeds. Wind erosion can damage good agricultural land by removing the top soil. High wind can also increase the risk of forest fire that can destroy farm crops.

### **SHIFTING CULTIVATION**

In the practice of shifting cultivation, the farm is not at a permanent location instead a piece of land is cleared, farmed for a few years and then abandoned in preference for a new site. While the new site is being farmed, natural vegetation (bush fallow) is allowed to grow on the old site. Eventually after several years of bush fallow, the farmer returns to the original location in its original and more primitive form.

Shifting cultivation involves moving the home along with the farm but this form of shifting cultivation exist in only a few places in the world today. On the other hand, shifting cultivation in which the farm is moved while the home is stationary is a common practice today in most part of the tropic including tropical Africa.

The details of the practice of shifting cultivation vary from place to place, the farmer first selects the site which has been under bush fallow for several years the vegetation is then cleared using hand tools. This clearing is done during the dry months preceding the planting season. The plant debris is allowed to dry for a few weeks and then set on fire. Any remaining unburnt material is either left on the field or gathered together again for burning. Crops are then grown on the field for 2 or 3 years starting with crop with high fertility requirement and ending with crop whose fertility requirement is low.

shifting cultivation as practiced in the tropics is invariably linked with low level of input with low level of input of technology and management cost of the operations are carried out with simple hand tools and labour requirements are high. Unfortunately, the very nature of shifting

cultivation tends to discourage a high level of input because the farm stays in one location only a short time, there is no incentive to invest in permanent structure such as storage facilities and irrigation facilities. Even certain pest control or soil conservation measures which may have long term benefit will only be carried out reluctantly on a field that is soon to be abandoned.

Consequently shifting cultivation continues to be characterized by low level of technology and correspondingly low yield.

To the shifting cultivator, bush burning constitute a technologically easy answer to the problem of clearing plant debris from the field prior to cropping. However, the practice of bush burning has certain serious adverse consequences, most of the nutrients e.g nitrogen and sulphur present in the debris are converted to oxide during burning and lost to the atmosphere. In addition burning may destroy beneficial microorganism and have adverse effect on soil structure.

On the other hand, burning may also be of benefit.

- It is an easy and inexpensive way of getting rid of excessive plant debris.
- It may serve to kill pests, pathogens and weed seeds which may be present in the soil.
- The alkaline ash left on the soil after burning serves as a good soil amendment in most location of the humid tropics which because of high rainfall and leaching have acid soils. Apart from its effect on soil acidity, ash also serve as an immediate source of certain mineral nutrients such as K and Ca for the planted crops. If not for the burning, such nutrient will have remained tied up in undecomposed vegetation for several months.

Fallowing system economically termed 'low input agricultural production system entails allowing a crop land to return to its original vegetation prior to clearing and farming. By so doing, restores lost nutrients. It is a period during which nutrient removed in crops and for leaching into the sub soil during cropping phase are accumulative in biomass.

Pest and disease infestation are as well reduced. Rate of mineralization decline due to change in microclimate and soil. The magnitude of nutrient loss by run-off and leaching is considerably negligible.

However, the ecological sustainability and fertility restoration potential of the fallow depends on its age and prevalent edaphic factors peculiar to their area. In view of the fact that the land is most fertile at the end of the bush fallow period, most shifting cultivators plant their most nutrient demanding crops such as yam in the 1<sup>st</sup> season after bush burning while crops such as cassava which can tolerate less fertility are planted in the 2<sup>nd</sup> or 3<sup>rd</sup> season just before the land is reverted to bush fallowing.

The real trouble about shifting cultivation nowadays is the lack of land. The land has been used for industrialization purposes. When the pressure becomes too great, shifting cultivation is abandoned completely in favour of continuous cropping on the same piece of land.

### **CONTINUOUS CROPPING**

In contrast to shifting cultivation, continuous cropping implies the cultivation of the same piece of land year in year out. Fallowing may occur but it never occurs for more than a season or two. The absence of fallow period means that other soil management procedure must be used to maintain high soil fertility. Partly for this reason, continuous cropping is usually associated with a higher level of technology and management than shifting cultivation.

Since the land will be used for cropping on a long term basis, it is economical to carry out various operations of long term values on the land after clearing. Such operations include

- Construction of contour bunds for erosion control
- grading of land for irrigation purposes e.t.c

Each of this is a valuable long term investment under continuous cropping. With the absence of bush fallowing, it might be wondered how soil fertility can be maintained under continuous cropping. This is done in at least 3 ways.

1        Continuous cropping does not rely solely on the native fertility of the soil.

Fertilizers and other soil amendments are applied to the soil at various times in order to boost fertility. These fertilizers may range from natural organic product such as manure and compost to artificially produced chemical fertilizer



2 By judicious selection of the crops and crop combinations to be grown. In this respect, crop rotation and carefully planned inter-crop combinations are indispensable. This practice ensures that nutrient removal from the soil is relatively uniform and that soil nitrogen is occasionally replenished by the cultivation of leguminous crops.

3 By introducing short term fallow period into the cropping cycle. After every 3 or 4 years of continuous cropping, the land is allowed to lie fallow. This fallow period does not last for several years as with bush fallow. It usually last for a few months. A leguminous cover crop may be planted on the land and allowed to grow on it for the duration of the fallow.

One major objective of fallow is the improvement of soil fertility through the fixation of nitrogen by legumes and through increasing the soil organic matter content when the fallow crop or vegetation is ploughed under.

Soil structure is also improved and the over crop protects the soil from erosion. The practice of continuous cropping is therefore based on the judicious management and conservation without this, soil fertility becomes depleted and crop yields are adversely affected.

### **CROP ROTATION AND MONOCULTURE**

In the practice of continuous cropping, it is theoretically possible to grow the same crop on the same land, season after season. Such a practice is referred to as monoculture.

Alternatively, the farmer may plan a definite sequence for growing his crops on the land. This practice of growing different crops one at a time in a definite sequence on the same piece of land is referred to as Crop Rotation.

The farmer must decide what crops to add in the rotation, in what sequence the crops should occur and for how many years or season each cycle of the rotation must run. Several factors have to be considered in deciding the sequence of crops. Usually the target crop comes immediately after the legume or the fallow period at this time, the fertility of the soil is at its peak and the best realizable yield of the target crop can be expected. Crops which are known to have a high demand for nutrients are also timed for the 1<sup>st</sup> or 2<sup>nd</sup> season after the fallow.

Another principle is that crop which are deep feeders should alternate with shallow feeders. In this way, nutrient removal occurs uniformly from the various soil layers rather than occurring in only one layer. Furthermore, the crop sequence is influenced by disease and pests (including weeds). Crops that are botanically similar (e.g tomatoes and potatoes) are likely to be attacked by the same diseases and pests, should not follow each other in the rotation. Even dissimilar crops which are known to suffer from the same diseases or pests should not follow each other in the rotation unless those particular diseases or pests are absent from the area e.g yam should not follow cowpea in rotation if the root knot nematodes is prevalent e.g yam should not follow cowpea in rotation if the root knot nematode is prevalent e.g as the nematode left over from the cowpea crop will severely reduce yam yield. However if the nematode does not exist in the area, yam could conveniently follow cowpea.

	Year 1	year 2	Year 3
Plot A	Cotton	Guinea corn	Groundnut
Plot B	Guinea corn	Groundnut	Cotton
Plot C	Groundnut	Cotton	Guinea corn

Crop Rotation is an effective means for controlling diseases and pests. In monoculture for example, diseases and pest of a particular crop always have their host around and therefore have the opportunity to build up over the years.

In crop rotation, the pathogens and pest of a particular crop are more likely to die off when their host crop is followed by a completely different non-host crop.

Crop rotation is a device for maintaining high soil productivity over several years of continuous cropping. The inclusion of legumes and fallow in the cycle and the use of crops that feeds at different levels are devices to sustain soil productivity. Monoculture does not provide this device.

The type of crop rotation where the field is divided to several plots offers the farmer some insurance against crop failure and enable him to spread out his labour needs.

## **INTERCROPPING AND SOLE CROPPING.**

The practice of growing one crop variety alone in pure stand on a field is referred to as sole cropping. In this practice, only one crop variety occupy the land at a time. The alternative practice of growing two or more crops simultaneously on the same field is called Inter-Cropping. The various crops in the inter-crop do not necessarily have to be sown or harvested at the same time, the main requirement is that they are on the field at the same time for a significant part of their growing period.

There are various kinds of intercropping system based on the exact arrangement of crops on the field, when the various crops are grown in separate rows. It is called ROW INTER-CROPPING when the various crops are grown intermingled, more or less at random with each other, it is called MIXED INTER-CROPPING/MIXED CROPPING.

Mixed cropping stabilize the environment and protect it from hazard like high rainfall intensity which result in the erosion of land, loss of nutrient and high temperature which leads to high rate of mineralization.

The planting of several crops which differ in height, root development and light requirement allows for more efficient use of solar radiation, soil nutrient and water.

In Nigeria, under arable cropping in the humid forest zones, ground cover is provided by sweet potatoes, cowpea, melon while cassava, maize and yam form the middle strata. Banana, plantain and pawpaw which rise above the rest of the crops provide the canopy. Where maize is planted, it provides for beans (cowpea) that enriches the soil with nitrogen while the life-mulch crop provide ground cover there by reducing soil erosion, soil compaction and weed growth.

## **MIXED FARMING**

Mixed farming is a system of farming in which the cultivation of crops is kept side by side with the rearing of farm animal. Most farmers in west Africa are practicing mixed farming to some extent. In some cases this practice may not be deliberate on their part but rather accidental in that keeping of a few chickens, goat and sheep are taken as a way of life. Hence, we can't compare

the level of mixed farming practice by West Africa farmers to that practice in the temperate region or in other part of Africa such as Kenya and South Africa. Mixed farming requires more technical skills in the various aspects of crop and animal production. It also requires much land and large capital outlay.

#### Advantages

- 1 Provision of variation in farm work.
- 2 Better use of farm labour and equipment throughout the year
- 3 The spread of farm risk.
- 4 The waste and by-product from crops can be used directly in feeding the animals while animal waste products can be used in manuring the soil.

### **PASTORALISM**

Cattle, sheep and goat rearers in West and East Africa are nomads or wandering herdsmen. They wander from place to place with their cattle mainly because of their seasonal grazing requirement or need for pasture. They move from area where pasture is scarce to those where pasture and water supply are plenty. Other causes of this movement include: - the need to get away from areas with animal diseases such as sleeping sickness and to escape from tax collectors.

Generally these wandering herdsmen destroy the grassland area because of keeping too many cattle (over-stocking).

Normadism is not the best method of keeping animals because animals rarely make steady gain in weight owing to seasonal variation in feeding and the need to walk long distances in search of grazing grounds.

Animals are also more open to attack by predators under this system.

This system relieves the herdsman from the burden of establishing a pasture for his cattle.

Normadism as was practiced by Fulani of West Africa and the Masai of East

Africa is dying out and being replaced by semi-permanent settlement husbandry.

## **RANCHING**

This is the opposite of pastoralism. Ranching involves the confinement of animals particularly beef or dairy (milk-producing) cattle to an area of land where they are controlled and fed for market purposes.

This method of raising cattle was first practiced in Spain and was later introduced to South America which is now world-famous.

Ranching is not widely practiced in West Africa except on a few government farms which can provide the amount of care and investment it entails.

Usually, ranching calls for pasture development i.e the deliberate planting of grass for the use of the animals. It therefore entails the use of large expanses of land. It also entails making drinking water available constantly all year round.

Ranched animals do not usually do very well in areas where there are marked weather or seasonal differences.

Factors which make ranching impossible in West Africa include:-

- 1 Lack of technical and managerial expert in ranch management.
- 2 Poor communication and marketing facilities.
- 3 Marked seasonal variation in weather condition.
- 4 Absence of mechanization in the farming system which does not allow the establishment of large acreages

- 5 Shortage of constant sources of drinking water in area where cattle can perform well (as in Northern Nigeria, Northern Ghana and Ivory Coast).
- 6 Low availability of crop by- product necessary for the efficient grazing of cattle.

### **FARMING IN THE HYDROMORPHIC AREA**

Hydromorphic or lowland areas occupy about 5 % of the total cultivable land in Nigeria. The high level of organic matter resulting from reduced rate of decomposition due to water logging and deposition of sediments. A lot of rice, sugarcane, vegetable crops and wheats are cultivated during the dry season in the “Fadama” of Northern Nigeria.

In the Southern Nigeria, these areas are called “Akuro” and are abandoned during the raining season because of drainage problem but are put into consideration during the dry season in period during which the water table is low.

### **TERRACE FARMING**

This system of cultivation is typically of mountainous and hilly areas consists of making a series of steps cut into a slope where the forward edges of the slope are never cultivated and are constructed as nearly vertical as possible. The land is intensively cultivated and the soil fertility is maintained by the use of organic waste of all types as a means of building up the soil fertility and reducing or eliminating the land extensive system of bush fallowing.

### **UPLAND FARMING**

The most important problem of the upland cereal-based system is very rapid decline in soil fertility, erosion and other agro-ecological problems.

Improved upland farming systems that enable sustained production should be based on those cultural practices that alleviate resource production constraint due to bio-physical and socio-economic factors. The major relevant cultural practices that can be considered include

- 1 Planted fallow
- 2 Green manure and mulches.
- 3 Balanced fertilization and manuring
- 4 Agroforestry and mixed cropping
- 5 Soil conservation

The above (5) intervention can not be seen independently, there is always a need for a combination of sub-systems and cultural practice.

Advantages of planted fallow (live mulch).

- Provision of surface cover to the soil thus reducing evaporation, improving soil moisture holding capacity, moderating daily soil temperature fluctuation and increasing microbial biomass activity.
- Reducing rain drop impact of the soil thereby reducing soil surface run off and erosion.
- Serving as biological agent of weed control.
- Addition of above and below ground organic input to the system.

### **ALLEY CROPPING**

In this system, food crops such as maize and cowpea are grown in alleys along the contours formed by hedge rows planted 3 - 4 m apart of fast growing leguminous shrubs and trees. E.g Leucaena. The hedge rows are periodically pruned during the cropping season to prevent shading. Prunings are used as mulch and green manure for the associated food crop.

The woody portion of pruned branches can also be used as fuel woods or sticks for yam. Leaves may also be used as fodder for livestock.

When trees and shrubs with their deep root system are planted along contours on sloppy land they are not only able to recycle soil nutrients but also minimize water run off and soil erosion.

A beneficial effect of alley cropping on acidic soils is the use of pruning as leguminous green manure can reduce soluble and exchangeable aluminium in the soil by forming less soluble organo-aluminium complexes.

Maintains soil moisture and provide an environment that favour micro and macro organisms and soil flora and fauna and suppress weeds.

### **DRY SEASON FARMING**

The creation of River Basin Authorities in the country marked a new era of agricultural production in the semi-arid zone of Northern-Nigeria. In Sokoto, Kaduna, Kano and Borno state, extensive large scale dry deason farming is being practiced.

Farmers take advantage of the cool harmattan to grow irrigated wheat, beans, carrot, irish potato, tomatoes and other vegetables in monoculture between November and March.

### **IRRIGATION**

Irrigation can be defined as the application of water to soil to provide moisture for crop growth. Irrigation could be supplementary when water is applied to supplement deficient rainfall or it may be total when all the crop water requirement are supplied by irrigation because of total lack of rainfall.

#### **Importance of irrigation**

Crop growth is impossible without moisture, and irrigation is necessary to ensure crop growth and development whenever and wherever there is not enough water for crop growth.

The following objectives can be achieved by irrigation:

- 1 All year round agricultural production is possible by irrigation where temperature poses no constraint.
2. Crop yield can be improved by application of irrigation which ensures that crop water requirement are always satisfied.
- 3 Application of irrigation consequently helps to avert crop losses in areas subject to incidence of draught.
- 4 Irrigation can facilitate the cultivation of crops which could not have been possible to cultivate under rain-fed agriculture.



## **Steps in planning irrigation projects**

- 1 Land capability assessment
- 2 Estimation of irrigation water requirement.
- 3 Determination of the quantity and quality of water available for irrigation use.
- 4 Design of water supply scheme for the project and the water distribution works.
- 5 Economic analysis of the project to determine its viability.
- 6 Establishment of appropriate organization to operate and manage the project.
- 7 An EIA of the project.

The aim of land capability assessment is to determine the ability of the land to produce crops which provides adequate returns of investment in the proposed irrigation project.

It includes analysis of the soil, topography and climate and hydrology of the project site. The soil must have high water holding capacity, reasonably permeable, well drained and deep enough to allow root development.

The soil must be free of toxic element while possessing adequate supply of nutrients for the growth of crops. Land slope must be moderate to discourage excessive erosion.

Land characterized by steep slope should be avoided. The land should be located in such a way that irrigation is possible without excessive water pumping or transmission costs.

## **Sources of water for irrigation**

There are 2 basic types

- 1 Surface water – rivers, streams
- 2 Ground water – well, borehole

Irrigation water may be directly abstracted from rivers and streams where possible. But considering the fact that irrigation is most needed when the weather is dry and stream flows are at or near their minimum, it is in most cases necessary to build reservoirs by damming the river.

Groundwater from wells and boreholes may sometimes be used for irrigation depending on local geology. Again, groundwater tends to be at minimum during dry weather when irrigation is most needed. Also, if the rate of recharge of ground water is low, mining of groundwater may occur.

Groundwater needs to be pumped out to the farm. The water may not also be of the right quality for irrigation especially if it is saline.

### **Methods of irrigation**

- 1 Sub-surface irrigation
- 2 Surface irrigation
- 3 Over head irrigation

### **Sub-surface irrigation**

Water is applied to crops at their roots. Different techniques are employed to deliver the water to the base of the crops. These include the use of porous or open-jointed pipes buried underground allowing water to seep into the soil.

#### Advantages

- 1 Minimum loss of water by evaporation
- 2 Minimum waste of surface water
- 3 Minimal field preparation and labour cost.

### **Surface irrigation**

Two main techniques of delivering irrigation water to crops under surface irrigation are

- 1 By flooding the field known as flooding irrigation

#### Disadvantages

- 1 Wasteful of water
- 2 Require fairly smooth ground to achieve even irrigation.

- 2 Controlled flooding which is achieved by the use of ditches, borders, checks or basins

The flow is turned into the borders, checks or basin to stand until it infiltrates.

#### Limitation of Surface Irrigation

- 1 It requires land with gentle or regular slope which may not be available.
- 2 Soil erosion may constitute a problem.
- 3 Inefficient use of water by crops.
- 4 The various water channels reduce the area available for planting some crops apart from the fact that weeds may grow on them.

#### **Over head irrigation**

Over head irrigation is the irrigation water applied above the crops mainly by the use of sprinklers. Over head irrigation is therefore synonymous with sprinkler irrigation.

Water is pumped under pressure and carried through a network of pipes from where the water is sprinkled over the crops.

Factors favouring overhead irrigation are:

- 1 Excessive soil porosity
- 2 Land gradient unsuitable for surface irrigation
- 3 The need for high application efficiency for irrigation water.

Other advantages

- 4 It can be used in hilly or mountainous terrain.
- 5 It can be flexible such that the application rate can be selected to suit the soil type and infiltration rate.
- 6 Little water is wasted or lost as over head irrigation requires only  $1/3^{\text{rd}}$  of the quantity of water required by surface method for the same crop treatment.
- 7 It can be used to distribute fertilizer or organic manure to crops.

#### Disadvantages

- 1 Large drops of water with high terminal velocity may damage the soil surface.

**Environmental and Health Problems Associated with Irrigation farming.**

- 1      Irrigation may increase the incidence of diseases such as malaria especially in semi-arid environment.
- 2      The incidence of some pests, diseases and weeds may increase with the introduction of irrigation.
- 3      There are also socio-economic problems of resettlement of people displaced by irrigation projects as well as problems of evaporation from reservoir.
- 4      Soil erosion
- 5      Soil salinity
- 6      Water logging
- 7      Leaching of nutrient and fertilizers
- 8      Lack of oxygen supply to the roots of crop
- 9      Pollution of ground water.