Open Vocational Education Programme

Course Code-453

Basic Rural Technology

2

AGRICULTURE & ANIMAL HUSBANDRY

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Basic Rural Technology

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FROM THE DESK OF CHAIRMAN ....

Dear Learner,

Welcome to the National Institute of Open Schooling!

By enroling with this institution, you have become a part of the family of the world's largest Open Schooling System. As a learner of the National Institute of Open Schooling's (NIOS) Vocational Programme, I am confident that you will enjoy studying and will benefit from this very unique School and method of training.

Before you begin reading your lessons and start your training, there are few words of advice that I would like to share with you. We, at the NIOS, are well aware that you are different from other learners. We realize that there are many of you who may have rich life experiences; you may have prior knowledge about trades and crafts that are part of your family's legacy; you may have a sharp business sense that will make you fine entrepreneur one day. Most importantly, you have the drive and motivation that has made you enrol with this institution, which believes in the spirit of freedom. Yes, we are aware that you have many positive aspects to your personality, which we respect and relate to them.

During the course of your study, NIOS will treat you as the manager of your own learning. This is why your course material has been developed keeping in mind the fact that there is no teacher to teach you. You are your own teacher. Of course, if you have a problem, we have provided for a teacher at your Accredited Vocational Institution (AVI). I would advise you that you should always be in touch with your AVI for collection of study material, examination schedules etc. You should also always attend the Personal Contact Programmes and practical / Training sessions held at your study centres. These will give you the necessary hands on training that is very essential to master a vocational course.

Studying for a vocational course is different from any other academic course. Here, while the marks obtained in the examination will indicate your grasp on your subject knowledge, your real achievement will be when you are able to apply your vocational skills in the market. I hope that this skill-based learning will help you perform your tasks better .This course of two year duration Diploma in basic Rural Technology has been developed in colloboration with Vigyan Ashram, Pune. It is a multi skilled programme, which will expose you to a variety of skills. We hope that you will find it useful. On behalf of NIOS, I wish you the very best for a bright and successful future.

Dr. S. S. Jena, Chairman,

National Institute of Open Schooling

FROM THE DESK OF DIRECTOR .....

Dear Learner,

In the fast expanding world of activities, learning new skills has become a necessity. Learning and re-learning has become essential for all. In such an environment, vocational education has assumed great importance. Vocational education, as a stream of education, promotes skill development, and training of youth and directs them towards meaningful employment.

In keeping with the needs of the Learners, NIOS conducts Vocational Education Programmes in many areas through distance mode. These programmes include Agriculture, Home Science, Engineering & Technology, Computer Science, Health & Paramedical. The Courses offered in these areas are aimed at providing self employment & wage employment opportunities for NIOS learners.

Vigyan Ashram under the leadership of late Dr.S.S.Kalbag, developed Rural Technology course for rural youth. Over the years, this course turned many youth into successful entrepreneurs. NIOS accrediated this course as Diploma in Basic Rural Technology and adopted it for further replication through AVI. This course will provide self-confidence to you and a new path to your future. You may be destined for starting a small enterprise and build your own future. This is multi-skilled programme, which will expose you to variety of skills. It includes Rural Engineering (Construction), Agriculture & Animal husbandry, Our Home Environment and Health sections. This will help in identifying learner's preference for future vocation. We are confident that this course will prove to be beneficial to you.

We wish you all the best in your future career.

Dr. K. P. Wasnik ,Director (VE),

National Institute of Open Schooling

A WORD WITH YOU.....

Dear Learner,

Welcome to the Open Vocational Education Programme: "Basic Rural Technology"

This programme is developed specially for all those who are school dropouts and have started many small enterprises, do agriculture work as skilled workforce and they contribute substantially to the progress of India.

The multi-skill content with hands-on experience of this programme stimulates the intellect by going through concrete operations and then abstracting the concepts. At the same time by giving a variety of skills usable in everyday life, open the door of modern technology to the youth, allowing them to form their preferences and know their aptitudes thus enabling them to choose a career. It also improves their self-image and gives them confidence and hope for the future. The level of training, though basic, empowers them to start their own enterprise after a short stint with another enterprise in the field. Basic Rural Technology content and the system of Hands-on training not only make the education relevant but also understandable because it uses the 'learning while doing' system and is closely linked to services to the community. Students will get training by working in real life environment. Learner will also learn basic skill like Drawing, costing and project planning in DBRT programme.

The Self – Instructional Material of this programme consists of Four Modules: 1. Our Health, 2. Agriculture & Animal Husbandry, 3. Rural Engineering (Material, Mechanics, Drawing & Costing) and 4. Our Home Environment. Learner friendly approach has been adopted throughout this material. Each lesson is written in very simple and chronological order. The in- text questions are included in the text matter to analyze the learner's understanding of the lesson. The suggested activities are provided that go beyond classroom.

We hope that this programme will help you to carve an niche in your career and play an important role in the society.

With best compliments

Dr. Pawan Kr. Chauhan
Executive Officer (HPM)
National Institute of Open Schooling

Basic Rural Technology

2

SECTION - A
AGRICULTURE

COURSE CONTENT

Notes

1

STUDY OF SOIL AND CLIMATE

1.1 INTRODUCTION

Soil is an important matter for cultivation of crops. Soil supplies all the important factors for the growth of the crop plants. The yielding potential is largely dependent on the soil in which the crops are grown. The type and properties of soil directly affect the crop growth and yield, hence management and conservation of soil should be done with interest.

Climate also is a factor that affects the crop growth and productivity. As we all know Indian agriculture is largely dependent on climatic conditions. The changing weather scenario affect the yield and quality of crop plants and one should find the ways to tackle the problem of such weather effects.

1.2 OBJECTIVES

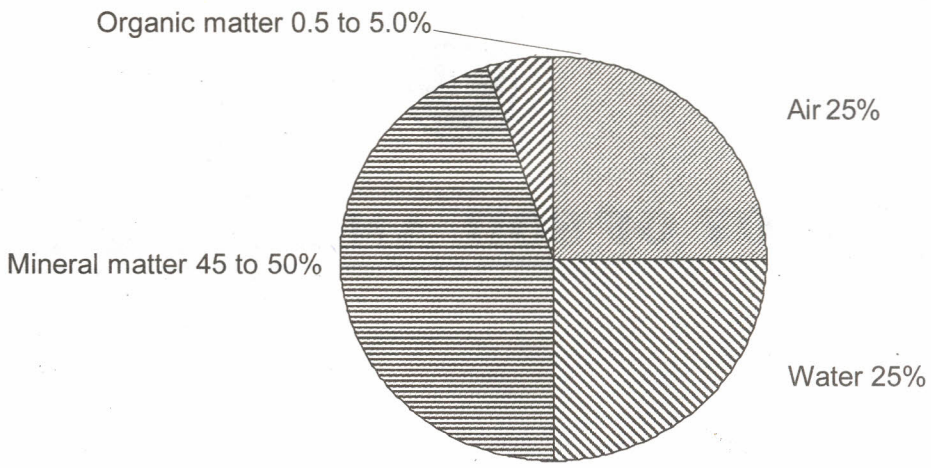
After reading this lesson you will be able to:-

- learn the importance of soil and climate in crop production.
- know the methods of soil improvement and conservation.
- understand climatic parameters and their effect on crop plants.

1.3 SOILS

We can define the soil as the topmost layer of surface of the earth in which the crops grow.

The upper layer of the earth crust on which crops are dependent for support and nutrition is called soil.



Components of soil

Functions of soil

Here we will discuss about the functions of soil:-

1) Provision of support- Soil helps the crop to stand erect by providing support to the roots.
2) Supply of water- Roots take the water from soil which is utilized in photo-synthetic activities.
3) Supply of Nutrients- All the important nutrients (13) are taken from the soil.
4) Function of soil organisms- Micro organisms in soil performs different functions like Nitrogen fixation, phosphate and sulphur solubilisation, decomposition of organic matter etc.

Characteristics of an ideal soil for crop production

We have read the functions of soil but it is essential to know the characteristics of an ideal soil. These characterstics are as follows:

1) The soil should be well aerated.
2) pH of soil should be 6 to 8.
3) Good water holding capacity.
4) Well drainage of excess water.
5) Good amount of organic matter.
6) Good amount of available nutrients.
7) Free from soil borne diseases and pests.
8) Deep, friable and well textured.

Formation of soil

Lets us see how the soils form—

Soil is formed from the rocks by the process called weathering of rocks and by different pedogenic processes. The properties of a soil are dependent on the rock from which it is formed, climatic conditions, organisms and time. The study of soil profile gives us knowledge about its formation and quality.

A simple formula for soil formation is as follows:

Well developed soil = Function of (Parent material + Topography + Climate + Living things + Time)

INTEXT QUESTIONS 1.1

a) Fill in the blanks:-

1. Soil supplies _____ nutrients to crop plants.
2. An ideal soil should have pH between _____ & _____.
3. Soil is formed form by the process called _____ of rocks.
4. The study of soil _____ gives us knowledge about formation and quality of soil.

1.4 TYPES OF SOILS

Soil types are classified according to many more factors. They are classified on the basis of colour, depth, pH, productivity, texture and process of formation.

Soil types according to depth are as follows:

1) **Shallow Soil -** Soil depth less than 22.5cm. Only shallow rooted crops are grown in such soil, e.g. Paddy, Nagli.

2) **Medium deep soil -** Soil depth is 22.5 to 45cm. Crops with medium deep roots are grown in this type of soil e.g. Sugar cane, Banana, Gram.

3) **Deep soil -** Soil depth is more than 45cm. Crops with long and deep roots are grown in this type a soil e.g. Mango, coconut

Major soil types in India

The main types of soil in India are as follows:

1) Red soils
2) Laterites and lateritic soil
3) Black soil
4) Alluvial soils

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5) Forest & hill soils

6) Peaty and marshy soils

1) **Red soils:** Red soils have two broad classes:

a) Red loam with cloddy structure and allow content of concretionary materials; and

b) Red earths with loose, Permeable top soil and a high content of secondary concretions. Generally these soils are light textured with porous and friable structure and there is absence of lime Kankar and free carbonates. They have neutral to acidic reaction and are deficient in nitrogen humus, phosphoric acid and lime.

2) **Laterites and Lateritic soils**

These soils are red to reddish yellow in colour and low in N, P, K, lime and magnesia. These soils are formed in-situ under conditions of high rainfall with alternation dry and wet periods. On account of heavy rainfall there is an excessive leaching of soil colloids and silica hence the soils are porous.

3) **Black soils**

These are mostly clay soils and form deep cracks during dry season. An accumulation of lime is generally noticed of varying depths. They are popularly known as "Black cotton soils" because of their dark brown colour and suitability for growing cotton. These are also known as Indian regurs.

These soils are deficient in nitrogen, phosphoric acid and organic matter but rich in calcium, potash and magnesium.

4) **Alluvial soils**

These soils occur along rivers and represent the soil materials that have been deposited by the rivers duing flood. Usually they are very productive soils but many are deficient in nitrogen, humus and phosphorus.

5) **Forest and hill soils**

These soils occur at high elevations as well as at low elevations, where the rainfall is sufficient to support trees. These soils are very shallow, steep, stony, and infertile for the production of field crops. However, they serve a very useful purpose by supplying forest product such as timber and fuel.

6) **Desert soils**

These are mostly sandy soils that occur in the low rainfall track. They are well supplied with soluble salts but are low in nitrogen and organic matter and have a high pH value. These are quite productive. These are often subjected to wind erosion.

7) **Saline & Alkaline soils**

These soils occur in areas having a little more rainfall than the areas of desert soils. They show white incrustation of salts of calcium & Magne-

sium and sodium on the surface. These are poor in drainage and are infertile.

8) **Peaty and Marshy soils**

These types of soils are found in Kerala, coastal track of Orissa, Sunderban area of W.B. When the vegetation growing in such wet places dies, it decomposes very slowly dues to excessive wetness of soils and after several hundreds of year a layer of partly decayed organic matter accumulates on the surface, giving rise to such peaty and marshy soils. These are black coloured, heavy and highly acidic soils. When properly drained and fertilized, these soils produce good crops of rice.

INTEXT QUESTIONS 1.2

A. Fill in the blanks:

1. Shallow soils have less than _____ depth.
2. Lateritic soils are _____ in colour.
3. Black soils are known as _____.
4. Desert soils are mostly _____ soils which occur in low rainfall track.

1.5 SOIL IMPROVEMENT

We have already learned characteristics of an ideal soil but we could not find such soil all the time. There are many types of problem soils and we have to improve those soils.

Problem soils: The soils with acidic or basic reaction, soils with poor drainage, soil with low water holding capacity, salt affected soils, and soils with pathogen are known as problem soils. Such soils have bad effect on crop growth and plants show deficiencies of different nutrients.

Steps for improvement of problem soils:

1. Bunding and leveling: The soil should be leveled properly and provided with strong bunds along with field boundary.
2. Provision of irrigation water: Sufficient salt free water should be made available.
3. Drainage: Provision of adequate drainage is essential. Proper surface and subsurface drainage is important factor in soil improvement.
4. Application of amendments: Gypsum is the standard amendment for alkaline soils. For acid soils calcium carbonate is applied as amendment.
5. Leaching: Leaching means removal of soluble salts from the root zone.
6. Cropping: Grow the crops which tolerate particular problem soil. For example salt tolerant crops like sugarcane, barley, and oats.

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7. Addition of organic manure: Addition of organic manure in sufficient amount will provide drainage in heavy soils and improves water holding capacity of poor soils.

INTEXT QUESTIONS 1.3

A) Match the followings:

A	B
1. Amendment	1. Removal of soluble salts
2. Leaching	2. Gypsum
3. Problem soil	3. Calcium carbonate
4. Acid soil	4. Water holding capacity
5. Organic manure	5. Poor drainage

1.6 CLIMATE

Different parameters of climate have direct and indirect effect on growth and yield of crop plants. Especially in India, climate plays an important role in agricultural production.

Climate – Long term average condition of climatic factors of a particular place is known as climate. E.g. Hot and dry or Hot and humid.

Weather – The condition of climatic factors of the particular place at a particular time is weather.

Parameters of climate are as follows:

1) **Temperature** – It is one of the important factors limiting the growth of crops. Each crop has its own range of temperature i.e. its minimum, maximum and optimum temperature for growth. Crops either die or cease their growth when the temperature is very high or very low. On the basis of temperature, the world is divided in six temperature zones.
   1) Tropical
   2) Temperate
   3) Micro thermal
   4) Taiga
   5) Tundra
   6) Perpetual frost

Crops are classified broadly as warm or cool weather crops.

Sr. No.	Crops	Preferable Temperature Range
1	Cotton, Sorghum, Rice, Sugarcane, Ground nut	20°C– 30°C
2	Wheat, Oat, Potato, Sugar beet, Peas	15°C– 20°C

2) **Humidity:** Humidity means amount of water vapour in the air. High humidity favours growth by reducing transpiration but increases possibility of pest and diseases and also affects quality of fruits. Humidity is expressed in terms of Relative Humidity. It is defined as the ratio of amount of water vapour present in the air at a particular place to the amount of water vapour in the saturated air. It is expressed in percentage.

3) **Rainfall:** The major source soil moisture is rainfall. The total amount and distribution of rainfall is important for crop growth, Heavy rain in short period is dangerous as it leads to water logging, cause soil erosion, affect fruit setting and pollination. Distribution of rainfall is not even in India. In some area it is scanty and in other area it may be heavy, causing problems in both the places.

4) **Light:** Light is an important factor for photosynthesis. Rate of photosynthesis is proportional to light intensity up to certain limit but beyond that excess light reduces chlorophyll content from the leaves. The duration of light in a day has significant effect on flowering of certain plant which is called as photoperiod. Accordingly plants are called short day, long day or day neutral plants.

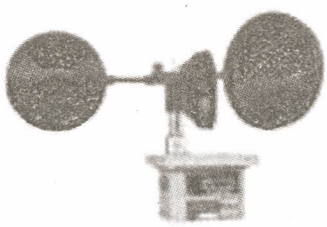
5) **Wind:** Moderate wind velocity is useful for pollination, but high wind velocity cause damage to crops. Also high wind velocity cause soil erosion and evapo transpiration losses.

6) **Frost:** Highly condensed or frozen form of water vapour is called as frost. Many tropical and subtropical plants are susceptible to frost.

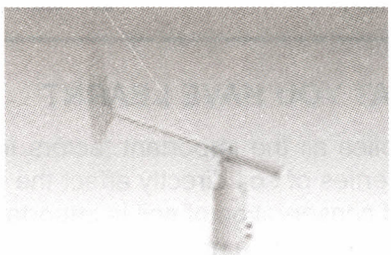
Instruments used to measure whether parameters:

Sr. No.	Parameter	Instrument
1	Rainfall	Rain gauge
2	Temperature	Thermometer
3	Sunshine	Sunshine recorder
4	Wind velocity	Anemometer
5	Wind direction	Wind wane
6	Humidity	Hygrometer

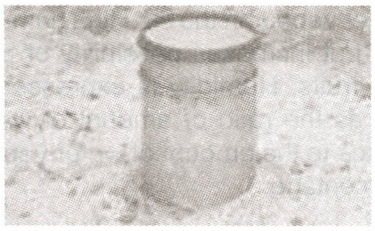
Meteorological Instruments



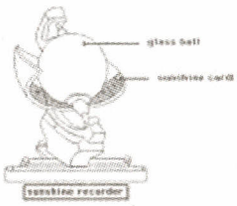
Cup Anemometer



Wind Wane



Rain Gauge



Sunshine Recorder

Stevenson's screen

INTEXT QUESTIONS 1.4

A) Match the following:

A	B
1. Rainfall	1. Hygrometer
2. Temperature	2. Anemometer
3. Sunshine	3. Thermometer
4. Wind velocity	4. Rain gauge
5. Humidity	5. Sun shine recorder

1.7 WHAT YOU HAVE LEARNT

Soil supplies all the important factors for the growth of crop plants. The type and properties of soil directly affect the crop growth and yield, hence management and conservation of soil is important. Ideal soil for crop production should be well aerated, have good water holding capacity, and optimum pH. The problem soils can be improved by proper bunding and leveling of soil, providing irrigation water, application of amendments and suitable cropping pattern. Indian agriculture is largely dependent on climatic conditions. The parameters

of climate viz. temperature, humidity, rainfall, light, Wind and frost have direct and indirect effect on growth and yield of crop plants.

1.8 TERMINAL QUESTIONS

1. Write the functions of soil.
2. Write the characteristics of an ideal soil for crop production.
3. Enlist the major soil types in India and explain any two.
4. Explain the different parameters of climate.
5. What do you mean by the problem soils? How they can be improved?

1.9 ANSWER TO INTEXT QUESTIONS

1.1

1. 13
2. 6 to 8
3. Weathering
4. Profile

1.2

1. 22.5 cm.
2. Red
3. Indian regurs
4. Sandy

1.3

1. Gypsum
2. Removal of soluble salts
3. Poor drainage
4. Calcium carbonate
5. Water holding capacity

1.4

1. Rain gauge
2. Thermometer
3. Sun shine recorder
4. Anemometer
5. Hygrometer

SUGGESTED ACTIVITIES

A) Visit a meteorological laboratory and observe their activities.

B) Collect the samples of different soil types and study their physical characters.

2

PLANT NUTRIENTS, MANURES AND FERTILIZERS

2.1 INTRODUCTION

Crop plants need sixteen essential elements for their normal growth and development. Most of these nutrients are supplied by organic manures and fertilizers. The organic manures and fertilizers perform different functions. The organic manures add organic matter to the soil and improve physical properties of the soil and also supply essential plant nutrients in small quantities. Whereas, fertilizers supply nutrients to the crop in large quantities and are helpful for maintaining fertility and productivity of the soil. Judicious combination of organic manures and fertilizers give the best results.

Vermicompost is prepared with the help of earthworms. Earthworms remain in moist soil and eat organic matter and convert such coarse material into a good soil.

Green manuring is the practice of enriching soil by turning under soil, undecomposed plant material mostly of legume plants.

2.2 OBJECTIVES

After reading this lesson, you will be able to understand:

- Nutrients required by plant for normal growth.
- Functions of nutrients.
- Classification of manures and fertilizers.
- Organic manures like farm yard manure, Compost, Green manuring, Biofertilizers and Vermicompost.
- Principles and Advantages of Organic farming.

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2.3 NUTRIENTS REQUIRED BY PLANTS FOR GROWTH

Crops obtain most of their carbon and oxygen from the air. Hydrogen is obtained from soil water. Carbon dioxide is especially important for plant growth. It is taken up by the plant from air through pores in the green leaves and combines with hydrogen from soil water, to form carbohydrate and other plant substances by energy from sunlight. This process is knows as photosynthesis.

Out of the 13 nutrients taken from the soil, Nitrogen, Phosphorus and Potassium are used in large quantities and hence known as primary nutrients. Calcium, Magnesium and Sulphur are needed in moderate to small quantities but they play an important role in formation of plant tissues. These are known as secondary nutrients. The remaining are needed in very small quantities and are known as micro-nutrients.

Plants need 16 elements to grow. They get these from air, water and soil.

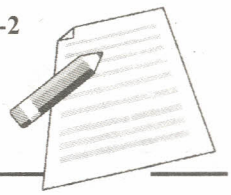
Source	Nutrients		
Air & Water	1. Carbon	Skeleton Elements	
	2. Hydrogen		
	3. Oxygen		
Soil	4. Nitrogen	Major nutrients	Macro-nutrients
	5. Phosphorus		
	6. Potassium		
	7. Calcium	Secondary nutrients	
	8. Magnesium		
	9. Sulphur		
	10. Iron	Micro-nutrients	
	11. Manganese		
	12. Boron		
	13. Zinc		
	14. Copper		
	15. Molybdenum		
	16. Chlorine		

INTEXT QUESTIONS 2.1

Fill in the blanks:

i) Plants need _____ elements to grow.

ii) Nitrogen, Phosphorus, Potassium are known as _____ nutrients.

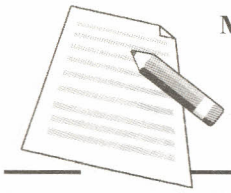


iii) Calcium, Magnesium and Sulphur are known as _____ secondary nutrients.

iv) Crops obtain carbon and oxygen from _____.

2.4 FUNCTIONS OF PLANT NUTRIENTS

Nutrient	Function
1. Nitrogen	i) It makes plant dark green & succulent. ii) It promotes vegetative growth.
2. Phosphorus	i) It stimulates root development, increases the number of tillers, gives strength to straw and prevents lodging. ii) It hastens ripening of plants and counteracts the effects of excessive nitrogen. iii) It improves the quality and yield of grain. iv) It increases disease resistance, enhances the activity of rhizobia and increases the formation of root nodules in legumes.
3. Potassium	i) Vigour and disease resistance to plants. ii) It increases efficiency of the leaf in manufacturing sugars and starch. iii) It helps to produce stiff straw in cereals and reduces lodging.
4. Calcium	i) Increases stiffness of straw and promotes early root development and growth. ii) It encourages seed production.
5. Magnesium	i) It is essential for all green plants. ii) Helps in uptake of phosphorus and regulates uptake of other nutrients.
6. Sulphur	i) It stimulates root growth, seed formation and nodule formation.
7. Iron	i) Essential for formation of chlorophyll and synthesis of proteins and several metabolic reactions.
8. Manganese	i) It helps in chlorophyll formation.
9. Zinc	i) It helps in formation of growth hormones and chlorophyll.
10. Copper	i) It regulates respiratory activities in plants.
11. Boron	i) It helps in uptake of calcium and its efficient use by plants. ii) It helps in absorption of nitrogen and is necessary in cell division.
12. Molybdenum	i) It is essential for nitrogen fixing organisms both symbiotic and non-symbiotic.
13. Chlorine	i) It is considered essential for photosynthetic process.



INTEXT QUESTIONS 2.2

Match the followings:

A		B	
i)	Nitrogen	a)	Essential for nitrogen fixing organisms
ii)	Potassium	b)	Respiratory activity plants.
iii)	Iron	c)	Dark green plants and succulent.
iv)	Copper	d)	Vigour and disease resistance
v)	Molybdenum	e)	essential for formation of chlorophyll.

2.5 CLASSIFICATION OF MANURES AND FERTILIZERS

Variety of manures and fertilizers available in the market are classified into two broad groups:

a) Natural or organic manures

b) Artificial or chemical fertilizers. Classification of manures and fertilizers is given in tabular chart.

2.5.1 Natural Organic Manures

1) Farm Yard Manure: It is a mixture of cattle dung, urine, litter or bedding material, portion of fodder not consumed by cattle and domestic wastes like ashes etc. collected and dumped into a pit or a heap in the corner of the backyard. It is allowed to remain there and rot till it is taken out and applied to fields. Well rotten Farm Yard Manure contains O.5.% N., 0.2 % P_2O_5 and 0.5 % K_2 O.

2) Compost: Well rotted plant and animal residue is called compost. Composting means rotting of plant and animal remains before applying in fields. The essential requirements of composting are air, moisture, optimum temperature and a small quantity of nitrogen. It is an activity of micro-organisms and same people recommend addition of suitably prepared inoculums to introduce micro-organisms for decomposing the material.

3) Green Manuring: Green manure crops are grown in the field itself either as a pure crop, or as an intercrop with the main crop, and buried in the same field. The most common green manure crops are sannhemp, dhaincha and guar. Tender green-twigs and leaves are collected from wastelands which are spread in the field and incorporated into the soil. Shrubs and trees are also cut and turned into the soil e.g. Shrubs like glyricidia, sesbania, karanj.

Biofertilizers : The biofertilizers containing biological nitrogen fixing organisms are of utmost importance in agriculture

Classification of manures and fertilizers

Organic Manures

Bulky Organic Manures

1. FYM Yard manure
2. Compost
3. Sewage
4. Sheep folding
5. Green manure
6. Vermi compost
7. Bio fertilizers

Concentrated Organic Manures

1. Edible oil cakes (GNC, til cake etc.)
2. Non edible oil cakes (Karanj, Castor etc.)
3. Blood meal
4. Fish meal
5. Bone meal

Artificial or Chemical Fertilizers

Nitrogenous Fertilizers
Urea
Ammonium Sulphate

Phosphatic Fertilizers
Super phosphate
Basic Slag

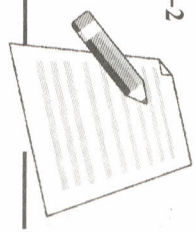
Potassic Fertilizers
Muriate of Potash
Sulphate of Potash

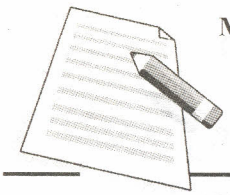
Complex Fertilizers
Di Ammonium phosphate
Nitro Phosphate

Mixture Fertilizers
Granulated Fertilizers
Mixtures of Different Grades

Soil Amendments
Gypsm
Lime

Micronutrients
Ferrous Sulphate
Manganese Sulphate
Borax
Copper Sulphate





Advantages Of Biofertilizer

i) They help in the establishment and growth of crop plants and trees.

ii) They enhance biomass production and grain yields by 10-20 percent.

iii) They are useful in sustainable agriculture.

iv) They are suitable in organic farming.

v) They play an important role in Agrotorestry/ Silvi- pastaural system.

Types of Biofertilizers :

Rhizobium : Most widely used biofertilizer is Rhizobium which colonizes the roots of specific legumes to form tumor like growths called root nodules. These nodules act as factories of ammonia production. The Rhizobium – legume association can fix up to 100-300 KG/N. in one crop season.

Azotobacter : Application of azotobacter has been found to increase yield of wheat, rice, maize, pearl-millet and sorghum by 0-30 p.c. over control. Apart from nitrogen this organism is also capable of producing antifungal and antibacterial compounds, hormones.

Azospirillum : Certain micro-organisms like bacteria and blue green algae have the ability to use atmospheric nitrogen and transport this nutrient to the crop plants. Azospirillum is inoculated to maize, barley, oats, sorghum, pearlmillet and forage crops. It increases grain productivity of cereals by 5-20%, of millets by 30% and fodder by over 50%.

Blue-green algae : - The utilization of blue green algae as a biofertilizer for rice is very promising. A judicious use of these algae could provide to the country's entire rice acreage as much nitrogen as obtained from 15-17 lakh tones of urea. Algae also helps to reduce soil alkalinity.

Azolla : A small floating water form Azolla is commonly seen in low land fields and in shallow fresh water bodies. These fern harbors a blue-green algae. Anabaena azollae. The Azolla – Anabaena association is a live floating nitrogen factory using energy from photosynthesis to fix atmospheric nitrogen accounting to 100-150 kg N/ ha / year from about 40 – 60 tones of biomass.

Mycorrhizae: It is the symbiotic association of fungi with roots of vascular plants. It is useful in increasing phosphorus uptake e.g. in fruit crops like citrus, papaya.

Vermi-compost

It is the method of making compost with the use of earthworms, which generally live in soil, eat bio-mass and excrete it in digested form. This compost is generally called vermi-compost or wormi-compost. It is estimated that 1800 worms which is an ideal population for one sq. meter can feed up to 80 tones of humus per day.

Procedure for preparing ideal vermi-compost :-

Each shed measuring 20 ft. x 80 ft. is to be constructed with the help of locally available material like bamboos, stems of trees etc. A hut type structure is build with the help of these articles. The roof is made from dried grass, leaves, bamboo sticks etc. in such way that the hut may be protected from rainwater and heat. Each hut may accommodate at least four vermi beds of 3ft. width.

These beds are prepared by putting 2 to 3 cm thick layer of farm manure as first layer followed by 10 to 15 cm of biomass with 200 – 250 worms per sq. ft. collected locally may be added and bed should be kept sufficiently moist. This layer should be followed by a layer of 10-15cm of half digested cow-dung layer which should be covered by a layer of leaves trash etc. and water is sprinkled on the entire bed. The bed may be covered with palm leaves or coconut leaves or with any indigenous material. The pit should be kept constantly moist but never flooded.

A month later, the covered leaves should be removed and layers of organic waste not exceeding 6-7 cm should be added every alternate day. Watering should continue with each filling. When the pit is nearly full to a height of one meter, the material should be turned to provide aeration. After a month the heap will be ready for harvest with good quality vermi compost. The dug out vermi-compost should be heaped in an open place. The worms will find way to the bottom of the heap. The vermi-compost from the top can be removed, dried and sieved for application in the field.

The compost can also be enriched with micro-nutrients, bacteria etc. by adding them externally. 16 tones of compost can be obtained from 4 beds in 30 days after 4 months period of gestation.

INTEXT QUESTIONS 2.3

Fill in the blanks:

i) _____ is a mixture of cattle dung urine and waste material from farm.

ii) Well rotted plant and animal residue is called _____.

iii) Sunnhemp is a _____ manure crop.

iv) _____ is the most widely used biofertilizer.

v) _____ is method of making compost with the use of earthworms.

2.6 ORGANIC FARMING

Organic farming is a production system which favours maximum use of organic material (crop residues, animal excreta, legumes, on and off farm organic wastes, growth regulators, bio-pesticides etc.) and discourages use of synthetically produced agro-inputs, for maintaining soil productivity and fertility and pest management under conditions of sustainable natural resources and healthy environment.

The more widely used term 'organic farming' describes two major aspects of alternate agriculture:

i) The substitution of manures and other organic matter for inorganic fertilizers; and

ii) The use of biological pest control instead of chemical pest control.

Principles of Organic Farming :

1) Organize the production of crops and livestock and the management of farm resources so that they harmonize rather than conflict with natural systems.
2) Use and development of appropriate technologies based upon an understanding of biological systems.
3) Achieve and maintain soil fertility for optimum production.
4) Use diversification to pursue optimum production.
5) Aim for optimum nutritional value of staple food.
6) Maintain and preserve wild life and their habitats.

Merits of Organic Farming :

1) It conserves the ecological base of farming.
2) No pollution of atmosphere, soil and water.
3) It maintains soil productivity and tilth.
4) Improves soil aeration, structure and water holding capacity.
5) It is low cost farming.
6) Improves physio-chemical and biological properties of soil.
7) Improves quality of food grain & fodder.

INTEXT QUESTIONS 2.4

Match the followings:

A		B	
i)	Soil fertility	a)	Predators
ii)	Soil productivity	b)	Auxins
iii)	Biological pest control	c)	yield of crop
iv)	Growth regulators	d)	ability to supply essential nutrient.

2.7 WHAT YOU HAVE LEARNT

Plant needs 16 elements to grow. They get these from air, water and soil. N.P.K. are primary nutrients required in large quantities for crop growth. Manures and fertilizers are classified into two broad group i.e. a) Natural or organic manures and b) Artificial or Chemical fertilizers. Biofertilizers containing biological nitrogen fixing organisms which are of utmost importance in agriculture. Vermicompost is method of making compost with the use of earthworms which generally live in soil, eat biomass and excrete it in digested form. Organic farming emphasize, using only organic manures for maintaining fertility and productivity of soil and banning nearly all chemical pest control methods.