NEW ORDINARY LEVEL AGRICULTURE RESEARCH BOOK

(DETAILED)

SENIOR ONE TO SENIOR FOUR

"LEARNER'S RESEARCH BOOK"

BASED ON THE NEW LOWER SECONDARY CURRICULUM

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Preface

This learner's research book has been written in line with the revised agriculture syllabus for the new lower secondary curriculum.

The main reason as to why We have written this book, is to make research easier to learners as they are making their own notes in agriculture. Therefore, this is a detailed research book for the new revised agriculture ordinary level syllabus.

This research book has been written in a Simplified way to help students read and understand the competence based agriculture on individual basis as they are coming up with their own notes. Therefore, learners understand key concepts and apply them in real life.

This learner's research book is one of the materials which are to be used to support the teaching and learning process of the new lower secondary curriculum.

Lwanga Books Ltd feels confident that this Book will be of immense value to both the learners and the teachers.

Any suggestions for improvement of this book are most welcomed, thanks.

"It is not what We do for you but what We will teach you to do for and by yourselves that will eventually make you successful beings in the society"

Acknowledgement

Lwanga Books Limited is deeply indebted to all those who participated in the development of **Lwanga William S1-S4 Agriculture Learner's Research Book.**

Special thanks go to **Mr. Lwanga William**, CEO of Lwanga Books Ltd for his valuable insights and advice on all publishing matters.

We would like to express our sincere appreciation to all those who worked tirelessly towards the production of this learner's research book.

First and foremost, we would like to thank our families and friends for supporting all our initiatives both financially and spiritually, Lwanga William's parents; **Mr. William Lwanga** and **Mrs. Harriet Lwanga,** his brother; Mr. Nsubuga Grace.

The initiative and guidance of the publishing partners, Ministry of Education and Sports (MoES) and National Curriculum Development Centre (NCDC) in development and implementation of the New Lower Secondary Curriculum are highly appreciated.

We thank God for the wisdom He has given us to produce this volume of work. May the Almighty God bless all the students that will use this book with knowledge of making their own notes as they are making research..……**AMEN**.

We welcome any suggestions for improvement to continue making our service delivery better.

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INTRODUCTION TO AGRICULTURE

AGRICULTURE

The word agriculture originated from two Latin words i.e;

- Ager which means soil, land or field;
- Cultural which means tillage or cultivation.

The word agriculture means cultivating/ tilling or management of the field, soil and land.

Definition;

Agriculture is the science and art of growing crops and rearing of animals for human benefit Agriculture is a science because;

- Modern crop and animal production requires knowledge of other science subjects such as Chemistry, Physics, Biology, Zoology, Botany, Pedology, Geography and Economic, Math.
- It requires application of knowledge from experiments and observations.

Agriculture is an art because it involves adopting specific skills for doing certain activities like construction.

AIMS OF TEACHING AGRICULTURE IN SECONDARY SCHOOLS

- To stimulate an interest and create awareness of existing problems and opportunities in Agriculture and rural development.
- To provide a background for advanced studies in agriculture in A-level,colleges and universities
- To promote an appreciation of agriculture as an applied science.
- To teach in a practical manner the basic principles and skills in agriculture.
- To ensure that schools take up an active role in rural development by intergrating agricultural activities in the school curriculum
- To demonstrate that farming is a respectable occupation that is both profitable and honorable.
- To show how improved griculture will contribute towards worldwide freedom from famine

BRANCHES OF AGRICULTURE

- Soil science (pedology); this deals with the study of soil, how it is formed, how it works to sustain life and how it is kept alive for many years.
- Crop production / husbandry; this deals with the study of crops i.e. plant life cycles, their health conditions (diseases and pests); plant breeding and genetics.
- Animal production / husbandry; this deals with the science of rearing animals of different types e.g. cattle, sheep, poultry, pigs etc.
- Agricultural engineering and mechanization concerned with the study and use of different types of agricultural machines and tools used to simplify and make work more efficient on the form e.g. tractors, Ox ploughs, combine harvesters etc.
- Agricultural Economies; Deals with the basic principles of economics such as accounting, record keeping, organization of farm activities, advertisement and marketing agricultural products.

IMPORTANCE OF AGRICULTURE TO THE ECONOMY AND FARMERS

- Source of food; Agriculture provided food to the farmer and his family e.g. meat, banana, maize which reduces malnutrition and improve health of farmer.
- Source of income to the farmer. After the farmer selling crops, animals and their products, they earn money which is used to acquire other necessities of life.
- Provision of market; Agriculture provides market for agricultural in put e.g. hoes, feeds, chemicals, fertilizer produced by various industries.
- Source of raw materials for agro based industries that use agricultural products like tobacco, coffee, and sunflower, cocoa get their raw materials from agriculture.
- Source of employment; about 80% of Ugandan are employed either directly or indirectly in agriculture as farmers,

veterinary doctors, transporters, engineers etc.

- Source of government revenue; through taxation and collection of market dues. This revenue is used to run other government sectors.
- Source of fuel to the farm e.g. biogas, firewood and charcoal.
- Agriculture is a source of power e.g. animals can be used to transport items and people, or can be used for ploughing e.g. camels, donkeys.
- Provides medicine / herbs for treating sickness in both animals and human beings e.g. Black jack, moringa, Neem tree.
- Cultural values or traditional values and ceremonies are done using animals like cows, goats, sheep and birds.
- Influx development.

PROBLEMS FACING AGRICULTURE

- Shortage of capital to fund the activities of Agriculture e.g. buying inputs like fertilizer, seeds etc.
- Pest and diseases that attack both c.rops and animals; pests include maize stalk borers, termites; diseases like Nagana, anthrax, CMD, reduce yield.
- Shortage of enough land for farming due to increasing population thus keeping agriculture at a subsistence level.
- Poor market conditions due to lack of market information hence farmers are cheated by middlemen.
- Poor animal breeds and crop varieties that give low levels of output / poor quality products.
- Price change / unstable prices; this makes it hard for the farmers to plan for their incomes.
- Poor storage facilities; most agricultural products are perishable e.g meat, milk, fruits and therefore get spoilt quickly.
- Unpredictable climatic conditions i.e. prolonged drought and unreliable rainfall.
- High costs of agricultural inputs.
- Low level of technology in agricultural production.
- Poor transport and communication network.
- Shortage of labour especially the skilled man power. This is common in rural areas.
- Shortage of farm inputs e.g. fertilizers, seeds, tools and machines.
- Inadequate extension services.
- Corruption / mismanagement of agricultural sector / funds by government officials.
- Ignorance and illiteracy. The farmers lack knowledge in modern methods of farming.
- Poor land tenure system / ownership that discourage long term investments on the land e.g. communal ownership.
- Inadequate feeds / pastures and water for the animals.

POSSIBLE SOLUTIONS TO THE PROBLEMS FACING AGRICULTURE

- Provision of low interest loans or grants to the farmers to reduce the problem of shortage of capital.
- Construction of valley dams to harvest water which can be used in irrigating crops and watering animals during prolonged dry seasons.
- By encouraging co – operatives and collective ownership of machines to solve the problem of low technology.
- Encouraging mass education to reduce ignorance and illiteracy among farmers.
- Government should construct proper storage facilities e.g. silos to store excess produce in time of harvest and for during scarcity.
- Developing an appropriate land tenure system to reduce on the problem of land shortage and poor tenure system.
- Rehabilitation of the existing roads and railways to improve on transport.
- Developing a proper pest and disease control programme in order to control pests and diseases.
- Government should promote good governance to avoid political instabilities and insecurity.
- Investing in agro – processing industries to improve on the value of agricultural products for sale.
- Training more extension workers so that they can be employed even in rural

areas to enable farmers to carryout appropriate farming methods / practices.

- Encouraging more research to develop better crop varieties and good animal breeds.
- Subsidizing on inputs like fertilizers, seeds etc.

FACTORS WHICH AFFECT THE DITRIBUTION OF CROPS AND ANIMALS IN E.AFRICA

1. Climate; The major elments here which affect agriculture are rainfall,temperature and humidity.Climate varies from place to place which varies crops grown in such areas
2. Altitude; This refers to the height of the placeabove sea level.some crops do well above sea level/high altitude e.g arabicca coffee give best yield on high altitude while sorghum does well onlower altitude with high tempratures.
3. Topography; This refers to the nature oflandsurfce i.e flatness or steepness of an area,crops dont do well in hilly areas due to soil erosion. Animalgrazing is not easy on steep slopes and this affect agriculture
4. Edaphic factors(soil factors); Growth of some crops and pastures for animals is greatly affected by the natural fertility of the soil.
5. Pests and diseases; This affects the growth and distribution of some crops and animals e.g cassava mosaic greatly affects cassava growth,tsetse flies on the other hand affect the distribution of animals
6. Biotic factors; The relationship between interraction of plants and animals.Man and their activities can affect the distribution of crops and animals e.g In high populated areas,farmers tend to groew more food crops than cashcrops and rear a few animals due to lack of land
7. Religious beiefs E.g muslims dont rear pigs because the religion prohibits it, However they rear other animals like goats,cattle,sheep etc
8. Vegetation E.g areas with alot of vegetation can favour animal grazing

FARMING SYSTEMS AND PRACTICES

Farming systems refer to the decisions that farmers make to utilize their land in rearing crops and animals in order to produce food and other necessities for their benefit.
Farming systems are divided into 2 groups;

- Traditional / Local farming systems
- Commercial farming systems.

TRADITIONAL & LOCAL FARMING SYSTEMS

✓ The local farming systems in Uganda include;

✧ TESO SYSTEM;

- Practice in Teso in the districts of Soroti, Kumi, Katakwi.
- The land is generally flat and soils light / sandy.
- Ox cultivation is used
- The area receives a monomodal rainfall pattern.
- Major food crop is millet, cotton is the main cash crop grown.

✧ BANANA ROBUSTA COFFEE SYSTEM

- Practiced around the fertile Lake Victoria cresent in districts of Mukono, Mpigi, Luwero, Wakiso, Kiboga etc.
- It has a bi-modal rainfall pattern (2rainfall seasons).
- Major cash crop grown in coffee; others include tea, cocoa and sugarcanes.
- There is a gradual change into modern dairy farming.
- Tractors and hoes are mainly used for cultivation.
- Land tenure system is individual with registered land title deeds.

✧ BANANA MILLET COTTON SYSTEM

- Practiced in districts of Tororo, Masindi, Ntungamo, hoima, Nakasongola, Kamuli.
- The area experiences a bimodal rainfall distribution which favours cotton as the main cash crop.
- The soils are silt clay loams of medium fertility.
- The system has more livestock compared to banana robusta coffee system.

✧ NORTHERN SYSTEM

- Practiced in districts of Lira, Gulu, Kitgum, Pader, Apac, Pakwach.
- It experiences a mono modal rainfall distribution pattern which favours annual crops.
- Main cash crops grown are cotton and tobacco, main food crop is finger millet.
- Land tenure system is communal.
- Food storage structures are common where the food is stored during the dry season.
- Inter cropping is commonly practiced.

✧ WEST NILE SYSTEM

- Is practiced in Moyo, Arua, Yumbe, Adjumani, Nebbi.
- Rainfall pattern received is monomodal.
- Cash crops include tobacco, cotton and Arabic coffee in the highlands.
- Food crops include cassava, finger millet, simsim, cowpeas, maize, beans etc.
- Some cattle and goats and sheep are managed at a subsistence level.

✧ MONTANE SYSTEM

- Is practiced in mountaneous areas / districts of Mbale, Kapchorwa, Kisoro, Kabale, Bundibugyo, Kasese with fertile volcanic soils.
- Population pressure is high in these areas.
- Major food crops grown are banana, Irish and sorghum (mainly in Kigezi).
- Major cash crop is Arabica coffee, some tea is also grown.
- Contour ploughing is commonly practiced to reduce soil erosion.
- Livestock rearing is intensive / zero grazing due to high population pressure.

✧ PASTORAL SYSTEM

- Practiced in Kotido, Moroto, Rakai, Mbarara by the Bahima, Banyankole and Karimajong.
- Farmers live a nomadic way of life.
- Large number of animals are kept.
- Drought resistant crops e.g. sorghum, millet are grown.
- Overgrazing and bush burning are common.

✓ TRADITIONAL FARMING SYSTEMS

These include the following;

- Shifting cultivation
- Bush fallowing
- Crop rotation
- Ley farming
- Pastoralism
- Intercropping
- Agro forestry

Bush fallowing;- is a system of growing crops on a piece of land until the soil is exhausted and crop yields decline after which the land is rested in bush form to regain fertility while cultivation continues on alternative pieces.

Arable farming;- this is the growing of short term crops on arable land (cultivable land)

A well planned crop rotation programme should be followed to mantain the productivity of the arable land.

Ley farming; - is a system of alternating temporarily planted pasture with crop production.

Advantages of ley farming;

- Rested land is fertilized by humus from the grass dug into the soil.
- Land is utilized all the time instead of leaving it to rest.
- Infertile areas are fertilized by dung and urine.
- The planted grasses reduce on soil erosion.
- Helps to break pests and diseases life cycle.
- Leys provide cheap feeds for livestock

Disadvantages;

- Requires fencing and paddocking which increases costs.
- Requires water points in each paddock.
- More labour is required in management and establishment of pastures.

Shifting cultivation;- is a farming system where a farmer clears a piece of land and grows crops in it for a number of seasons until the soil is exhausted and crop yields decline; he then moves / shifts to a fresh land.

Characteristics of shifting cultivation

- It is subsistence oriented.
- Family members are the major source of labour.
- Simple tools e.g. hand hoes, Pangas are used.
- Settlement by farmers is not permanent.
- Farming plots / fields are usually small.
- Food crops are mainly grown.
- Mainly practiced in sparsely populated areas.
- Quick maturing crops are grown and no perennial crops are grown.
- Forests are usually cleared by fire.

Advantages:

- Fire destroys pests and disease causing organisms.
- Constant movement by farmers ensures fresh soils thus ensuring high crop yields.
- Easy and cheap to carry out.
- There is enough time given to the land to regain its fertility.
- Burning also controls weeds.
- Enables other activities e.g. hunting to go on well.
- Communal ownership of land does not allow land disputes.
- Plant nutrients e.g. potash are released quickly from the ash.

Disadvantages:

- Regular movement hinders land development.
- Burning of vegetation always destroys organic matter and useful living organisms.
- The system requires a lot of land and is not suitable for densely populated areas.
- A lot of timber will be destroyed due to destruction of trees by fire.
- Carbon, Sulphur and Nitrogen are lost by volatilization.
- Soil erosion and desertification may result.
- No soil conservation because people own the land communally and therefore, they do not care.

Conditions that favor shifting cultivation;

- Abundance of land
- Sparse population.
- Few crops grown for domestic use only.
- Communal ownership of land.
- When there is lack of modern farming techniques and facilities to improve the exhausted land.
- Pastoralism and Nomadism;

Pastoralism is the keeping of herds of cattle, sheep and goats on practices (graze at random)

OR

Pastoralism is a system of farming where the farmers look after livestock as their main occupation.

Types of pastoralism

- Sedentary pastoralism / sendentarism; is the grazing of animals near permanent established homesteads and neighbouring marginal land. At night farmers keep their animals in enclosure or pans for security reasons e.g. the Bahima.
- Nomadic pastoralism / Nomadism; Is the type of herding in which owners of livestock move from place to place in search of water and pastures for their livestock e.g. the Turkana, Pokot, Samburu, Boran and Somari.
- Transhumant pastoralists / Transhumance; Refers to the movement of farmers with their animals looking for water and pastures when their areas are hit drought (scarcity of water and pasture) but go back to settle in their homeland when the weather is favourable e.g. Karamajongs.

Characteristics / features of nomadic pastoralism

- Very large number of animals are kept.
- Local indigenous breeds are normally kept.
- Owners do not have permanent settlements.
- Quantity of animals is more important to the owners than the quality.
- There is communal ownership of land i.e. grazing is done communally.
- Animals are reared for subsistence purposes.
- Overstocking and overgrazing are common.
- Most nomads are characterized by low education.

- No controlled breeding so mating is random.
- Normally practiced in areas with low rainfall and poor soils.
- Parasites and diseases are common.

Problems faced by pastoralists:

- Parasites, diseases and wild animals attack animals.
- Harsh climatic conditions e.g. low rainfall.
- Poor veterinary services which led to low quality of animals.
- Lack of inputs e.g. drugs, chemicals and equipment.
- Lack of capital to establish animal structures and purchase equipment.
- Poor quality breeds of livestock.
- Random mating leading to inbreeding.
- Overgrazing and overstocking hence erosion.
- Movement of long distances makes animal lose weights.
- Cattle rustling in some places.
- Poor market facilities characterized by unstable prices for animal products.
- Poor management of livestock due to low levels of education.
- Lack of transport facilities to transport products cheaply.
- Poor pastures that are coarse and fibrous hence difficult for the animals to digest and utilize.
- Fire outbreaks especially during clearing vegetation hence exposing the land to erosion.

Measures to improve nomadic herding:

- Restricting numbers of animals per unit area to avoid over grazing.
- There should be parasites and disease control e.g. mass vaccination, dipping, regular spraying and fencing.
- Selective breeding should be carried out to improve on live stock quality.
- Introduction of better breeds of animals which are high yielding to enable nomads reduce number of animals kept.
- Provision of better transport and communication for pastoralists to access markets for their animals and products.
- The government should provide loans to farmers to enable them construct farm structures, purchase improved breeds of cattle.
- Provision of processing facilities for livestock products in order to add value to them.
- Provision of general education to pastoralists to equip them with skills and modern livestock management techniques.
- Establishment of demonstration farms where farmers can learn modern techniques of livestock management.
- Provision and construction of water reservoirs, valley dams, boreholes and wells.
- Improvement of veterinary services e.g. A.I, disease and pest control.
- Introduction of new and improved varieties of pastures species that are palatable to animals and highly nutritious.

SUBSISTENCE FARMING

This is the growing of crops and rearing of animals purposely for home consumption and the surplus is sold to meet other domestic needs e.g. clothes, medical care, shelter, education etc.

Characteristics of subsistence farming:

- It depends mainly on family labor for cultivation, planting, harvesting etc.
- Simple tools e.g. hoes, pangas are used.
- The fields / plots are often small (less than 5ha family)
- The standard of living is low.
- Intercropping of crops is a common practice.
- Modern methods of farming e.g. fertilizer application are not commonly practiced.
- Gardens are normally fragmented / scattered.
- Products are mainly for domestic consumption e.g. cereals, root crops, legumes and bananas.

Advantages of subsistence farming:

- A variety of crops can be grown of the same time; this safe guards against hunger.
- It requires less capital.
- Growing many different types of crops protects the soil fertility.

- Price fluctuations do not affect the farmers.
- Meets the domestic and local demand for food.
- Production for home consumption saves transport and marketing costs.

Disadvantages of subsistence farming:

- Small scale farming tends to keep farmers poor.
- Small scale production does not encourage mechanization.
- Land fragmentation is common which hinders mechanization.
- The rate of economic development is slow.
- Labourers are redundant (idle) between harvesting and the next planting season.
- As more inputs are added, farmers operate at a loss because of the law of diminishing returns.
- Purchasing power of other goods in the market in low due of poverty.

COMMERCIAL FARMING SYSTEMS

This refers to the farming systems where farmers grow crops and rear animals mainly on large scale to get profit.

Examples include;

- Mixed farming
- Ranching
- Plantation farming
- Dairy farming

MIXED FARMING

This is the growing of crops and rearing of animals on the same farm land at the same time.

Advantages:

- The farmer gets double income from both animals and crops.
- Animals provide manure which is used in crop production.
- Remains of crops e.g. banana peelings, maize stalks can be fed to the animals instead of being wasted.
- Labour is well distributed or utilized throughout the year.
- In case of crop failure due to pests and diseases, the farmers still gets some income from animals.
- Land is better utilized (land unsuitable for crop production can be used for animal production).
- The farmer and his family get a balanced diet.

Disadvantages:

- It needs more capital to start.
- Animals may destroy crops especially of fencing is not well done.
- It requires more labour to manage both crops and animals.
- It requires a lot of land.
- It requires the farmer to have skills of managing crops and animals which is always not easy.
- Generally the system lacks specialisation.
- Individual projects take up a small portion of the land because much of it is shared by many enterprises.

COMMERCIAL RANCHING

Large scale animal rearing is known as ranching and it comprises products for sale This may be dairy or beef production of a large well managed livestock farm.

Characteristics of ranching:

- Large numbers of animals are kept.
- There is a lot of capital investment needed.
- Animals are kept especially for sale.
- Only highly productive breeds are kept.
- There is specialisation.
- Pastures are well established and managed.
- Selective breeding of livestock is done to get high quality breeds of livestock / products.
- There is less movement of animals than in nomadic pastoralism.
- Large areas of land are used.
- Land is often individually owned and thus no communal grazing on the land.
- More scientific methods of management are used.
- Often carried out in drier parts of the country where there is little or no crop cultivation.
- A few breeds of animals are kept.

Factors that influence success of Ranching / factors necessary for success of Ranching:

- Availability of adequate pasture.
- Efficient transport to ensure quick movement of animals to slaughter houses; and milk transportation.
- Availability of ready market for animal products.
- Ready access to facilities like cold storage plants to avoid spoilage of milk and meat.
- Presence of well trained veterinary personnel.
- Availability of extension services.
- Security in the area to make farmers stable.

PLANTATION FARMING / ESTATE FARMING

This is the type of farming where farmers grow mainly one type of crop on a large scale mainly for commercial purposes and year after year E.g. Sugar Estates (Kakira, Kinyara, Lugazi), Tea Plantations (Kasaku), Sisal (Kagera in Tanzania).

Characteristics / features of plantation farming:

- It is highly specialized (i.e. a single type of crop is grown).
- There is a high level of mechanization like use of tractors
- There is a high output.
- It employs many people from the communities
- Products are normally grown and processed for export.
- Products are normally processed on the farm to increase their value and profit.
- They mainly concentrate on perrenial crops only
- High quality products are produced due to improved methods of farming e.g use of fertilizers

Advantages of plantation farming:

- Many labourers are employed and this reduces unemployment.
- Governments get a lot of revenue through taxation of the product and labour force.
- On spot processing increases the value of produce and hence higher profits.
- Governments earn foreign exchange due to export of the products.
- Machines are economically used due to large sizes of farms.
- There is regular supply of produce because management is centralized and efficient.
- Workers become skilled as they specialize in the production of one commodity.
- It promotes growth of industries because they act as a source of raw materials.
- Stimulates the development of infrastructure in an area e.g. roads, schools, hospitals etc.
- Wastes / By – products are used for other purposes e.g. feeding cattle, manufacture of alcohol etc.
- The owner benefits from large scale production (economies of scale) e.g. reduced transport costs).
- High quality products is produced because processing is carried out on the farm.

Disadvantages of plantation farming

- Plantations require a lot of capital to establish and operate.
- Most plantations are foreign owned and the owners send nearly all the profits to the countries of the expense of the host country.
- Pests and diseases can cause serious damage.
- It may result in heavy losses as they crop prices fluctuate; so earnings are not predictable.
- It requires a lot of land which is not easy to get.
- Monoculture destroys the soil structure and exhausts the soil.
- Growing one crop accumulates pests and diseases which necessitates use of expensive chemicals to control them.
- It has a negative effect on food production since it emphasizes cash crop production.

- The many jobs created increase congestion of workers and social problems e.g. prostitution, illegitimate children etc.
- At times owners get a challenge of getting enough skilled and unskilled labour.
- Any slight mismanagement may cause heavy losses.
- Owners take some time to earn money due to long gestation period of most plantation crops.

CROPPING SYSTEMS

MONOCROPPING / SOLE CROPPING

This is the growing of a single / individual crop in a pure stand in the field / garden e.g. maize alone.

NB: Monoculture is the growing of one type of crop on the same piece of land season after season.

Advantages of mono cropping

- Weeding is easy
- Harvesting is easy
- It is easy to estimate the yields.
- It is easy to establish the correct plant population per unit area.
- It is easy to mechanise the field.
- Spraying against pests and diseases is easy.

Disadvantages

- Pests and diseases may spread very fast and destroy the whole crops.
- Soil erosion is encouraged if the crop does not offer good soil cover
- In widely spaced crops, the land is not fully utilized.
- In case of crop failure or drop in the market, the farmers suffer loss of income.

INTER CROPPING/MIXED CROPPING

This is the planting of a minor crop (quick growing crop) alongside a major crop e.g. beans in bananas.

NB: Mixed cropping is the growing of many crops intercropped or in different plots of pure stands on the same piece of land at the same time.

Advantages of intercropping

- Total yields per unit area are higher than in mono cropping.
- There is better and full utilization of labour.
- It controls weeds since little space is left.
- Safe guards against famine since the crops mature at different times.
- There is maximum utilization of soil nutrients.
- Legumes in the mixture fix nitrogen into the soil.
- Interrupts the spread of pests and diseases.
- The risk of having total crop failure is reduced.
- Farmers get a balanced diet.
- Some crops act as nurse crops to the other crops.

Disadvantages of intercropping

- Too close spacing leads to entiolation and poor growth of crops.
- There is competition for water, nutrients, light, space.
- It hinders use of machines in operations e.g. weeding, harvesting etc.
- Late maturing crops are damaged while harvesting the early maturing crops.
- There may be build up of pests and diseases.
- Sometimes, fertilizers may be wasted on the crops in the mixture which are less profitable.
- Chemical control of pests and diseases is difficult.
- There is wastage of fertilizers especially when one of the crop is uneconomical.

CROP ROTATION

This is the growing of different types of crops on the same piece of land in an orderly sequence / definite order.

It is done in order to preserve and maintain soil fertility and productivity.

Factors to consider / principles to follow when designing a good crop rotation.

- Heavy feeders such as maize, cotton or sweet potatoes should be planted first in the newly opened land to taka advantage of the so much available nutrients
- The deep rooted crops should follow shallow rooted crops. This will allow

efficient use of nutrients at different soil layers.

- Crops with similar pests and diseases should not follow one another in a rotation.
- Crops of the same family should not follow one another in the rotation because they have similar feeding requirements, pests and diseases.
- Crops that do not provide good soil surface cover should alternate with those that provide good surface cover to control soil erosion.
- The rotation should have a resting phase/fallow period planted with a grass ley to restore soil fertility.
- Crops which are easy to weed should alternate with those which are difficult to weed.
- Legumes such as G. nuts, beans, peas should be included in the rotation to provide nitrogen in the soil.

Advantages of crop rotation.

- It breaks the life cycle of crop pests and diseases.
- The legumes included add nitrogen to the soil.
- It controls weeds which are specific to particular crops e.g. striga in cereals.
- It checks on soil erosion by using cover crops.
- There is maximum use of environmental resources by growing crops of different growth habits.
- It improves the soil structure due to fallowing.
- It helps to even out labour requirements over the year.
- It spreads financial risks over several crops.

Designing crop rotation programmes.

Qn. 1. Design a crop rotation programme for maize, beans and cassava.

2nd Year BEANS

1st Year MAIZE

3rd year CASSAVA

OR

	Year 1	Year 2	Year 3
Plot 1	Maize	Beans	Cassava
Plot 2	Beans	Cassava	Maize
Plot 3	Cassava	Maize	Beans

2. Design a crop rotation programme for G.nuts, cotton, cabbage.

POPULATION

Population is the total number of people living in a particular area in a given period of time.

COMMON TERMS USED IN POPULATION

- Population density; This is the number of people per unit area (e.g. per square kilometer)

Population density = $\frac{\text{Number of people}}{\text{Total area}}$

e.g. The population of a given city is 28,000,000 people.

If the land area of that city is 560,000km^2

What is the population density of the city?

Population density = $\frac{\text{No. of people}}{\text{Total area}}$

= $\frac{28,000,000}{560,000}$

= 50 people / Km^2

- Population structure and composition; This refers to the way the population of a country is distributed in terms of sex, age, literacy rates, marriage, occupation, distribution etc.
- In terms of age distribution, there are 3 basic age groups used in description of the population.
  - (i) the young
  - (ii) the working class / age
  - (iii) the old
- Population growth: This refers to the rate at which population size grows over time.

$$\text{Population growth rate} = \frac{\text{No. of births}}{1000 \text{ of population}} - \frac{\text{No. of deaths}}{1000 \text{ of population}} \times 100$$

- Over population; this refers to a situation where there are too many people in an area / country for the available resources.

- Under population: this refers to a situation where there are too few people in an area / country for the resources available. OR When the available resources are more than the available people.
- Optimum population; This refers to a situation where the resources of a country are fully exploited and can optimally sustain the population without excess or shortage.
- Birth rate; This refers to the number of live children born each year and is expressed per thousand.
- Death rate; this refers to the number of people who die each year and is expressed as per thousand.
- Infant mortality rate: Refers to the deaths among children who die between birth and one year of age.

CAUSES OF HIGH POPULATION

- Early marriages due to inadequate education.
- Polygamy among young African families.
- Cultural factors; some cultures see children as a source of wealth and prestige.
- High fertility rates in women.
- Idleness in rural areas and some urban areas. This makes some people to view sex as a form of recreation.
- Absence of family planning.
- Improved medical services that have reduced death rates and increased birth rates.
- Ignorance of women who believe that their key role is to produce children.
- The need to provide cheap family labour in the peasantry life.
- Unchecked immigration into the country like Uganda.
- Promiscuous sexual relationships e.g. indiscriminate sexual relationship among men and women.
- Existence of cheap and abundant food plus accommodation in rural areas.

EFFECTS OF POPULATION INCREASE ON AGRICULTURE

Negative effects

- Leads to land fragmentation i.e. subdivision of land into many plots.
- Leads to over use of land which results into loss of fertility.
- It leads to shortage of food for the population.
- It leads to unemployment and under employment.
- There will be wide spread poverty because resources are shared by too many people.
- High population widens income disputes and causes social, political and economic discontent.
- There is always low standard of living due to low per capital income.
- Many social services will be run down.
- It calls for more expenditure on education, housing, food, medical care, clothing etc. This reduces investment in more directly productive sectors e.g. Agriculture, tourism etc.
- There will be congestion, famine, diseases and high crime rates.
- There is heavy dependence burden especially where there is increasing number of children.
- There will be inflation.
- Poor housing facilities and development of slums.
- High rates of illiteracy.
- Overgrazing on the existing small agricultural land.

POSITIVE EFFECTS

- Creation of wealth; large population is able to utilize the resources available for creation of wealth.
- It increases the market size.
- It increases the size of the labour force and so makes the labour cheap.
- High population justifies the establishment of infrastructure in an area.
- It leads to increases in government revenue through taxes paid by the citizens.

- High population boasts the growth of industries because there will be many people to work in the industries.
- It also leads to increase in the GDP (Gross Domestic Product).
- High population enhances the status if a country in international affairs e.g. China is a super power because of its high population.
- Efforts to work hard are stimulated and this promotes innovation and invention to cope with the challenges.

WAYS OF LOWERING HIGH POPULATION

- Family planning
- Legalizing abortion
- Education of women to delay them in school to avoid early marriages.
- Encouraging migration to areas with sparse population.
- Taxing those with large families.
- Denying bursaries for the extra children.
- Setting the minimum marriage age.
- Encouraging celibacy to reduce the number of breeding humans.
- Sex education to prevent early undesired births.

Importance of Agriculture

- Is a source of raw materials used industries e.g. cotton for textile industries.
- Hides and skins – leather used in industry.
- Sugarcane – sugar industry.
- It provides employment both indirectly and indirectly like Agricultural officers, farm managers and accountants working in agriculture institutions.
- It is a source of income to the farmer through the sale of agriculture products.
- It is a source of food to both the rural and urban human population.
- It is a source of government revenue through taxation government revenuecan be used to improve social services like health and education.
- It is a source of foreign exchange through agriculture exports.
- Agriculture is a source of energy used for other purposes e.g. Baggase (waste from sugar manufacture) can be used in producingelectricity.
- Trade in agricultural products between countries bring about internationalrelation.
- It can be a source of tourist attraction.

PROBLEMS OF AGRICULTURE IN UGANDA

1. **Pest and diseases** (These attacks both crops and animals leading to low yields) To most destructive crop diseases in Uganda today are: coffee wilt, cassava mosaic, Banana bacterial wilt. In animals the serious diseases are foot and mouthdiseases, Nagana and contiguous abortions.
2. **Poor transport and communication.** Most of the feeder roads in rural areas are seasonally hence affecting transportation of our agricultural products to the market during the rainy season.
3. **Natural disasters** e.g. long drought and floods cause destruction of crop andanimals leading to loses. This has been greatly caused by climate changes.
4. **Poverty.** Most of the rural farmers are poor therefore cannot afford the expensiveagricultural unit like fertilizers, wood seeds and pesticides.
5. **Inadequate knowledge and skills:** Most farmers lack enough knowledge which has greatly affected their level of production. E.g. most of them cannot read or write hence cannot take instructionson pesticides.
6. **Poor crop varieties and animal breeds:** Crop and animals being raised are of low production leading to loses.
7. **Poor technology/tools used;**The majority of the farmers are using poor

tools that cannot support large scale products.

8. Poor funding of agriculture sector by government.

9. The funding of agriculture are still very low which affect the level of production.

10. Price fluctuation. Due to over production and bad weather, prices for agriculture products are not stable which affect the farmer' s income.

PROBLEMS OF AGRICULTURE IN UGANDA

High taxes on inputs

This makes agricultural products to be expensive as the cost of production increase.

Conservation

Due to the low education among farmers, they are not willing to change the doingof things.

Inadequate market information

Due to the low technology and remoteness of many rural areas access to marketinformation by farmers difficult.

Competition at the world market

Due to low quality of agricultural produce in Uganda, it may not compete favourably with the product from the developed world.

Land degradation

Due to increasing human population, most of the land available has been overused leading to exhaustion.

SOLUTION FOR AGRICULTURE PROBLEMS

1. Farmers should be provided with loans at a low interest to be used.
2. Pests and diseases should be controlled through growing instant varieties,vaccination.
3. Agricultural reaserch should be carried out improve the quality of seeds andanimals.
4. Agricultural research station are; Kawanda for crops, Serere for crops and animals, Entebbe Namulonge
5. Agriculture should be processed to improve quality maintain prices in the market.
6. Storage structures should be constructed so that excess produce is store forfuture so as to maintain the prices.
7. Government should subsidize agriculture inputs to make it affordable to thefarmers.
8. Compulsory, primary and secondary education should be encouraged so thatall people receive education to fight ignorance and illiteracy.
9. Farmers should provide with enough marked information through the media and either means.

CLIMATE AND AGRICULTURE

What is climate?

Climate is the average weather condition of a place recorded and studied for a longperiod of time.

Weather

Is the daily condition

Is the state of the atmosphere observed studied and recorded a short period of time.

Rainfall

It is the amount of rainfall in an area at a certain time.

Rainfall is measured using a rain gauge. The water is collected during the previous 24hours and measured and recorded. This is done every day for the moth to give amonthly total.

Types of rainfall

1. Relief rainfall
2. Convention rainfall
3. Frontal/ cyclonic rainfall
4. Convergence

The most important attributes of rainfall in agriculture are;

1. Rainfall distribution
2. Rainfall intensity
3. Rainfall effectiveness
4. Rainfall reliability

1. Rainfall distribution

This is the way rainfall is spread over the months in years.

The distribution of rainfall may be described in terms of rain season.

A place with two seasons is referred to as Bimodal rain while that one with a single long season is referred to as **Monomodal rain**.

Rainfall distribution may influence type of crops grown, time of planting andharvesting.

2. Rainfall intensity

This is the measure of the heaviness of rain over a given period of time.It is measures using a rain gauge.

NB. High intensity of rainfall can result into erosion since the soil not be able to absorb most of the water.

3. Rainfall effectiveness

This is the measure of the amounted rainfall that is able to ensure successful growth of crops.

4. Rainfall reliability

This is the ability of rainfall to come as and when expected. This greatly influences the planting season.

EFFECTS OF RAINFALL IN AGRICULTURE

- It can cause pollination in crops
- It provides water/soil moisture needed for crop growth.
- It regulates soil temperatures
- It provides with water at the farm for washing, drinking etc.
- Provides water needed in seed germination.
- However, rain can be destructive through soil erosion and flooding.

Temperature

It is the measure of the hotness or coldness using a thermometer.

Temperature ismeasures in degrees, centigrade (^{o}C) and degree Fahrenheit (^{o}F).

To convert ^{o}C to ^{o}F

Example

The average temperature of Mukono Town for the month of March was 28.5^{o}C.Convert to degrees Fahrenheit

Effects of temperature in Agriculture

1. Higher temperatures are used in drying crop produce.
2. It affects the rate of photosynthesis in crops.
3. It affects germination of seeds.
4. It affects the rate of transpiration in crops.
5. Higher temperature may increase the evaporation rate of water from the soil.
6. WIND

This is moving air and its direction is measured by the wind vane. While the speed is measured by the Anemometer.

Effects of wind in Agriculture

It helps in seed dispersal
It is important in crop pollination
It is a source of power in wind millsIt is used in winnowing of seeds
It is used dying of crop produce
Wind currents can help in rainfall formation.

Rainfall effectiveness

This is the measure of the amounted rainfall that is able to ensure successful growth of crops.

Rainfall reliability

This is the ability of rainfall to come as and when expected. This greatly influences the planting season.

LAND USE /LAND FORMS IN UGANDA

This is the way how land is put to use. In Uganda land is used in the following ways.

- We use land for settlement
- Agriculture
- Mining
- Burial grounds
- Transport and communication

- Industrialization
- Wild life
- Water bodies
- Forests
- Mortgage.

1. Settlement

In this form of landuse, land is occupied by housing estates, schools, hospitals, urbancenters etc.

2. Agriculture

This is the biggest form landuse in Uganda. Land is put to a growing of cropsand rearing of animals.

3. Mining

This is land which is occupied by mines for copper, phosphates petroleumand sand.

4. Wildlife

This is land occupied by National parks and game reserves.

5. Water bodies

This covers lakes, rivers and springs.

6. Tourism

This refers to land which is occupied by national parks and game reserves. Itis a very good source of foreign exchange for the country.

7. Forests

This land is occupied by natural and artificial forests in the different parts of Uganda.

Importance of forests

1. Important in rainfall formation (convectional rainfall)
2. They reduce global warming by absorbing excess carbondioxide from theatmosphere.
3. They provide timber that can be used in the construction of farm structure.
4. They can act as habitants for wild animals.
5. They are a source of herbs used in the manufacturer of medicine.
6. They attract tourists bringing in foreign exchange for the country.

Conservation of forests

These are measures aimed at preserving and protecting forests for generations to come.

Measures of forest conservation

Carrying out agro – forestry
Practice afforestation
Carrying out re – afforestation

1. Afforestation

More areas of land should be turned into forests by planting trees.

2. Re – afforestation

Every tree out should be replaced through planting other trees.

3. Agro – forestry

Trees should be integrated with crops and animals of forests

4. Government should set up strict laws against deforestation.

5. Education

People should be educated about the importance of forests.

6. Use of alternative sources

Government should encourage the use of alternative sources of fuel likebiogas, petroleum, solar.

7. Rural electrification should be encouraged to reduce the dependence

FARMING PRACTICES

Subsistence farming

This is the growing of crops for consumption and selling the surplus.

Forms of subsistence farming

- Shifting cultivation
- Rotational bush furrowing
- Nomadic pastoralism.

Advantages of subsistence farming

- It requires les land to be practiced.
- It requires less initial capital
- It requires simple tools that are cheap
- It requires less labour since it mainly depends on family labour. (Women andchildren).
- It requires less skills to be practiced.
- It uses cheap inputs.

Disadvantages of subsistence farming

- It leads to poverty because the peasants lack income
- Production is low which may easily lead to food.
- It reduces government revenue since peasants are difficult to tax.
- It may lead to soil exhaustion due to poor methods of farming practiced.
- It increases unemployment in the community.

Shifting cultivation

This is where a farmer clears land uses it until it loses fertility then she/he movesto fresh place.

Characteristics of shifting cultivation

- Land is cleared by cutting and burning vegetation.
- It is practiced in areas with low human population
- Simple tools are used
- Small areas are cleared
- Few annual crops are grown.
- Intercropping is common
- Little attention is given to the crops
- Crops are mainly grown for home consumption.

Advantages of shifting cultivation

1. It uses simple tools therefore it is cheap to maintain.
2. The use of fire makes clearance of land easy
3. Bush burning adds, more minerals to the soil.
4. Intercropping guards against crop failure.
5. It is easy to control pests and diseases since the farmers can move to a fresh place.
6. Crop yields are usually high due to use of fresh land.
7. There is less weeding as the fire used can burn weeds seeds.

Disadvantages of shifting cultivation

1. Bush burning leads to the destruction of soil living organisms.
2. It can only be practiced in areas with low population.
3. It cannot provide enough food for a big population.
4. It may leave the land bear and exhausted which exposes it to erosion.
5. It leads to massive destruction of forests.

Nomadic Pastoralism

Nomadism: Means moving from one place to place to another.Pastoralism means rearing of animals more especially cattle.

Therefore

Nomadic Pastoralism

Is the practice is the rearing of cattle while moving from one place to another. Insearch for water and pastures for the animals.

Characteristics of nomadic Pastoralism

1. They keep very large number of animals.
2. There is movement from place to place.
3. There' s growing of few annual crops on a small scale.
4. Animals kept are of poor breeds.
5. Poor animal husbandry practices are carried out.
6. Over grazing is common which leads to soil erosion.
7. Animals depend on natural pastures.
8. Animals are grazed on land owned by the community.
9. The practice is mainly carried out in the arid and semi-arid areas.

Problems faced by pastoral nomadism

1. Poor weather leading to drought.
2. Walking long distances
3. Lack of pasture for the animals
4. Poor breeds of animals kept.
5. Cattle rustling which leads to death
6. Lack of water for animals
7. Parasites which attack animal leading to poor breeds.
8. Pastoralists may be attacked by tropical diseases which lead to death.
9. Conservatism.
10. Poor veterinary services
11. Poor housing of animal
12. Shortage of land

INTERCROPPING

This is the growing of a major crop together with a minor crop on the same piece ofland at the same time. E.g. maize and beans, cassava and beans, maize and groundnuts, coffee and banana.

Advantages of intercropping

1. A farmer may get a balanced diet when her production legumes and cereals atthe same time.
2. A farmer gets double income after selling the 2 crops.
3. The weak plants can be supported by the strong ones e.g. maize can supportthe climbing beans.
4. Growing legumes together with other crops maintains soil fertility since nitrogen is fixed by the legumes.
5. It guards against total loss to the farmer since failure from one crop can becovered by the other.
6. Production per available land is high since land is utilized maximally.
7. Weeds are easily controlled since they are denied space.

Disadvantages of intercropping.

1. It is difficult to weed a garden that has more than one type of crop grown together.
2. The number of pests and diseases increase due to a variety of food source.
3. There is high competition of nutrients between crops which may result to lowyields.
4. Spraying of crops against pests and diseases is difficult.
5. Much more labour is required in carrying out agronomic practices.
6. It can easily lead to soil exhaustion due to the high intake of nutrients fromsoil by the different crops.
7. Difficult to use machines when carrying out operations like weeding.
8. It is difficult to apply fertilizers and manures to the crops in the garden.

Modern farming/systems

1. Mixed farming
2. Plantation farming
3. Intensive farming

Advantages Mixed farming

1. A farmer gets double income i.e. from crops animals sold.
2. A farmer gets a balanced diet by eating crops and animals products.
3. Animals can provide manure (from yard manure) that can be used to improvesoil fertility for proper crop growth.
4. Crop residues and products can be fed to animals therefore reducing feed costs.
5. The practice guards against total loss to the farmer since failure in crops canbe compensated by animals.
6. Animals can provide labour used in Ploughing and transportation of plantproduce.
7. It ensures income to the farmer throughout the year.
8. Labour is efficiently utilized throughout the year.

Disadvantages of mixed farming

- It requires a high initial capital
- It is expensive to maintain
- It requires a large piece of land to be carried
- It requires more skills to be carried out.
- It requires much more labour
- It requires a large piece of land to be carried out.
- It requires much skills to be carried out

Plantation farming

This is the growing of one type of crop on a large scale using scientific methods offarming.

The plantations can also be referred to as estates.

In Uganda, sugar cane and tea are the main crops grow on plantations.

Characteristics of plantations

1. The form concentrates on production of a single crop e.g. sugarcane plantations in Kakira, Lugazi and Kinyara.
2. The farm covers hundreds of hectares
3. Crops are grown for commercial purposes
4. There' s use of machines when carrying out farm operations
5. A lot of capital is required to set up a plantation.
6. It employs a large labour force
7. Scientific methods of farming are used

Advantages of plantation farming

1. It provides employment to both skilled and unskilled labour
2. It is a source of government revenue through taxation.
3. They earn foreign exchange to the government by exporting products
4. They engage in Agriculture research which encourages development
5. They provide high quality agriculture products.
6. The encourage development of out-growers.
7. Plantation provide social services e.g. health and education to the workers

Disadvantages of plantation farming

1. It may lead to displacement of people during establishment.
2. Production of a single crop on the same piece of land for a long time may leadto soil exhaustion
3. Plantations may cause environmental degradations by encroaching on forestsand wetlands
4. It requires a lot of capital to establish a plantation.
5. Foreigners who own these plantations take most of the profits outside thecountry.

Intensive farming;

This is the use of scientific methods of production in agriculture on a small area toproduce high yields.

The scientific methods of production are;

(i) Use of fertilizer and manures

(ii) Use of pesticides i.e. Herbsites, insecticides, acasides, wormicides etc

(iii) Use of drugs and machines to treat livestock

(iv) Irrigation of crops

(v) Use of improved crop seeds and animal seeds.

(vi) Use of machines in carrying out farmwork

(vii) Use of high quality labour /skilled labour

(viii) Use of green houses in growing crops

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