



MANYAM FRANCHISE
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KCSE AGRICULTURE NOTES

TOPIC 2: FACTORS INFLUENCING AGRICULTURE



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MANYAM FRANCHISE
0728 450425



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Specific Objectives

By the end of the topic, the learner should be able to:

- a) Explain the human factors influencing agriculture
- b) Explain biotic factors influencing agriculture
- c) Explain how climatic factors influence agriculture
- d) Define soil
- e) Describe the process of soil formation
- f) Describe soil profile
- g) Determine soil constituents
- h) Classify soils by physical characteristics
- i) Explain chemical properties of soils
- j) Relate crop and livestock distribution to soils in different regions.



Factors Influencing Agriculture

Introduction

Agricultural production is influenced by external factors:

- a) Human factors
- b) Biotic factors
- c) Climatic factors
- d) Edaphic factors.

Human Factors

These are human characteristics which affect the way decisions are made and operations carried out.

Level of education and technology:

- ✓ Skills
- ✓ Technological advancements.

Human health/HIV-AIDS:

- ✓ These affect the strength, the vigour, vision and the determination to work.
- ✓ HIV/AIDS is the biggest threat to human health today and has long lasting effects on agriculture, such as;
 - ✓ Shortage of farm labour.
 - ✓ Loss of family support.
 - ✓ Low living standards leading to despondency and hopelessness.
 - ✓ Increased criminal activities.
 - ✓ More time spent by the Government and NGO's in Caring for the sick.



Economy;

- ✓ Stability in the countries' economy affect agricultural production.

Government Policy:

- ✓ These are governmental laws which have been enacted to protect farmers, land and livestock.
- ✓ Food policy
- ✓ Policies on control of livestock parasites and diseases.
- ✓ Policies on marketing of both local and export products and others.

Transport and communication:

- ✓ For agricultural goods to move from the farm to the consumers.

Cultural practices and religious beliefs:

- ✓ These activities hinder important changes in a society that may bring agricultural development.

Market forces:

- ✓ Demand and supply forces which affect prices of commodities in a free market.

Biotic Factors

These are living organisms which affect agricultural production.

- Pests** - Destructive organisms which destroy crops.
- Parasites** - These are invertebrates which live in or on other living organisms.
- Decomposers** - Organisms which act on plants and animal tissues to form manure.
- Pathogens** - Micro-organisms which cause diseases.
- Predators** - Animals that kill and feed on other animals.
- Pollinators** - They transfer pollen grains from the stamens to the pistil of a flower.
- Nitrogen fixing bacteria** - They are micro-organisms which convert atmospheric nitrogen to nitrates ready for use by the plants.



Climatic Factors (weather elements).

- a) Rainfall,
- b) Temperature,
- c) Wind,
- d) Relative humidity
- e) Light.

Weather - Atmospheric conditions of a place at a given time period.

Climate - weather conditions of a place observed and recorded for a period of 30-40 years.

Rainfall

Supplies Water:

- ✓ Which is necessary for the life process in plants and animals.
- ✓ Which makes the plant turgid hence provides support.
- ✓ Acts as a solvent for plant nutrients.
- ✓ Cools the plant during transpiration.
- ✓ Which is used as a raw material in photosynthesis.

When plants lack enough water they respond in different ways as follows:

- ✓ By closing the stomata to restrict water loss.
- ✓ Hastens maturity.
- ✓ Some will roll their leaves.

Other plants have developed permanent adaptation to water stress such as:

- ✓ Growing needle like leaves.
- ✓ Develop fleshy leaves for water storage.
- ✓ Develop long roots.



- ✓ Wilting and death in extreme conditions.

Important Aspects of Rainfall:

Rainfall reliability; - This is the dependency on the timing of the onset of the rains.

Amount of rainfall; - Quantity of rain that falls in a given area within a given year.

Rainfall distribution; - The number of wet months in a year.

Rainfall intensity; - Amount of rainfall that falls in an area within a period of 1 hour.

Temperature

This is the degree of hotness or coldness of a place measured in degrees Celsius.

Cardinal range of temperature is the temperature required by plant to grow and thrive well.

Optimum range of temperatures - the best temperature for the best performance of plants.

Effects of Temperatures on Crop Production:

Low temperatures:

- ✓ Slow the growth rate of crops due to slowed photosynthesis and respiration.
- ✓ High incidences of disease infection.
- ✓ Improves quality of crops such as tea and pyrethrum.

High Temperatures

- ✓ Increase evaporation rate leading to
- ✓ Wilting.
- ✓ Hastens the maturity of crops.
- ✓ Increase disease and pest infection.
- ✓ Improves quality of crops such as pineapples, oranges and pawpaws.



Wind

Wind is moving air.

Good effects of wind include:

- ✓ Seed dispersal
- ✓ Cooling of land
- ✓ Pollination in crops
- ✓ Brings rain bearing clouds

Negative effects of wind:

- ✓ Increases the rate of evaporation of water.
- ✓ Causes lodging of cereals and distorts perennial crops.
- ✓ Increases evapo-transpiration.
- ✓ Spreads diseases and pests.
- ✓ Destroys farm structures.

Relative humidity

This is the amount of water vapour in the air

- ✓ Affects the rate of evapo-transpiration.
- ✓ Forms dew which supplies soil with moisture under dry conditions.
- ✓ High humidity induce rooting in cuttings.
- ✓ Increases disease multiplication and spread.

Light

Provide radiant energy harnessed by green plant for photosynthesis.



Important aspects of light:

Light intensity;

The strength with which light is harnessed by chlorophyll for photosynthesis.

Light duration;

This is the period during which light is available to plants per day.

- ✓ Plant response to light duration is known as photoperiodism.
- ✓ Short-day plants, require less than 12 hours of daylight to flower and seed.
- ✓ Long-day plants - require more than 12 hours of daylight to flower and seed.
- ✓ Day-neutral plants require 12 hours of daylight to flower and seed.

Light wavelength;

This is the distance between two - successive crests of a wavelength.

- ✓ It dictates the difference between natural and artificial light.
- ✓ Chlorophyll absorbs certain wavelengths of light.

Edaphic Factors Influencing Agriculture

These are soil factors.

Soil is the natural material that covers the surface of the earth,

Made of weathered rock particles and decomposed animal and plant tissues, and on which plants grow.

Importance of Soil

- ✓ Provides anchorage to the plants by holding their roots firmly.
- ✓ Provides plants with mineral salts/ nutrients which are necessary for their growth.
- ✓ Provide the plants with water.



- ✓ Contains oxygen necessary for respiration of the plants and soil micro-organisms.

Soil Formation:

Soil is formed through weathering process.

Weathering is the breakdown and alteration of the parent rock near the surface of the earth to a stable substance.

Weathering process is a combination of disintegration (breakdown) and synthesis (build up) process.

Weathering process is continuous.

Types of Weathering

- Physical weathering
- Chemical weathering
- Biological weathering

Agents of Weathering

Physical Agents of Weathering

Include wind, water, moving ice and temperature.

Wind - carry materials which hit against each other to break into fragments.

Water - intensity of rainfall causes breakdown of rock.

Moving ice - has grinding effects which tear off rock particles.

Extreme temperature cause rocks to expand and contract suddenly peeling off their surface.

Chemical Weathering

Affects the chemical composition and structure of the rock.

Involves processes such as;



- a) Hydrolysis,
- b) Hydration,
- c) Carbonation
- d) Oxidation.

Hydration;

The process by which soluble minerals in the rocks absorb water and expand weakening the rock thus leading to disintegration.

Hydrolysis;

The process whereby water dissolves soluble minerals in the rock weakening it.

Oxidation;

The reaction of rock minerals with oxygen to form oxides which break easily.

Carbonation;

The process whereby carbonic acids formed when rain water dissolves carbon dioxide,

It reacts with calcium carbonates in limestone causing it to disintegrate.

Biological Weathering

This involves the action of living organisms, plants and animals on the rocks.

Burrowing animals, for example, termites and moles bring soil particles to the surface exposing them to other agents of weathering.

Big animals like, elephants, buffaloes, camels and cattle exert a lot of pressure on the rocks as they step on them due to their heavy weights causing the rocks to disintegrate.

Earthworms take part in the decomposition of plant matter with the soil particles.



Man's activities like, mining and quarrying expose rocks to the surface during excavation. These activities breakdown large rocks into smaller rock particles.

Plant roots force their way through the cracks in the rocks thus widening and splitting them.

Humic acids formed when plant tissues decompose react with the rocks weakening them further.

Plant remains decompose adding humus into the soil.

Factors influencing soil formation

- a) **Climate** - (rainfall, temperature and wind)
- b) **Biotic factors** - living organisms.
- c) **Parent material** - Nature and properties of the original rock from which the soil is formed.
- d) **Time** - length of time during which the soil forming processes have taken place.
- e) **Topography** - influences the movement of disintegrated materials.

Soil Profile

It is the vertical arrangement of different layers of soil from the ground surface to the bedrock.

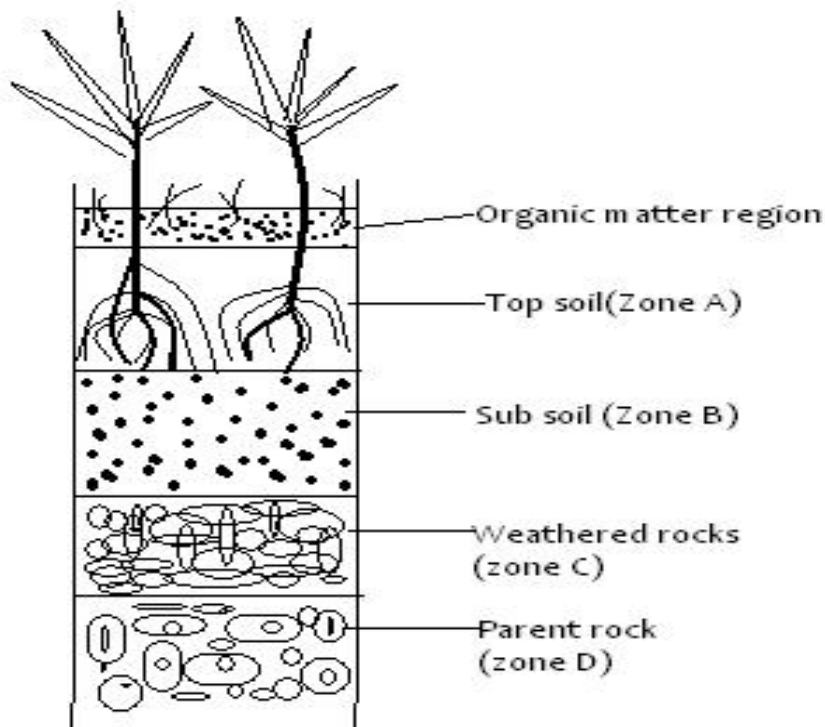
These layers are also referred to as horizons.

The layers show differences in their contents and physical properties such as colour, texture and structure.

The layers include: organic matter region, top soil, sub-soil, weathered rocks and parent material.



Soil Profile



Organic Matter Region

First layer of the soil found on the surface.

Made up of leaves and other plant remains at various stages of decomposition.

Some soil organisms may also be found here.

Top Soil

Has a dark colour due to the presence of humus.

Is rich in plant nutrients and well aerated.

It is a zone of maximum leaching (zone of eluviation)

Sub-Soil

It is compact and less aerated.

It is a zone of accumulation of leached material (zone of aluviation) from the top layers.



Deep rooted crops have their roots growing up to this region.

Hard pans normally form in this layer

Weathered Rocks

It is also called substratum.

Rocks at various stages of disintegration are found in this zone.

Most of the materials found in this zone originate from the parent rock.

Parent Rock

It exists as a solid mass which is un-weathered.

It is the source of the inorganic composition of the soil.

The water table is on the surface of this rock.

Soils Formed in Situ and Soils Deposited

Soil formed in the same place and remains there is said to be in situ. However, soil can be formed due to deposition of soil particles carried from its original site of formation to another area which is usually in the lower areas of slopes. Such soils are said to have been formed through deposition.

Soil Formed in Situ	Soil Deposited
Has the colour of the parent rock	Has the characteristics of when: it came from.
Shallower	Deeper
Less rich in plant nutrients	Richer in plant nutrients
Easily eroded	Not easily eroded
Less silty	More silty
Have the same chemical composition as that of the underlying parent rock.	Differ in chemical composition from the underlying parent rock.



Soil Depth

This is the distance between top soil layer and the bottom soil layer in a profile.

It dictates root penetration and growth

Deep soils are more suitable for crop growth since they contain more nutrients.

Have a larger surface area for root expansion.

Deep soils facilitate good drainage and aeration.

Soil Constituents

- ✓ **Organic Matter** - Dead and decaying plants and animal remains
- ✓ **Living Organisms** - Soil organisms and plant roots.
- ✓ **Micro-organisms** (bacteria, protozoa and fungi)
- ✓ **Invertebrates** -termites,
- ✓ Earthworms and mollusks.
- ✓ **Higher animals** - rodents and others.

Inorganic or Mineral Matter

Formed from the parent materials.

- ✓ Supply plant nutrients
- ✓ Form the skeleton and framework of the soil.

Air

- ✓ Found in the pore spaces of the soil.
- ✓ Used for root and organism respiration
- ✓ Used for germination of seeds.
- ✓ Helps in decomposition of organic matter.
- ✓ Regulates soil temperature.



- ✓ Regulates the movement of water through capillary action.

Water

- ✓ Dissolves mineral salts
- ✓ Maintain turgidity in plants.
- ✓ Used for germination of seeds
- ✓ Used by soil organisms.
- ✓ Regulate soil temperature
- ✓ Dictates the amount of air in the soil.

Water in the soil exists in three forms namely:

Superfluous/Gravitational Water

Found in the large spaces (macro-pores) in the soil particles.

Held by gravitation forces.

When the pores are saturated, the soil is said to be waterlogged.

It moves and may cause leaching.

Hygroscopic Water

Water found in thin films on the soil particles.

Held by strong adhesive forces between water and soil particles.

Does not move and hence not available for plant use.

Capillary Water

Occupy micro-pores in the soil particles.

Held by cohesive forces between water molecules.



Moves through capillary action

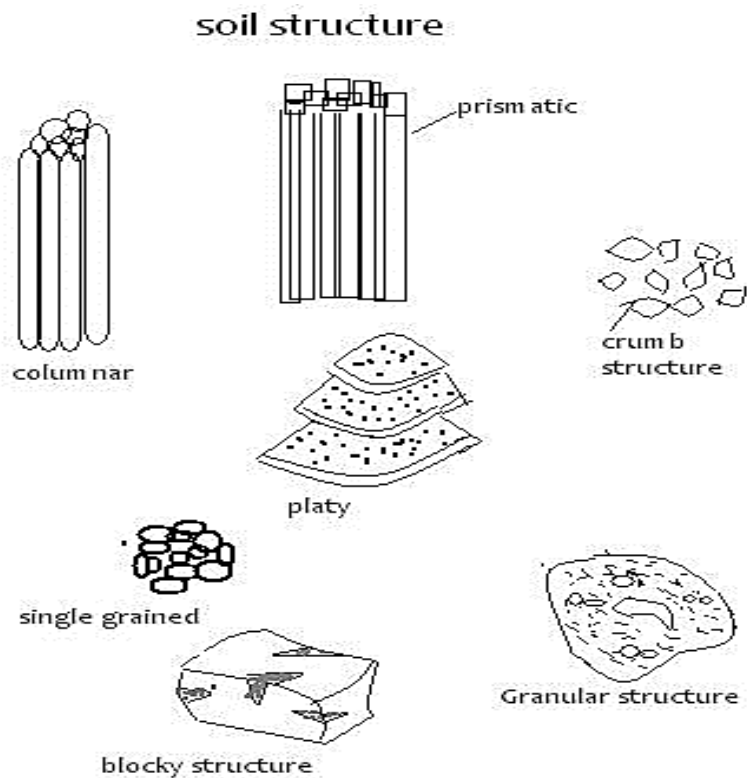
Available to plants for use.

Soil Structure

This is the arrangement of soil particles in a soil horizon.

Types of Soil Structure

- ✓ Single-grained
- ✓ Crumby
- ✓ Granular
- ✓ Prismatic
- ✓ Columnar
- ✓ Platy
- ✓ Blocky





Importance of Soil Structure on Crop Production

Soil Structure Influences

- ✓ Soil aeration
- ✓ Soil drainage and water holding capacity.
- ✓ Plants root penetrability and anchorage.
- ✓ Microbial activities in the soil.
- ✓ Circulation of gases in the soil.

Farming practices which improve the soil structure are:

- ✓ Application of inorganic manure into the soil.
- ✓ Tilling the land at the right moisture content.
- ✓ Crop rotation.
- ✓ Minimum tillage.
- ✓ Cover cropping.
- ✓ Mulching.

Soil Texture

It refers to the relative proportion of the various sizes of the mineral particles of soil.

Importance of Soil Texture on Crop Production;

Influences soil fertility

- ✓ Affects the organic matter content
- ✓ Influences the drainage of the soil.
- ✓ Influences soil aeration.
- ✓ Influences water holding capacity.



- ✓ Influences the capillarity or movement of water in the soil.

Soil Textural Classes

Sandy Soils

- ✓ Made up largely of sand particles.
- ✓ Have large pore spaces hence poor in water retention.
- ✓ Easy to till (light soils).
- ✓ Freely draining.
- ✓ Low fertility due to leaching of minerals.
- ✓ Easily erodible.

Clayey Soils

- ✓ Made up largely of clayey particles.
- ✓ Have small pore spaces hence good in moisture retention.
- ✓ Difficult to till (heavy soils).
- ✓ Poorly 'drained.
- ✓ Expand when wet, crack when dry.
- ✓ High capillary.
- ✓ Rich in plant nutrients.

Loam Soils

- ✓ About equal amounts of sand and clay.
- ✓ Moderately good in both moisture and air retention.
- ✓ Fertile soils.

Soil Colour

This depends on the, mineral composition of the parent rock and the organic matter content.



Soils containing a lot of iron are brownish, yellowing and reddish in colour.

Soils with a lot of silica are white.

Soils with a lot of humus are dark or grey.

Soil pH

This refers to the acidity or alkalinity of the soil solution/the concentration of hydrogen ions in the soil solution.

Soil pH is determined by the concentration of hydrogen ions (H^+) or the hydroxyl ions (OH) in the soil solution.

A pH of less than 7 means that the soil is acidic.

A pH of more than 7 means that the soil is alkaline.

As the hydroxyl ions (OH) in the soil increase the soil becomes more alkaline.

Influence of Soil pH Crop Growth

It determines the type of crop to be grown in a particular area.

Most crops are affected by either very acidic or very basic soil PH.

Soil pH affects the choice of fertilizers and the availability of nutrients to crops.

At low PH the concentration of available iron and aluminium in the soil solution may increase to toxic levels, which is harmful to plants.

Very acidic or low pH inhibit the activity of soil micro-organisms.