

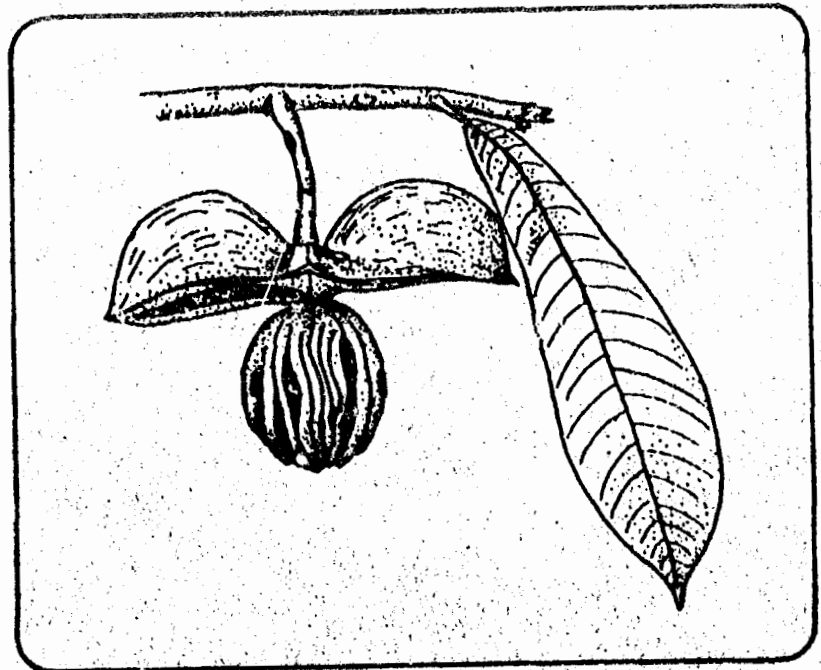


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# UPPER-SECONDARY AGRICULTURAL COURSE

A Suggested Three'-Year  
Teacher's Guide



## P R E F A C E

Unesco, at the 18th Session of its General Conference held in November 1974, adopted the Revised Recommendation concerning Technical and Vocational Education. In accordance with this Revised Recommendation, Unesco will undertake studies and prepare publications in the field of technical and vocational education. The studies are intended to assist planners, administrators and experts in technical and vocational education. They reflect Unesco's concern with fostering an effective exchange of knowledge and experience in this field as well as the efforts of Member States to promote the implementation of the policy instrument.

The present document is part of a series entitled "Studies in Technical and Vocational Education" and is a teacher's guide for upper secondary agricultural programmes designed to improve and strengthen the teaching of this subject at the upper secondary level. The fact that conditions in different countries vary, this document, when put into use, will need to be adjusted to take account of prevailing conditions in the country.

The specialist concerned with the preparation is responsible for the choice and the presentation of the facts contained in this guide and for the opinions expressed therein, which are not necessarily those of Unesco and do not commit the Organisation.

A SUGGESTED THREE-YEAR TEACHER'S GUIDE  
FOR  
RURAL UPPER-SECONDARY AGRICULTURAL SCHOOLS

PART 1

1. INTRODUCTION

These proposals are made with the following understanding :

- That the programme would be on its own as a separate vocational option following a three year junior secondary programme. It might indeed be housed at a separate campus and administered independently.
- That it may be terminal, enabling its products to go straight into farming; or that it would provide an adequate basis for further study at a higher level of education.

2. GENERAL DESCRIPTION OF THE PROGRAMME

The programme is conceived as a three year programme in which practice is given more prominence.

It is proposed that the normal daily activity be broken down in three parts as follows : (a) an early morning practical class from 6.30 a.m. to 7.30 a.m ; (b) theoretical classes from 9.30 a.m. to 12.50 p.m. or 5 x 40 minutes per day ; and (c) an afternoon/evening practical class from 3 p.m. to 5 p.m.

2.1 Practical engagements

The early morning practical classes shall be devoted to such light jobs and routine operations as egg collection, milking, watering, etc. This is meant to inculcate in the students the healthy farming attitude of starting the day early.

The afternoon/evening practical classes shall be devoted to the more arduous jobs such as cultivation, pruning, debeaking, dipping, etc.

Wednesdays shall be normally declared a "field day". On this day visits would be arranged to places of agricultural and agro-industrial interest, for example, plantations, traditional farming areas, food-processing factories, produce-inspection centres, ports for exports, quarantine centres, research centres, etc. This day may also be used for recreational activities in the evening.

Long vacations shall be used for prolonged attachment to selected agricultural enterprises. Students may be rotated at two or three weekly intervals to offer varied exposure.

In the final year the student shall be required to design and execute a simple manageable project in a chosen field of agriculture and produce a small report on it. This effort shall be closely supervised.

Saturdays and Sundays shall normally be considered days of rest. On these days, as well as on Wednesdays, (the field day), the early-morning practical obligations would normally be fulfilled.

## 2.2 Theoretical classes

These will normally take place from 9.30 a.m. to 12.50 p.m. each day, except Wednesdays, Saturdays and Sundays. They shall be organized with considerable flexibility so that, wherever necessary, they can be meaningfully integrated with practical demonstrations.

## 2.3 Syllabuses

The syllabuses have been developed in full recognition of the fact that the success of modern agriculture has its basis in scientific principles. As the basic sciences would not have been covered adequately at the junior secondary level, provision has been made in this programme for courses in the basic sciences.

The success of this programme will depend on the extent to which it succeeds in changing attitudes. The rural environment to which much of this programme is directed has its distinctiveness. It is relatively more deprived in terms of modern amenities. People being prepared for these areas need to be familiar with its constraints and develop an attitude for its transformation. An introductory course in rural sociology is provided in the programme for this conditioning.

**PART 2**

**SYLLABUSES**

FIRST YEAR

1.1 AGRONOMY AND HORTICULTURE

1.1.1 The influence of climate on crop adaptation and distribution

Elements of climate; their diurnal and seasonal patterns.

Influence of climate on crop growth : light - duration, intensity, quality; photoperiodism-long day, short day, day neutral plant; light loving, shade tolerant crops ; temperature - cool season and warm season crops ; rainfall - evaporation and humidity; wet and dry climates; xerophytic, mesophytic and hydrophytic crops.

Climate, vegetation distribution and associated agricultural land use pattern : humid tropics - evergreen forest, deciduous forest; sub-humid tropics-savannans, scrub and desert.

1.1.2 Nature and properties of soil

Soil as a medium in which plants grow : offer mechanical support for the plant; medium from which the plant derives nutrients water and some air.

The agricultural soil : composition : (a) weathered rock particles; (b) organic matter ; (c) water ; (d) air ; (e) micro-organisms. Origin : in the first instance by rock weathering.

1.1.3 Types of rock

The big bang theory of the origin of the earth ; the earth's crust; the earth's crust ; types of common rocks : igneous, sedimentary, metamorphic ; rock forming minerals.

1.1.4 Formations of soils

Weathering : a process of physical disintegration as well as chemical decomposition of rock and organic remains.

Factors involved : physical; chemical and biological.

Physical (mechanical) weathering - induce by wide temperature fluctuations ; erosive agents : water and wind.

Chemical weathering - hydration, hydrolysis, oxidation, carbonation, dissolution.

Biological weathering - through physical action of roots and the chemical action of root exudates ; soil microbial action on organic residue from root slough, leaf fall and crop residue.

Factors influencing soil formation : climate, parent material, topography, time, living organism and man.

#### 1.1.5 Physical properties of soil

The soil fractions representing groups of sizes of mineral particles.

Soil texture representing the feel of the soil as affected by the relative proportions of the different soil fractions present ; classified by careful mechanical analysis of soil in the laboratory ; or by touch and worm test in the field ; soil texture and soil properties-water-holding capacity, movement of water through the soil ; nutrient holding capacity ; aggregation ; aeration. The merits of a loamy soil containing moderate quantities of the various soil fractions.

Soil structure ; permeability (porosity) ; aeration/water ; temperature ; reaction.

#### 1.1.6 Sources of organic matter to the soil

From animal and vegetable remains, the chief sources being vegetable - root slough, root exudates, dead roots ; litter from leaf fall, broken twigs and plants ; excrement from small soil organisms and their dead bodies ; on cultivated land from crop remains, weeds and organic manure ploughed into the land.

#### 1.1.7 Soil profile

The soil profile representing a vertical section through the soil; main layers of the agricultural soil - the top-soil and the subsoil and their relative importance.

#### 1.1.8 Farm layout

On the general farm the best soils are given over preferably to cropping. The less favourable areas are given over to grazing. The even less favourable land is given over to buildings and other facilities.

Objectives of a good farm layout are :

To protect the land particularly against deterioration from erosion.

To make for easy movement within the farm ; give ready access to facilities e.g. tractor workshop and ready access to individual fields.

The best layout takes into consideration the topography, natural drainage ; the soil types, their suitability to the crops intended, their erosion resistant characteristics, the intensity of the rain and the capacity of the drainage system.

#### 1.1.9 Agents of erosion - water, wind and man

Erosion as a natural phenomenon ; the basis of rich soil deposits of aluvial plains in Asia, Africa and throughout the world.

Erosion becomes catastrophic when unduly accelerated usually by the the activity of man through improper farming methods, and overgrazing.

Types : sheet erosion ; gully erosion ; splash or raindrop erosion, rills.

Methods of erosion control are as follows :

Maintaining constant good cover - cover crop, fallow crop, mulch, crop residue.

Strip cropping/rotational cropping.

Cultivation on the contour across the gradient.

Leaving seedbed rough.

Terracing.

Grassing over areas with tendency to gully erosion.

#### 1.1.10 Principles and practice of land preparation and cultivation

A seedbed is defined as the place where seed germinates and from which the established plant through the roots receive nourishment and support.

Characteristics of a good seedbed are : (a) fine and granular at the top but firm underneath ; (b) one that retains adequate moisture but is porous enough to ensure drainage of excess water and free movement of air ; (c) one that is free from diseases, pests and weeds ; and (d) one that is less prone to run off and soil erosion.

Processes of land preparation are :

Bush clearing - complete (total tree felling) ; selective (underbrushing); and partial or phased.

Windrowing and stumping/burning.

Tillage-ploughing-timing and depth in relation to yield ; harrowing ; and ridging/mounding.

Simple tools and equipment involved in land preparation ; circumstances of their use and their comparative merits.



### 1.1.11 Planting

Time of planting - onset of the rains; to avoid the peak of pest infestation in the field; to mature for harvest in dry weather.

Spacing : optimum for the crop.

Pattern : random; regular - rectangular, staggered, clumped.

Direction.

Seed rate - optimum for the crop; higher seed rate where seed viability is low, or where pests e.g. patriges occur.

Relation of density to crop yield.

### 1.1.12 The Nursery

i. This is the area set aside to generate planting material for the field. Used more in horticulture than field crops, not only to raise seedlings but also to facilitate operations related to vegetation propagation.

ii. Location should be : (a) near a reliable water source ; (b) unshaded and with a good and gentle circulation of air ; (c) on easy and gentle topography ; (d) on good fertile soil, deep, friable and free draining ; (e) preferably on soil just out of a long fallow (f) near to the main farm except where this is a risk from pests and (g) free from obnoxious diseases, pests and weeds.

iii. Layout should be one of two kinds :

a nursery shed with nursery boxes, posts, potting soil, watering point ; or an open nursery : nursery beds raised, sunken or flat; must be laid out to receive as much sunshine from early morning and to facilitate movement between beds and to give personal access to individual seedlings ; to conserve moisture and soil ; must be fenced where necessary for security against thieves and stray animals.

## 1.2 AGRICULTURE BIOLOGY

### 1.2.1 General organization

General organization of the plant/animal body from cell to tissue and organs. The relationship of organs in systems within the organism.

### 1.2.2 The cell as the basic unit of the organism

Basic structure of the cell : the outer cell membrane (plasma, membrane or plasmaderma) ; the cell wall (in plants only) ; the cytoplasm with the microbubules, microfilaments and intermediate fibres ; vacuoles ; nucleus with nucleolus.

Major differences between the plant and animal cell.

The unicellular organism - to illustrate the self-contained nature of the cell ; the highly structured nature of the cytoplasm into organelles for example, ribosomes, golgi bodies, mitochondria, plastids.

The basis of metabolic efficiency and the limitation on size. Illustrate with spirogyra or some agriculture equivalent.

### 1.2.3 The plant body

Cell types, tissue, organs and systems.

Tissue : mesophyll, epidermis, phloem xylem (contrast monocot and dicots).

Organ : branch, leaf, flowers, fruits, root (describe types).

System : shoot, root, inflorescence (describe types).

### 1.2.4 Plant parts and function

Root : internal and external structure : types and patterns of growth ; functions.

Stem : structure, types, adaptations ; branching patterns ; functions.

Leaves : structure, types, adaptations ; functions ; photosynthesis.

Flowers : structure, types, parts and function.

Fruits : structure, types, function.

Nodes and internodes : structure and function

Buds : distribution, structure and function.

Seeds : structure, types, function.

### 1.2.5 Animal organs and function

Body tissues : epithelial, connective (collagen,, cartilage) bone, vascular, muscular, nervous.

Organs : paired and unpaired ; external and internal.

Structure and function of the following systems : digestive, reproductive, respiratory, circulatory, excretory, nervous.

### 1.2.6 Basis of scientific nomenclature

The need for a name : to make for easy and common identification; to make it easier to establish relationships ; to classify.

Types of names :

Common names : of local origin and significance hence not internationally useful.

Polynomial names : developed as a degeneration of a system of descriptive naming ; lacked precision.

Binominal name : associated with Linnaeus ; the name of plant/ animal consisted of two words ; the first, the generic name ; the second, originally called the trival name.

The two words gave the organism its specific name.

Now botanists refer to the second name as specific epithet while zoologists refer to it as specific name ; so that, in Botany : generic name and specific epithet = specific name ; in Zoology : generic name and specific name = binomen.

The rules in naming require that the specific name or binomen be written in Latin ; that the generic name should always begin with a capital letter, and when repeated only the initial be used.

#### 1.2.7 Characteristics of major groups of plants and animals of agricultural importance

A survey of the plant and animal kingdoms :

As a resource for exploitation in agricultural production : to feed the world's populations ; to provide industrial raw materials which are converted to items for the use of man ; as a means of transporting man and his goods for doing work on the farm.

As exploiters of man and his agricultural productions (harmful organisms to man, his crops and livestock).

Harmful in terms of the following : (a) as parasitic organism ; (b) as pests or predators ; and (c) as disease-causing organisms.

The plant kingdom :

The schizophyta - bacteria ; unicellular, non-green ; reproduction- asexual (binary fission) ; cause diseases in both plants and animals ; help in the breakdown of organic matter and in symbiosis with such plants as legumes.

Thallophyta-algae (Chlamydomonas, Spirogyra, Fucus, Volvox) ; fungi (mucor, rhizopus, penicillium, mushrooms).

Algae-green, blue-green, red, brown-multicellular ; mainly aquatic ; use as a source of animal feed ; few cause disease in plants.

Fungi-simple multicellular, non-green ; parasitic or saprophytic ; cause many diseases in plants and animals ; some mushrooms are edible and are under cultivation ; help in the breakdown of organic matter.

Bryophyta - mosses and liverworts : multicellular, non-flowering, non-vascular.

Pteridophyta - ferns : non-flowering vascular plants ; could be terrestrial, or aquatic.

Spermatophyta - green seed-producing vascular plants : divided into gymnosperms and angiosperms :

Gymnosperms - conifers : non-flowering, seed producing vascular plants ; have true roots and stems ; leaves - fine needle-like or scale-like ; seed borne in structures called cones ; used as timber.

Angiosperms - flowering plants ; seeds arise from flowers bearing ovaries and ovules ; have true roots, stem, leaves ; divided into monocotyledons and dicotyledons ; most cultivated crops, weeds, timber, medicinal herbs belong to this group.

Monocotyledons - lillies, palms, grasses, etc. : plants with seeds that have one seed leaf each ; vascular bundles of stem and roots scattered ; petals arranged mostly in groups of three or multiples of three ; leaves have parallel veins ; most have fibrous root systems.

Dicotyledons - legumes, cocoa, etc. ; seeds have two seed leaves each ; vascular bundles arranged regularly ; petals arranged in streips from four to five ; leaves have veins arranged in branched network ; most have a tap-root system.

The animal kingdon :

The invertebrates lack the vertebrla column/backbone and divide in the following groups :

Protozoa - amoeba, plasmodium, paramecium ; unicellular, and aquatic ; as parasites of many animals.

Coelenterata - hydra, jellyfish, corals, sea anemones ; simple multicellur aquatic animals.

Platyhelminthes - tapeworms, liverflukes, planarians ; flatworms, with only one opening which serves for entrance of food and exit of wastes ; mostly as parasites of man and other animals.

Mollusca : snails, mussels, squids ; soft-bodies animals, many of which possess external shells ; some have internal shells ; presence of fleshy muscular ventral foot in some this is modified into tentacles ; some giant snails as food ; other as crop pests.

Annelida - earthworms, leeches, roundworms : true worms which are segmented or 'ringed' ; body tubular with two openings ; earthworms improve soil characteristics ; other worms live as parasites in the digestive systems of man and animals.

Arthropoda - insects, prawn, crabs, spiders : segmented with jointed legs ; presence of jointed hard exoskeleton ; some are a source of food to man ; help in the pollination of plants ; cause extensive damage to crops and livestock as pests and transmission of diseases.

Echinodermata - starfish, sea urchins, brittle star : marine organisms ; have bilateral symmetry in larval stage ; five rayed radial symmetry in adult stage ; calcareous exoskeleton and locomotory organs - tube feet

### 1.3 PLANT PROTECTION

Relates to organisms whose activities affect adversely the growth development and yield of the crop in the field and depreciate their value in storage.

Agriculture is particularly prone to pests and diseases for the following reasons :

Agricultural production situation is artificial and is ecologically not biotically balanced.

A concentration of a few or one species promotes a build up of favoured pest and diseases.

Crop varieties often selected and evolved for higher yield, often achieve this at expense of tolerance to pests, and disease.

High nutritive value in crops enhance reproductive capacity.

Modern agricultural methods use pesticides which may also destroy the natural enemies of other pests.

The significance of plant protection in agriculture.

For reasons listed above disease and pest problems will prevail wherever there is agriculture.

As world population increases and more intensive methods are adopted losses from pest and diseases become a greater proportion of production. The need for control becomes more urgent.

The need for quick control of pests and diseases is inducing and increasing use of pesticides with a resultant increasing pollution of the environment and greater cost of production.

Disease causing organisms : fungi, bacteria, virus, nematodes ; their characteristics and classification ; common local diseases.

Broad classification of pests ; common local examples ; the damage they cause :

Insects : adaptation and success as pest ; classification :

- (a) biting and chewing, e.g. cockroaches ;
- (b) piercing and sucking, e.g. aphids.

Mites : rodents - mice, squirrels, porcupines.

Birds - weaver birds, bush fowls (partridges).

Molluscs - garden snails, slugs, etc. ; monkeys.

Weeds : ecology - plants of disturbed habitat.

Biology - high reproductive capacity ; efficient mechanism of seed dispersal ; efficient survival mechanism e.g. dormancy.

Nuisance in agriculture : land depreciation ; competition with the crop ; increased cost of production ; alternate hosts to diseases and pests, etc. ; reduction of quality of produce ; poisonous weeds and stock.

#### 1.4 FARM MECHANIZATION

##### 1.4.1 Simple mechanics

Vector and scalar quantity :

Vector quantity - any quantity which has both magnitude and direction. Ex. : displacement, velocity, acceleration, force, weight.

Scalar quantity - any quantity which has only magnitude. Ex. : speed, distance, mass.

Vectors : addition and subtraction of vectors ; resolution of vectors into components.

Motion : types of motion - translational, circular, oscillatory and rotational .

Speed : distance covered per unit time.

Velocity : the rate of change of distance moved with time in a specified direction or rate of change of displacement ; distinction between speed and velocity. Velocity is a vector quantity, whereas speed is a scalar quantity.

Force : that which changes a body's state of rest or uniform motion in a straight line.

Acceleration : rate of change of velocity with time; gravitational force and acceleration of free falling bodies.

Mass and weight (differences) - Newton's first law of motion : every body continues in its state of rest or uniform motion in a straight line unless external force acts on it.

Concept of inertia : the tendency of a body to remain at rest or continue its motion in a straight line is called "inertia". Its relation to the first law should be noted.

Newton's third law : to every action there is an equal and opposite reaction.

Friction : the force which opposes the relative sliding motion of two surfaces in contact with one another.

Static friction, sliding (kinetic) friction.

Coefficient of friction ( $U = F/R$ ), where

F = force of friction

R = normal reaction

U = coefficient of friction.

Methods of reducing friction, e.g. lubrication.

Advantages and disadvantages of friction.

Moment of forces : the moment of a force about a point is the product of the force and the perpendicular distance of its line of action from the point. Principle of moments : conditions for parallel forces to be in equilibrium as demonstrated by common balance, see-saw ; types of equilibrium : stable, unstable and neutral.

Machines : crowbar, screw jack, lever, pulley, wheel and axle.

A machine is any device by means of which a force applied at one point can be used to overcome a force at another point.

Mechanical advantages (MA) = ration of the load to the effort ;

$$MA = \frac{\text{Load}}{\text{Effort}}$$

Velocity Ration (VR) = ration of distance moved by the effort to the distance moved by the load in the same...

$$\begin{aligned} \text{Efficiency} &= \frac{\text{Work Output}}{\text{Work Input}} \times 100\% \\ &= \frac{MA}{VR} \times 100\% \end{aligned}$$

Energy - Capacity to do work . Work = force (x) distance moved in direction of force.

Types of energy - potential and kinetic energy. Potential energy : energy by reason of its position or its state of rest. Kinetic energy : energy which a body has by reason of its motion.

The law of conservation of energy : energy cannot be created or destroyed. It only changes from one form to another. On the farm many such transformation of energy occurs, e.g. electrical energy to mechanical energy in the null fuel energy to mechanical and heat energy on the tractor.

$$\frac{\text{Work done}}{\text{Time taken}} \quad \text{Power} = \text{rate of doing work}$$

The rate of expenditure of energy is measured as power, which is defined as the rate of doing work.

Categories of farm power : (a) hand power ; (b) animal power - oxen, horses, donkey, bulls ; and (c) mechanical power - wind power - windmill, drying ; fuel power, internal combustion engine ; electric power - electric motors, heaters, refrigeration ; solar power - photosynthesis, etc..

#### 1.4.2 Woodwork

Safety precautions in the workshop : use of tools, especially cutting tools ; use of workshop machines.

Introduction to woodworking tools : their description and uses ; care, maintenance and storage.

Saws - bench saws ; coarse saws ; curve-cutting saws  
Planes - rough ; jack ; smooth ; Chisels - firmer ; bench ; bevelled edge ; paring ; mortise ; Geometrical tools - steel rule ; sliding bevel ; mortise gauge ; 2H lead pencil ; Holding tools - bench hook ; mitre box ; G-cramp ; bench vice ; Percussion and impelling tools - claw hammer ; pincers ; Warrington hammer nail punch ; screwdriver ; Screw and wire nails.

Some woodworking terms : define and explain : kerf, grain, across the grain, along the grain, grooving, chamfering, soft woods, hard woods, end grain, trenching.

Simple isometric sketching ; cross-halving ; T-halving; bridle ; mortise and tenon.



Practical use of some woodworking tools : sawing, planing, using the marking gauge, using the chisel, cross halving, T-having, joints.

#### 1.4.3 Simple farm tools

A wide range exists, depicting different levels of technological advancement.

Progress of human development has been along the lines of the use of hand tools, animal tools, mechanical tools.

Handtools - the simplest and easy to maintain ; but limited in scope because energy behind it is low and easily exhausted.

Animal tools - a little more elaborate, but equally easy to maintain at the rural level. With it man can work three times as much. Sources of animal power include commonly bullocks, horses, donkey, mules, etc.

Mechanical tools - a wide range of complexity ; requires more than ordinary skill to operate and maintain. Concept of appropriate technology implies choice within range of technical competence to manage and cost. Energy source initially mainly renewable e.g. firewood, straw, cowdung, water, wind, sunshine ; lately more dependent on non-renewable fossil-fuel oil. Scope is tremendous, has made it possible for the world to feed itself in spite of increasing population.

#### 1.4.4 Farm structures

Principles of farm housing :

Location on least fertile land; on high ground, well drained, central and protected from strong winds.

Block-making - sandcrete, landcrete; block and brick-laying; use of the spirit level and the plumb-line.

Roofing - Thatch and bambo roofing, their preparation, construction and maintenance; roof well anchored and securely attached; good overhang to protect walls from rain and sunshine; good pitch of roof, 80 degrees or more.

Principles of ventilation in housing.

Specialized farm structures : the maize barn or crib; the silo; various types of housing for poultry and live-stock; silage pits or ramp and compost pit; their features, construction and maintenance.

Simple farm gadgets : nursery boxes, nest boxes, feeding troughs, hatches, coups, wallows, etc.; their features and construction.

## 1.5 ANIMAL HUSBANDRY

### 1.5.1 Types of farm animals

Ruminants : cattle, sheep and goats; complex stomach of four parts : rumen, reticulu, omasum and abomasum; adapted to feed of high fibre content.

Non-ruminants ; (monogastrics) - poultry; pigs, simple stomach of one compartment, omnivorous feeders.

Herbivores : rabbits, guinea-pig, horses, donkey, camels, non-ruminants but plant-eaters.

### 1.5.2 Importance of farm animals

Source of food for man : meat, milk, eggs.

Work and transport : camels, bullocks, horses, donkeys.

Source of animal by-products : bloodmeal, bonemeal, hides and skins, horns, hooves, manure.

Socially, wealth.

Religiously for sacrifices.

### 1.5.3 Principles and fundamentals of animal nutrition

The sun as fundamental energy source.

Autotrophic or primary producers (plants).

Heterotrophic or secondary producers (animals).

Food chain.

Inability of animals to synthesize all essential nutrients; the need for balanced diet for animals for :

(a) maintenance (maintenance ration), and growth and production (production ration).

Types of feedstuff :

(a) roughage - hay, silage, fodder; (b) concentrates protein (animal or vegetable); energy.

Chemical composition of feeds : water, carbohydrates, fats and oils, proteins, vitamins, fibre, minerals (ash); comparative study of digestion in ruminants and monogastrics.

### 1.5.3 Principles of animal health and disease control

Causes of disease: (a) specific causes: disease organisms such as bacteria, fungi, viruses, nematodes; vectors, e.g. insects, ticks, lice; poisons; nutritional defects, e.g. calcium deficiency; mechanical causes, e.g. fracture; (b) predisposing factors: age, sex, hereditary, colour, etc., poor nutrition, overcrowding and stress.

Signs of good health - pulse rate, body temperature, condition of skin and coat; condition of visible mucus membranes - feeding habits; any deviation from normal is unsatisfactory.

### 1.5.5 Principles of animal housing

Extent of housing determined by type of animal, intensity of management; scanty to nil for extensive systems continuous and elaborate for intensive systems.

A good animal housing should provide shelter from rain, strong wind and the heat of the sun; should be cheap to construct, easy to clean and disinfect; should be easy and convenient to operate; should be airy, cool and generally well ventilated; should be located on a well drained site, and provided with adequate surface drainage; should be sheltered from the main highway or any frequent source of jarring noise; should be adequately fitted for management.

## 1.6 FARM MANAGEMENT

### 1.6.1 Agriculture and society

Basis of human survival; a source of food, clothing and shelter.

Main source of livelihood of rural folk; often binding together the community in various traditional cultures.

The principal source of foreign earnings of many developing countries.

### 1.6.2 Agricultural production, population pressure and change in technique

Agriculture as a primary production; the oldest and most widely practised industry.

Evolved in response to human need for food and greater security in food supply.

As population increases the need for food and other industrial material also increases; as the community develops society becomes more complex and structured, and the proportion of non-agricultural producers increases.

Under this pressure, agricultural production moves from a predominantly subsistence nature becoming more and more commercialized.

Production techniques must change to enable the few to provide the food and the industrial needs of the rest.

#### 1.6.3 Factors of agricultural production

Productive resources - land, labour, capital and entrepreneurship.

Law of diminishing returns as relates to the factors of production (inputs); marginal utility.

Optimum scale of operation.

#### 1.6.4 Characteristics of production

Seasonality, making for periods of plenty and periods of plenty and periods of scarcity.

Bulkiness - expensive to transport.

Perishability - the need for special processing and storage.

Elasticity of prices.

#### 1.6.5 Rural sociology

Living conditions - closer to nature in the use of such resources as land and vegetation for food, energy, health, clothing and shelter; technologically less advanced and hence appear more deprived in terms of amenities; such as housing, health communication, etc., enjoy less pollution of the environment from industrial waste; cleaner air. Life more peaceful and less tense.

A smaller and simpler human society; closer community life and human interaction, more intimate and more passionate; mutual security based on community solidarity;

1.6.6 Other factors

Opportunity costs.

Demande and supply - graphical relationships.

Cost of production - total cost; average and marginal cost ;  
fixed and variable cost; perfect competition, monopoly, inflation.

Price.

1.7 ENGLISH LANGUAGE

(see Notes on page 45)

1. Figures of speech: nouns, pronouns
2. Basic sentence patterns
3. Basic time tenses (for, since)
4. Basic essay writings (introduction) e.g. narrative and descriptive essays
5. Letters: informal
6. Possessives
7. Conjunctions
8. Clauses and phrases
9. Comprehensions (introduction)  
Lexis: introduction to idioms

1.8 MATHEMATICS

1. Operations on Sets: Union, null and universal sets ; complement: use of venn diagrams (not more than 3 sets).
2. Indices; surds; notion of real numbers.
3. Logarithms: use of 4-figure tables.
4. Statistics: frequency tables; arithmetic means; mode, median and dispersion; pie-chart; bar-chart, histograms; cumulative frequency.
5. Simple probability: involving equally likely events.
6. Solution of simultaneous linear equations in two variables :  
solution by substitution; solution by graphical methods; solution by application of the principle of  
 $ax + by = 0$        $a = 0$       or    $b = 0$
7. Simultaneous equations in two variables :  
One linear; one quadratic (graphical solution only).

8. Drawing travel graphs; speed; motion at a variable speed.
9. Formulae; calculating from formulae; inverse problems; change of subject.
10. Accuracy and error : Precision; percentage error, rounding of errors.
11. Factorization of trinomials and by grouping : difference of two squares.
12. Loci : The constant angle locus.

SECOND YEAR

2.1 AGRONOMY AND HORTICULTURE

2.1.1 Factors of environmental degradation

Degradation from :

- (a) over exploitation and over grazing due to population pressure on the land ;
- (b) abuse and misuse from improper farming methods.

Agents of degradation : erosion, leaching, crop removal.

Manifestations of degradation : poor yields ; weediness; low productivity ; poor grass or tree cover; aridity and desertification.

2.1.2 Plant growth in relation to water

Water uptake by roots : osmosis, diffusion; xylem; transport of water ; transpiration through the leaves.

Importance of water in the plant : constitutes about 80 per cent of the cytoplasm; transport of nutrients; turgor pressure, etc.

Atomospheric water balance: the hydrologic cycle; concept of evapotranspiration and atmospheric moisture deficit; water stress in plants.

2.1.3 Soil fertility

Definid as the ability of the soil to sustain crop growth and maintain productivity of the land.

Nutrietn balance in the soil :

- (a) natural sources of replenishment ; weathering of rock fragments, organic decay ;
- (b) losses : erosion, leaching, crop removal, chemical immobilization.

2.1.4 Mineral nutrition of crops : classes of nutrient elements

Macronutrients, N P K; required in large quantities;  
Micronutrients or trace elements Fe, Mn, B, Cu, Zn, Na, Cl, Mo, Ca, S, required in small quantities.

Importance of various nutrient elements; their role in plant growth and development ; signs of their deficiency.

Nutrient uptake by plant roots : mobile nutrients e.g. N ; non-mobile nutrients e.g. P and K mass flow, diffusion and cation exchange ; the transpiration stream.

#### 2.1.5 Methods of improving soil fertility

Use of fertilizers and manures.  
Bush fallowing or fallow cropping.  
Mulching and cover cropping.

#### 2.1.6 Fertilizers and manures

Two basic types : organic and inorganic.

Inorganic fertilizers : relatively highly concentrated; usually refined chemical salts either mined or synthesized in the factory.

Described as : (a) straight, single or simple when used to provide a single principal nutrient ; and  
(b) compound or mixed : when used to provide a combination of two or more basic nutrients.

Organic fertilizers : from organic sources ; cheap in capital outlay, can be produced from discarded farm resources ; a low-concentration fertilizer, hence bulky.

More balanced in nutrients, hence an insurance against trace element deficiency; a source of soil colloids, improving the structure and other physical properties of soil; slow nutrient release minimizing losses by leaching.

Types : Farm yard manure (FYM), compost, green manure:  
FYM and compost : preparation storage and use; microbial, physical and chemical changes during preparation;  
green manuring : desirable characteristics of a good green manure crop; production and application;  
the nitrogen-negative period and the microbial activity associated with it.

Methods of fertilizer application : broadcasting ; merits and demerits ; placement methods-types merits and demerits; foliar application-merits for trace elements application; how to constitute compound or mixed fertilizers.



### 2.1.7 Farming and cropping systems

Distinguish between farming systems and cropping systems: cropping involves only crops but farming can involve animals as well.

Factors inducing the type of system : cropping involves only crops but farming can involve animals as well.

Factors inducing the type of systems : climate; vegetation soil; and socio-economic factors.

Types of farming systems : (a) pastoralism (nomadic) perhaps the most primitive ; (b) shifting cultivation/land rotation/bush fallow ; (c) plantation agriculture, and (d) ley farming mixed farming.

Types of cropping systems : (a) monoculture ; (b) rotational cropping ; (c) multiple cropping ; (d) mixed cropping/relay cropping ; and (e) alley cropping. Describe these systems discussing the factors that have led to their evolution.

### 2.1.8 Methods of propagation

Sexual reproduction : parts and functions of the flower: the sepals, the calyx; petals and the corolla; stamens; filament, anther, pollen, carpels, stigma, style, ovary, ovules; processes of pollination and fertilization.

Fruit and seed formation : seed as a propagating material; structure of a monocot and dicot seed; characteristics of a good seed; purity, health and viability; conditions required for germination; germination test.

Vegetative propagation : merits; a means of perpetuating characteristics of parent. Methods : cutting and layering; budding and grafting; storage organs e.g. corms, bulbs, tuber and rhizomes; of shoots e.g. suckers, slips, crown, offsets.

### 2.1.9 Vegetable crop management

A branch of horticultural science related to the production of fresh, green material for the kitchen. Contrast with other fields of horticulture, i.e. fruit culture and ornamental plant culture.

Location - usually associated with the home in small backyard garden, or nearby plots; for commercial produc-

tion, proximity to the market is important; a reliable source of water is indispensable. Deep sandy loams, ideal, but any soil can be improved in time with management and organic manuring; keep soil acidity within 6.0 to 7.0 pH; keep plots out of shade.

**Management :** choose crops adapted to soil and climate of the place; plan production so that there is regularity of supply; rotate crops to minimise incidence of pests and diseases; recognize the following grouping for purposes of rotation : (a) solanaceous crop: tomato, potato, pepper, egg plant; (b) cruciferous crop: cabbage, cauliflower, broccoli, brussels sprouts, kale savoy, kohlrabi, swede; (c) cucurbit crop: cucumber, pumpkin, vegetable marrow, squash, melon, shushu ; (d) leguminous crops: beans and peas; (e) root crops: carrot, turnip, beetroot, parsnip, sweet potato; (f) leaf crop: lettuce, spinach, kale, mustard, chard; (g) miscellaneous crops: okra, onion.

**Seed supply:** Secure seed from reputable certified source to guarantee genetic quality and disease-free material; store seed in a cool dry place preferably in a desiccator; treat seeds before planting.

**Nutritive value:** Vegetables cherished for their value as health food; a source of vitamins particularly vitamin C and vitamin A; a source of minerals particularly Ca and Fe; not a good source of quality protein. This can be improved by eating vegetables from different sources.

A study of vegetable crops selected to give a broad representation of the different types listed below. The study should discuss the following: common name; specific name; plant family; origin; growth requirement; plant characteristics: locally proved cultivars; culture: land preparation fertilizer application seeding, cultivation, notable local pests and diseases and their control, harvesting, yield, storage, nutritional value and marketing: (a) root or tuber: carrot, beetroot, horse-radish, parsnip, turnip, sweet potato; (b) bulb: onion, shallot, gallic, chive; stem: asparagus; leaf: lettuce, spinach, kale, mustard, chard; (e) leaf stalk: celery, rhubarb; (f) bud: cabbage, brussels sprouts; (g) flower: cauliflower, broccoli; (h) seed: peas, beans.

## 2.2 PLANT PROTECTION

### 2.2.1 Principles of pest and disease control

Factors promoting disease and pest development in agriculture:

High temperatures, high humidity promote rapid growth of pest and diseases in the tropics.

Agriculture, a violation of the ecosystem; adjustments set in train by nature favour some diseases and pests. Weeds are particularly adapted to such disturbed habitats.

Agricultural crops being more nutritive and more luscious offer more attractive food to pests and diseases. Vegetable crops in particular suffer in this respect.

Agriculture tends to concentrate a few species and this provide pests and diseases easy access to their hosts; increased feeding promotes increased growth rate of pests and diseases.

Some pesticides selectively reduce the population of parasites of some predators enabling their numbers to grow.

Methods of Control - physical, legislative, cultural, biological, chemical and pest management:

Physical: by the creation of barriers preventing pest access to host e.g. traps, seed treatment.

Legislative: aims at preventing new diseases and pests entering the country and indigenous ones moving to new areas; controls achieved by quarantine and certification.

Cultural: observe general farms hygiene, removing weeds and volunteers; burn all diseased or infected material; rotate crops, separating susceptible crops by long interval; use disease-free seeds or propagating material; encourage vigorous growth by appropriate manuring and cultivation; spot diseases, pests or weeds early and remove them; trap cropping; variation in planting and harvesting dates; etc.

Biological: the use of other organisms (predators) to control the growth of others.

Chemical control: the trend towards the increasing use of pesticides in agriculture should be deplored.

The risks of the use of pesticides: human health hazard; general environmental pollution; the cost of chemical dependent methods against more culturally based techniques.

Types of pesticides: insecticides, fungicides, herbicides, nematocides, acaricides, rodenticides, etc.

## 2.3 FARM MECHANIZATION

### 2.3.1 Principles of water conservation

The need to conserve the soil and conserve water in the soil. The vulnerability of the topsoil; loss by erosion.

Rainfall - the main source of water for agriculture; seasonality in the distribution of rainfall; the prolonged dry season of arid and semi arid areas; the water secured during rainfall must be made to stretch to maintain plant life in the off season.

The fate of rainfall: the water balance equation and the concept of effective rainfall; effective rainfall (R) = total R (runoff), evapotranspiration, percolation (groundwater reserve).

The soil as a reservoir of water; forms of soil water: gravitational, capillary and hygroscopic; concept of available water as water held between wilting point and field capacity; pattern of depletion of soil moisture by roots, the duty of water as the unit of water required to produce one unit weight of produce.

Water conservation practices: reduce evaporation by providing a bare fallow; improve water percolation into the soil reserve by slowing down runoff through contour cultivation, strip-cropping and terracing.

#### Surveys:

Objectives: to establish extent of resources; provide data for farm capability and land-use planning.

The understanding and use of simple survey equipment; the theodolite, the staff, range poles, etc.

Planning the layout of a field; simple interpretation of maps and land-use maps.

Irrigation: potential use in agriculture; siting and survey of soil and water resources; irrigation systems: furrow, basin, sub-irrigation, sprinkler, trickle or drip; irrigation cycles; advantages and hazards of irrigation.

Drainage: causes of floods and poor drainage in soils. Importance of drainage in agricultural land use; field drainage system. Fencing - simple introduction.

Specialized farm structures: the maize barn, or crib; the silo; various types of housing for poultry and livestock, silage pits or ramps; compost pits. Their features, construction and maintenance.

Integrated pest control and integrated pest management: means of reducing dependence on chemicals; offer appropriate blend of chemical and cultural practices, reducing cost and minimising environmental pollution.

Specific methods of control: weed control - relate this to the biology of weeds; preventive measures: use of clean seeds; clean equipment; confinement of livestock for three to seven days before releasing them to graze new fields, destroy weeds thoroughly and persistently to prevent them setting seed; keep irrigation channels relatively weed free and prevent weeds from seeding.

Control measures: (a) cultural-tillage, rotation-catch cropping, strip cropping, smothering-flooding, cover cropping, mulching; (b) fire; (c) biological; (d) chemical-contact, residual and translocated; soil acting, foliar acting application equipment, simple calculations.

## 2.4 ANIMAL HUSBANDRY

### 2.4.1 Pastures and fodders

A study of common pasture species; establishment of pastures; pasture management; paddocking; rotational grazing; use of fire in grassland management; preservation of fodder, hay and silage.

#### 2.4.2 Principles of animal improvement

Basic genetics and the concepts of inheritance; the nucleus, the chromosome and the genes; mitosis and simple meiosis; simple mendelian inheritance; simple introduction to population genetics, and the concepts of variation, segregation and selection.

Animal improvement; objective - to produce a better animal in terms of production, feed conversion, disease resistance, etc.

Methods: introduction, selectionm cross-breeding, specify adverse effects of in-breeding; artificial insemination; integration of breeding with other improvement methods such as improved feeding, housing and disease control.

#### 2.4.3 Management of farm animals for production

Business consideration: capital acquisition; potential market; strict farm budgeting; struct farm record keeping; efficient supervision.

Establishment and management of animal enterprises

Ruminants: sheep, goats, dairy cattle, beef cattle; their relative importance in the economy and the nutrition of the people; their relative merits for small or large scale production.

Types and choice of breed: contrast improved and local breeds.

Flock establishment: site selection; farm plans; housing of foundation stock; breeding. Management: feeding; tuype of pasture and pasture utilization; supplementary feeding for production, health and routine vaccinations. Dipping or other ectoparasite control measures; handling and restraining for examination; castration; milking; slaughtering.

Products: meat, milk, hides, wool, manure, etc.; marketing.

#### 2.4.4 Pig production

Types and basis of choice of production stock: profile, adaptability, early maturity, good converter of feed.

Constraints in production: expensive outlay in housing; labour intensive; competition with man for feed; market restricted by religious prejudices; offensive effluent restricts location. Other considerations as indicated for fuminants.

#### 2.4.5 Poultry production

Merits over other types of stock to the national economy and to nutrition.

Types: broiler or layer or both.

Systems of production: free-range, semi-intensive, intensive.

Production of other types of stock: turkeys, ducks, geese, guineafowl, pigeons, etc.

It should be noted that the cost of feeding is high and risk of losses by disease high; also high standard of hygiene is an important aspect of management.

Skills in incubation, feeding, post-mortem examination, medication, feeding, counting, slaughtering, dressing should be frequently conveyed under supervision.

#### 2.5 FARM MANAGEMENT

Principles of farm management - Identification of production goals and the efforts to achieve them. Management as representing the fourth factor of production; responsible for the right blend of capital, labour and finance to employ in production.

Organization and operation of the farm - Determined by the choice of enterprise made; the importance of feasibility studies; optimum and profitable scale of operation; structures and organs required to translate plans into commercial reality.

Size of business - Advantages of scale; size as a constraint in traditional farming business; scale effects on the failure to promote certain improved practices (e.g. mechanical cultivation) in traditional farming; the benefits of scale e.g. co-operative farming.

Farm records and accounting - Importance of careful and systematic record-keeping to provide the data base upon which to make decisions and choices. Provide information of stocks that can be drawn upon, enables objectivity of decision; allows operations to be kept within limits of budgets; provides a basis for future budgeting; helps management to identify problems and set to solve them; constitutes the basis of farm accounting, in the provision of the assets and liability accounts, receipts and expenses accounts, capital account, credit account.

Book-keeping - Journals, redgers, trial balance, final account; double-entry system; asset, liability, credit, equity.

## 2.6 CHEMISTRY

### 2.6.1 Chemistry of organic compounds

An introduction to structure, physical properties and chemical reaction of carbon compounds. The characteristic functional group of each class of compound.

#### 1. Hydrocarbons

Alkanes: general formula, homologous series in relation to physical properties. Substitution reaction.

Isomers: a few examples and uses of halogenated products, e.g. chloromethane.

Alkenes : general formula, nomenclatura, addition reactions, polymerization reactions, uses of alkenes and products.

Alkynes: ethyne; production from action of water on carbides and its uses in lamps and welding.

Petroleum: practical distillation of petroleum, physical properties of the products. Combustion of the products. The uses of the fractions.

Octane rating, fuel additives reforming and cracking of petroleum.



2. Alkanols

General formula. Examples such as methanol and ethanol. Production of ethanol by fermentation, reactions of the OH group, uses of alkanols.

3. Alkanoic acids

General formula. Examples such as methanoic (formic) acid, ethanoic (acetic) acid. Examples of chemical reactions such as neutralization and esterification.

4. Alkanoates (esters)

Formation from alkanoic acids and alkanols. Fats and oils as esters. Saponification production of soap and margarine.

5. Carbohydrates

6. Products obtained from the destructive distillation of wood

7. Proteins

Nonaqueous component of cells; enzyme molecules as proteins; regulatory hormones also as proteins.

Functions: components of peri- and intra-cellular membranes; serve as antibodies to foreign antigens; perform the oxygen-carrying function in the blood; constitute some of the chromosomal material.

Protein as polymers of amino acids; general structure of amino acids; the twenty amino acids in protein molecules and their structures.

8. Lipids

As water-insoluble component of cells; extracted with organic solvents like ether, benzene and chloroform; fatty acids as major part of lipid extract.

Classification of lipids: (a) simple lipids: fats esters of sugar molecules and glycerol in esterified with fatty acids and phosphoric acid.

Structure of common fatty acids, e.g. butter, coconut oil, palm oil, soybean oil, etc.

Functions of lipids: (a) as part of cell membrane, sandwiched between two layers of protein; (b) control the transport of substances to and from the cell; (c) as constituents of protective tissue which insulates warm-blooded animals; (d) in plants as waxes that protect leaves and stem surfaces against water and pest attack (insect bacteria, etc.); and (e) main function as the major and most efficient repository of energy.

## 2.7 ENGLISH LANGUAGE

(See Notes on page

1. More on Essays: Essays of explanation/process/ideas/direction
2. Comprehension (continued)
3. Introduction to summaries
4. More on sentences - types, etc. tenses, phrased verbs, adverbs particles
5. Lexis and structure (continued)
6. Speeches: direct and indirect
7. Idioms (continued)

## 2.8 MATHEMATICS

1. Logic and simple reasoning: implication, converse, equivalence, the chain rule, "and" and "or".
2. Basic solids: pyramids, prisms and spheres, include cuboid, circular cylinders and cones, properties, nets, sketches, plane sections, views (maps and plans).
3. Mensuration of basic solids and plane figures: perimeters, areas, volumes; include sector and segment of a circle; earth as a sphere, great and small circles, distances along lines of latitude and longitude.
4. Construction Loci: Parallels, perpendiculars, mediators; angle by sectors, angles of  $60^\circ$ ,  $45^\circ$ ,  $30^\circ$  and an angle equal to a given angle, triangles, quadrilaterals

Application of above constructions to loci in two and three dimensions where appropriate - include constant angle locus.

5. Circles: chords in a circle, tangents to a circle.
6. Taxation and finance: income tax; customs and excise; saving your money; insurance.
7. Direct; inverse and part variation: rates of work, costs, taxes, foreign exchange, density (e.g. for population, mass) distance-time, speed. Graphical treatment of the above where applicable.

THIRD YEAR

3.1 AGRONOMY AND HORTICULTURE

3.1.1 Field crop production

Crops of open habitat; sun-loving crops that do not grow well in shade; cultivated in the open field where the natural vegetation is completely cleared.

Mainly annuals and grown for a season; some have tendency to stay beyond a season.

Known for their produce which may be classified as cereal grains, grain legumes, tuber crops, root crops, sugar crops, oil crops, etc.

Often cultivated on a large scale and cultivation is highly mechanized; mechanized cultivation necessitates through bush clearing and stumping.

Constant control of weeds and pests needed as a result of the open habitat.

Specific studies of some members of the groups listed above, taking into consideration their economic potential in the area. Consider their origin (briefly), botanical classification (in many cases just the botanical name) their growth conditions, their cultivation, local planting date, crop spacing (planting rate) disease and pest control, harvesting, post-harvest handling of crop, storage and marketing.

Students must be made to participate in the cultivation of these crops on the school farm. They should be made to keep field notebooks in which they should form the habit of recording activities on the farm, and anything unusual.

3.1.2 Orchard, tree or plantation crops

Crops of long gestation and prolonged productive life; adapted to wetter climatic or irrigated situations; may require some shade temporarily at some stage of their lives, or permanently throughout life; often raised in the nursery as seedlings and transplanted later to the field; highly labour intensive; produce often requires some processing before marketing.

A study of some fruit or tree crops of economic potential in the area. Discuss and encourage student participation in all field operations as indicated for field crops above.

### 3.1.3 Ornamental horticulture

A simple introduction to the identification cultivation and the use of flowers in landscaping, internal decoration and for other aesthetic operations. Wild plants of ornamental value and their market potential.

### 3.1.4 Forestry

Its importance: some notable forest products: timber, veneer, paper, and their potential; medicinal herbs, fuel, other food sources, etc.

Conservation: legislative; forest reserves, etc., their distribution; structure and species composition of the forest, the relationship between agricultural expansion and forestry; the threat of over exploitation of the forest; solutions to abuses.

### 3.1.5 Principles and methods of crop improvement

The need for crop improvement through breeding. Methods: crop introduction, selection, cross breeding, hybrid vigour, inbreeding depression.

## 3.2 PLANT PROTECTION

Composition of pesticides: active ingredient and the carrier or the diluent; other additives: sticker, wetting agent, etc..

Formulation: Principles and types; soluble concentrate, emulsifiable concentrate, stock emulsion, wetttable power, dusts, granules, fumigants, aerosols.

Application: simple calculations of pesticide rates and requirements; examination of simple equipment for pesticide application; the nozzle; the pressure unit; the delivery rate; speed of operation and the spray volume; measures to ensure uniform application.

Environmental hazards - range of toxicity of herbicides; care in handling herbicides; the use of protective clothing where necessary; pesticide residue; safe times of harvest after application; storage of pesticide; cleaning up of equipment and storage. Public health and pesticide use; the protection of wells and streams; protection of man and domestic animals.

Diseases and pests of specific crops in the locality;  
simple introduction to stored product pests.

### 3.3 ANIMAL HUSBANDRY

#### 3.3.1 Introduction to fish farming

Importance of fish farming; its importance to the country;  
its importance in human nutrition; its adaptability to small  
producers as a backyard effort.

The biology of fish and its relation to breeding and  
conservation.

Inland and marine fishing (a brief introduction).

Cultivable fishes: their identification and culture.

Fish processing and preservation.

#### 3.3.2 Rabbit production

Potential as source of meat with less competition for food  
with humans; easy housing and initial capital outlay;  
a convenient and rewarding enterprise.

Breeds and breeding: basic biology and behaviour selection  
criteria.

Housing-design, materials and construction; watering and  
feeding equipment; nest boxes, etc.

Feeds and feeding: significance of indigenous grasses and  
herbage; importance of supplementary feeding particularly  
during gestation.

Slaughtering and processing for meat and pelts.

#### 3.3.3 Bee-keeping

Potential as source of honey; but also as pollinator of many  
fruit trees. Treat general biology.

Housing: the beehive, design, construction and location.

Seeding the hive, general care and harvesting.

Processing of honey; processing of wax.

First-aid against bee-stings.

### 3.4 FARM MECHANIZATION

The importance of preservation and storage in agriculture; perishability of produce, seasonality of food availability.

Simple introduction to principles of preservation and storage.

Traditional methods of pre-processing and drying and suggested improvements.

Pest control in storage and the risk of using chemicals.

### 3.5 FARM MANAGEMENT

#### 3.5.1 Marketing

The importance of marketing in agricultural production; perishable nature of commodities and the necessity of careful handling; inaccessibility of farms hence commodities acquire value when moved from farm gate to centres of consumption - place utility; seasonal nature of production gives commodities time utility. The need to consider all this in planning.

The conventional route of marketing: producers, assemblers; transporters; wholesalers; retailers; consumer.

Structures and institutions of marketing; the role of the market agent, the marketing boards and co-operatives and the involvement of Government.

Efficiency of marketing.

Problems and constraints to marketing in developing countries (documented); measures for their solution.

#### 3.5.2 Project evaluation

A simple understanding of a feasibility study report.

### 3.6 PROJECT

In the final year and in partial requirement of the conditions of evaluation, each student will be required to undertake a project in any chosen field of agriculture. He will be required to produce a report which will be submitted in partial fulfilment for his certificate.

3.7

ENGLISH LANGUAGE\*

(See Note on page 45)

1. Even more on essays: Essays of arguments, debates,
2. Business essays: Minutes
3. Articles, speeches (formal and informal)
4. More on summaries and comprehensions.
5. Inversions
6. Letters continued: Formal letters, etc.
7. Idioms continued
8. More on Lexis and Structure (covering all fields of human activity)



ENGLISH LANGUAGE - NOTES

1. Letter writing: (a) formal letters ; (b) informal letters.

Letters to be based on subjects relevant to experiences of students.

Emphasis should be placed on the persons to be addressed, purpose of the letter, length of the letter (long - between 250 and 350 words; short - about 150 words)

2. Essay writing: emphasis to be placed on the students' ability to communicate in writing under the following: (a) narrative writing; (b) description; (c) explanation of an idea; (d) explanation of a process; and (e) giving directions or instruction.

Length of essays should be about 400 words which is about two to two-and-a-half pages

Credit is given for arrangement, including formal features, paragraphing, appropriate emphasis on sequence of ideas, appropriateness of language (control of vocabulary and sentence structure) to the topic and to the specified audience and purpose; mechanical accuracy, including punctuation and spelling.

3. Comprehension and summary

Comprehension: students should be able to understand prose passages as a whole and in detail. Emphasis should be laid on the following:

Individual words to be explained in relation to their context;

Phrases or sentences to be recast or explained;

Questions testing comprehension of the whole or part of a given passage;

Turning direct into indirect, or indirect into direct, speech;

Synthesis and exercises in sentence construction (phrases, clauses, sentences; grammatical function of words, etc.)

Recognition, comprehension and use of simple figures of speech.

All passages set to be in good modern prose, and writing of the following kinds may be used : (a) dialogue or conversation with a maximum of four speakers; (b) narrative; (c) description; (d) explanation of a process; (e) explanation of an idea or a sequence of ideas; (f) argument; and (g) giving directions or instructions.

Passages to be selected from a wide variety of suitable modern sources, including translation, fiction, drama, travel writing, elementary scientific exposition for the layman, the press, modern historical and biographical writing, and elementary exposition of topics of social, economic and political interest.

Summary: students should be able to judge relevant points and to write clear summaries of prose passage. Candidates may be asked to summarize the main points of the passage or to extract materials relevant to certain specified topics, and to summarize these materials clearly and coherently. (N.B. stating the essential points in a concise form is what is required.)

#### 4. Lexical and structural items

Lexis: (a) vocabulary in the normally accepted sense of the word (dictionary headwords in their normally patterned senses and uses); (b) idioms, i.e. collocations the total meaning of which cannot be arrived at simply by consideration of the dictionary meanings of the words in structures in which they appear; (c) figurative usage.

In addition to items testing knowledge of the vocabulary of everyday usage (i.e. of the home, social intercourse, the press, the common-care school subjects, etc.) items may be set testing the more general vocabulary associated with the following major fields of human activity: (a) building; (b) agriculture; (c) commerce; (d) photography; (e) fishing; (f) mineral exploitation; (g) common manufacturing industries; (h) printing, publishing, the press and libraries; (i) sea, road and air transport; (j) government and politics; (k) sports and entertainments; (l) religion; (m) elementary science; and (n) power production.

In practice, the test of lexis will be designed so as to explore not merely the extent of the candidates vocabulary but, more importantly, their ability to discriminate between the appropriateness to (a) total situation and (b) verbal context of words commonly regarded as 'synonyms'.

Structure

Structure in the sense in which the word is used here includes: (a) the patterns of changes in word-forms which indicate, e.g., number, tense, degree; (b) the patterns in which different categories of words regularly combine to form groups and these groups in turn combine to form sentences; and (c) the use of structural words.

**PART 3**

**SPECIMEN MODULES**

AGRONOMY

MANURING IN CROP PRODUCTION

(9 hours)

Course description and aims

This unit briefly introduces students to the importance of manures in crop production in general.

The various types of manures used in agricultural productions are outlined and discussed in greater detail. Students are then exposed to the various methods adopted in the application of these manures for effective plant use and the merits and demerits of these methods discussed.

Practical preparation as well as handling of some of these manures are demonstrated and students encouraged to perform such activities under supervision.

Objectives

1. State and discuss the role played by manures in the sustenance of crop growth as well as the productivity of the land.
2. Outline the two main types of manures as inorganic and organic and discuss their unique characteristics.
3. State and describe the various classes under the two main types. This should include straight or compound fertilizers; farm yard manures, compost, etc.
4. Describe briefly the main methods of the application of manures and discuss with the students the merits and demerits of the various methods. This should include broadcasting, placement and folia applications.

Activities

A practical demonstration class should be organised for students to observe displayed specimens of some manures.

Compost preparation process should be carried out by students on their plots.

A plot should be set aside and put under green manuring.

Manuring application methods should be demonstrated with full participation of students.

### Evaluation

A short answer test should be given at the end of the unit to cover the course. Students should be asked to identify various manures and in addition asked to apply these be specified methods to test their competences.

HORTICULTURE  
METHODS OF CROP PROPAGATION

(10 hours)

Course description and aims

This unit briefly discusses the significance of the propagation of crop species in agricultural productions. The various types of crop propagation are stated and described in detail. Seed characteristics as well as environmental conditions necessary for its germination are discussed and practical investigation into these carried out by students. Methods of asexual propagation are discussed and demonstrated with full students' participation. Advantages of these various methods are outlined for discussion with students.

Objectives

1. Outline and discuss the significance of crop propagation to include perpetuation of the species; as a basis for growth in size; as a means of healing, eg. callus growth; and as a basis of evolution.
2. State and describe the types of crop propagation. Under sexual propagation, discuss the process of fruit and seed formation, including the structure of the flower, monocot and dicot seeds.
3. Discuss the characteristics of a good seed as a propagating material to include purity, viability, and health (free of diseases and pests.)
4. State and discuss briefly the conditions necessary for germination and guide students to conduct simple investigations into these conditions.
5. Stress the importance of the germination test and guide the students to perform a test on a quantity of seeds.
6. The advantages of asexual propagation should be discussed and various methods such as budding and grafting demonstrated with full students' participation.

Activities

Students should perform simple investigative experiments on the

conditions of germination.

A germination test experiment should be performed on some seed stocks by the students.

All the methods of vegetative propagation should be demonstrated and students encouraged to adopt them on their plots.

### Evaluation

Students should be given a written test to cover the theory part of the unit.

A practical test should be organised to examine students' ability to identify various seeds and other planting materials such corms, bulbs, rhizomes etc; in addition certain vegetative propagation methods such as budding and grafting should be performed.



AGRICULTURAL BIOLOGY

PLANTS PARTS AND THEIR FUNCTIONS

(5 hours)

Course description and aims

The external morphology of plants as well as their functions are studied under this unit.

Structures that are modified for special functions are also discussed, eg. bulbs modified for storage.

Structural differences between monocots and dicots are discussed.

Objectives

1. Discuss the two main parts of the plant body as the shoot system and the root system.
2. Using a live specimen discuss the various morphological features of the shoot system and their functions. This should include the stem, leaf, flower, fruit and seed.
3. The root system should be similarly discussed as with the shoot system.

Activities

Students should be guided to make good biological drawings of a monocot plant and a dicot plant. Diagrams should also be made of some of the essential parts such as flowers, leaves, etc.

Evaluation

A short test should be conducted to cover the course under the unit. This should include short answer questions on plant parts and their specialized functions. Specimens of certain plant structures should be given to students for drawing and labelling.

Evaluation

Students should be given a short class test to cover the main items of the unit.

CHEMISTRY

AMINO ACIDS AND THEIR RELATIONSHIP TO PROTEINS

(3 hours)

Course description and aims

This unit outlines the twenty amino acids and discusses the fact that they are the basic components of proteins. The structures of these amino acids are discussed to include how they are linked to form the protein molecule.

Objectives

1. The names of the twenty amino acids should be outlined and discussed as the basis of the protein molecule.
2. Discuss the structures of the amino acids, and explain how they link up to form the protein molecule. The peptide bond should be explained in detail.

Activities

Students should be made to draw and distinguish between the structures of the various amino acids. They should check out and prepare a list of the amino acid components of certain food stuffs and feed ingredients.

Evaluation

Students should be given a short test at the end of the unit to examine the course content.

PLANT PROTECTION

CONTROL OF WEEDS IN CROP PRODUCTION

(5 hours)

Course description and aims

This unit discusses the fact that a weed is a serious pest in crop production, depriving crops of growth resources such as nutrients.

The various control measures of weeds on crop farms are stated and discussed.

Objectives

1. Discuss with the students the pest nature of weeds to include competition with crops for growth resources. Other characteristics of weeds such as harbouring other pests may be discussed briefly for emphasis.
2. Preventive measures such as the use of clean seeds should be outlined and discussed.
3. Other control measures should also be discussed. This should include cultural methods, the use of fire, chemical as well as biological methods.

Activities

The effect of various chemicals used as herbicides should be demonstrated to the students. Methods as well as applicators used for these herbicides should be exposed to the students.

Evaluation

Students should be given a short test to cover the main points of the course under this unit.

FARM MANAGEMENT

FACTORS OF AGRICULTURAL PRODUCTION

(3 hours)

Course description and aims

This unit states and discusses the factors of agricultural production. These factors are treated in detail to cover labour, capital, land and entrepreneurship.

Objectives

1. Outline the factors of agricultural production as labour, capital, land and entrepreneurship.
2. Discuss the first factor, land, to include some characteristics such as its limitation in quantity and where it is situated.
3. Discuss labour as mainly supplied by human beings and subjected to moral as well as ethical considerations.
4. Capital should be discussed as wealth used for the production of further wealth.
5. Discuss entrepreneurship and its relationship to labour - specialized form, that takes over management control.

Activities

Students should prepare a short essay to cover the role of an entrepreneur in a farm set up.

Evaluation

Students should be given a short essay question e.g. on the importance of land or labour in agricultural production.

ENGLISH LANGUAGE  
READING COMPREHENSION

(2 hours)

Objectives

By nature of the lesson students should be able to :

1. Explain the new and difficult words used in the passage and form sentences of their own with them.
2. Recognize and produce the words and structure contained in the passage.
3. Answer the questions posed at the end of the passage.

Activities

Silent reading and then reading allowed to correct pronunciation. Explain as used in the passage and form new sentences with new and difficult words. Answer questions other than those posed on the passage already.

Evaluation

Using the new and difficult words for two sentences each of your own, ensure that the meaning of the words come out. Answer the questions posed on the passage.

Remarks

Form 2

Reflexive pronouns/self words

(2 hours)

By the end of the lesson students should be able to:

1. Say what reflexive pronouns are.
2. Construct sentences using reflexive pronouns.
3. Tell when to use them and when not to use them.
4. Differentiate between - selves and each other.

### Activities

Identify the pronouns students know already eg. he/she, him/her, it. Ask student to add self to some of these eg. herself, himself, itself. Ask for some more words which end in -self eg. yourself, myself, etc. These are self words or reflexive pronouns.

Differentiate between when to use the and when not to use them (special verbs, everyday activities etc.). Also used for emphasis.

Differentiate between selves and each other, eg. Kofi and Ama are killing themselves. Ben and Ama are killing each other.

### Evaluation

Give students a test and exercise on the activity done so far to determine comprehension achieved.

### Remarks

MATHEMATICS

INDICES

(2½ hours)

Course description and aims

This topic should cover positive integrals, indices, zero index, negative indices and rational indices. The aim is to enable students to evaluate problems in index form.

Objectives

1. The basic laws of indices should be derived with the students.
2. Examples based on each of the laws should be worked out to enable the students to understand the various steps.
3. The laws are:

$$\begin{aligned} \underline{a}^{\underline{m}} \times \underline{a}^{\underline{n}} &= \underline{a}^{\underline{m+n}} ; \underline{a}^{\underline{m}} : \underline{a}^{\underline{n}} = \underline{a}^{\underline{m:n}} ; \\ (\underline{a}^{\underline{m}})^{\underline{n}} &= \underline{a}^{\underline{mn}} ; \underline{a}^{\underline{0}} = 1 ; \\ \underline{a}^{-\underline{n}} &= \frac{1}{\underline{a}^{\underline{n}}} \end{aligned}$$

Activities

Students should be given some problems to solve to see that they have understood the procedure.

Evaluation

Students should be given a short test at the end of the unit to examine the course content.

## FARM MECHANISATION

### Simple farm tools

(5 hours)

#### Course description and aims

This unit aims at introducing the students to a wide range of farm tools, in manner depicting different levels of technological advancements.

It outlines the main types used on farm and describes them in detail. The unit also deals briefly with the concept of appropriate technology in the selection of tools used on farms.

#### Objectives

1. Discuss the range of farm tools indicating differences on the basis of technological advancement.
2. Relate the progress of human development to the use of hand tools, animal tools and mechanical tools.
3. Describe hand tools used on the farm and give examples as they pertain to your area.
4. Discuss animal tools in a similar way as the hand tools and stress their advantages over simple hand tools.
5. Discuss mechanical tools to show their wide range of complexity and also the need for skills in operating and maintaining them. Describe the various energy sources used in the operation of mechanical tools.
6. Discuss the role of farm mechanisation in meeting the food requirements of the world's increasing population.

#### Activities

Students should be encouraged to identify with local farm tools. They should participate regularly in their use on the farm.

They should also pay a visit to a field which is being ploughed and examine the operation of the tractor and its implements.



Evaluation

A short practical test should be organised for the student to identify a wide range of tools, their uses on the farm and the methods of maintenance.



**Equipment guide list f**

Field

Educational  
Level

Total  
Est.  
Price  
\$

Code :

Date :

Sub-Code

Item/No.

Specifications

Quantity

Use

G  
2

V  
B

T  
B

Possible  
Supplier

Ang siilarjt:y i.n.t:h.e.abon  
..i.i.t.a.n.t:b s.p.e.c.i.f.i.c.a.a.s.or.a.o.d.e.l.s  
i.s.p.a.r.l.y.c.o.i.n.c.i.d.e.n.t.:a.l.

Legend: D - Domestic, C - Commercial, I = Industrial, GT - General Technical,  
VB • Vocational Education, TB = Technical Education

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