R. B. Ghorpade
SCH, Parner

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END THEORY EXAMINATION
MODEL ANSWER PAPER
B. Sc. (Hons.) Horticulture

Semester	:	II (New)	**Academic Year**	:	2018-19
Course No	:	H/SSAC- 122	**Title**	:	Soil Fertility and Nutrient Management
Credits	:	2 (1 + 1)			
Day & date	:		**Time**	:	**Total marks : 40**

Note: 1. Solve **ANY EIGHT** questions from **SECTION "A"**.
2. All questions from **SECTION "B"** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagrams wherever necessary.

SECTION 'A'

Q. 1 Describe in detail mechanisms of nutrient transport from soil to plant. (4 Marks)

Ans: There are generally three ways in which nutrients ions in soil may reach the root surface.

1) Mass flow 2) Diffusion 3) Root interception.

1) **Mass flow:-** Mass flow occurs when plant nutrient ions and other dissolved substances are transported in the flow of water to the root that results from transpirational water uptake by the plants. Some mass flow can also take place in response to evaporation and percolation of soil water.

2) **Diffusion:-** Diffusion occurs when an ion moves from an area of high concentration to one of low concentration. Most of P and K move to the root by diffusion. As plant roots absorb nutrients from the surrounding soil solution, the nutrient concentration at the root surface decreases compared to the bulk soil solution concentration. Therefore, a nutrient concentration gradient is established that causes ions to diffuse toward the plant root.

Many soil factors influence nutrient diffusion in soil, **Fick's Law** describes this relationship.

$$dC/dt = De \cdot A \cdot dC/dx$$

where dC/dt = rate of diffusion (change in conc. C with time t)

De = effective diffusion coefficient

A = cross-sectional area through which the ions diffuse

dC/dx = concentration gradient

Fick's law states that the rate of diffusion is proportional to the concentrations gradient.

3) Root interception: - As the root system develops and exploits more soil, soil solution and soil surfaces retaining adsorbed ions are exposed to the root mass and absorption of these ions occurs by a contact exchange mechanism. Ions attached to the surface of root hairs may exchange with ions held on the surface of clays and organic matter in soils because of the intimate contact that exists between roots and soil particles. The ions held by electrostatic forces at these sites tend to oscillate within a certain volume. When the oscillation volumes of two ions overlap, the ions exchange places.

Q. 2 Define soil fertility evaluation. Enlist different method of soil fertility evaluation

Ans: Soil Fertility Evaluation: The assessment of nutrient supplying capacity of a soil is called soil fertility evaluation. **(1 Marks)**

The various methods to evaluate soil fertility are classified as follows

Methods : I) Chemical II) Biological III) Visual symptoms (1 Marks for each)

I) Chemical methods
A) Soil analysis
1) Total nutrient analysis
2) Avail. nutrient analysis
3) Rapid soil testing
B) Plant analysis
1) Total elemental analysis.
a) Crop log technique
b) 'A' Value technique
2) Tissue testing

II) Biological methods :
A) Using higher plants
1) Neubauer seedling
2) Pot culture experiments
3) Field experiments
4) Mitscherlich pot culture method
5) Jenny pot culture test
6) Sunflower pot culture technique for boron
B) Using micro-organisms
1) Azotobacter
2) Aspergillus niger
3) Cunninghamella plaque method

III)Visual symptom method :
1. Yellowing
2. Purling
3. Local necrosis
4. Stunting

Q. 3 Write importance of pH in plant nutrition (0.5 Marks each)

Ans:
1. The soil pH or soil reaction is the chemical properties/characteristics of the soil showing the degree of acidity, alkalinity or neutral condition of soil. The pH is having many roles in crop production and particularly in plant nutrition.
2. It significantly influences other chemical as well as biological properties and also affect the availability of most of the chemical elements of importance to plants and

microbes.

3. The soil pH greatly affects the solubility of minerals.
4. The soil pH determines the amount and type of nutrient element availability in soils.
5. Eg : In strongly acidic soils (pH 4-5) usually have high and toxic concentration of soluble Al and Mn.
6. The soil pH also influences plant growth by the effect of pH on activity of beneficial microorganisms.
7. Soil pH affects the mobility of many pollutants in soil by influencing the rate of their biochemical breakdown, their solubility and adsorption to colloids.
8. Better nutrient availability found at neutral pH (6.5-7.5) like N, P, K, S, Ca, Mg but in low pH acid soil toxicity of Fe, Al, Mn etc., and deficiency of P, Mo etc. while in saline and alkaline soils Fe, Mn, Zn and Cu may be deficient. Mo availability is more.
9. It helps in recommendation of soil amendments and fertilizer applications.
10. It is a good guide for predicting which plant nutrients are likely to be deficient.
11. It determines the microbial activity and the rate of decomposition.
12. Availability and mobility of both macro and micro nutrients in soil is greatly affected by soil pH.

Q.4 Write short notes on (ANY TWO)

Ans: i) Fertilizer Control Order [FCO]: (2 Marks)

The government of India passed the FERTILIZER CONTROL ORDER [FCO] on 28th of April, 1957 in exercise of the power conferred by the section III of the essential commodities act of 1955. This order is intended to regulate the manufacture, distribution and supply of the fertilizers in India at a control cost. This has been effective from May 18th 1957. It is revised in 1985 with effect from 25-9-1985. The Government of India has delegated to powers to state Governments to implement the order.

The Government of India (GOI) also passed the Fertilizer Movement Order (FMO) on 31st December, 1960 in order to regulate the interstate movement of fertilizers and the export of fertilizers which came into force with effect from 1-1-1961.

ii) Visual diagnosis deficiency symptoms (0.5 Marks each)

1. **Chlorosis** (Yellowing) : Centralized yellowing of old leaves or all leaves may

indicate deficiency of N or S, though it may also indicate old age, water logging or lack of light. Chlorosis of part of the nature leaves is some time sign of P or Mg deficiency. Interveinal chlorosis is a symptom of a deficiency of Fe, Mn or some times Zn or Ca.

2. **Purling** (accumulation of anthocyanin pigments) : An overall dark colour with a purple, blue of red tints is the common sign of P deficiency. It can also occure in Al toxicity and draught.
3. **Local necrosis** (death of tissue) : Necrosis of patches of spots or margins on leaves is a sign of K deficiency, salt damage of some times Mn deficiency. It can also result from drought of frost.
4. **Stunting** : Overall stunting (reduced growth) is a sign of all nutrients disorders. It is hardest to detect unless normal plants are nearby for comparison. Acute stunting of growing points produce distinct growth patterns character of certain deficiency. Zn deficiency produces 'little leaf' and resetting. B deficiency commonly kills the growing point.

iii) Micronutrient Fertilizers (2 Marks)

Micronutrients are those which required by plants in very minute quantities by plants but they have equal role as that of primary nutrients. They govern most of the physiological as well as biochemical reactions of plant growth and development. The most important micronutrients are iron, manganese, zinc, copper, molybdenum, chlorine, boron and nickel. The fertilizers carrying micronutrients are;

A. Fe carrying fertilizers

1. Ferrous sulphate (19.0% Fe)
2. Ferric sulphate (23.0% Fe)
3. Ferrous ammonium sulphate (29.0%Fe)
4. Ferric & ferrous oxide (70 & 77.0% Fe)

B. Zinc carrying fertilizers

1. Zinc sulphate (55.0% Zn)
2. Zinc oxide (67.0% Zn)
3. Zinc sulphide (67.0% Zn)
4. Zinc ammonium sulphate (33.5% Zn)

D. Boron carrying fertilizers

1. Borax (11.0% B)
2. Boric acid (17.0% B)
3. Sodium tetra borate (14.0% B)
4. Borosite (21.0% B)

E. Manganese carrying fertilizers

1. Manganese sulphate (20 to 28% Mn)
2. Manganese carbonate (31.0% Mn)
3. Manganese chloride (17.0% Mn)

F. Molybdenum carrying fertilizers

7 nutrient – Nutrient that are requried by plant 4
11 quantity than primary nutrients

C. Copper carrying fertilizers: 1. Sodium molybdate (39.0% Mo)

Copper sulphate 2. Ammonium molybdate (54.0% Mo)

Q. 5 Give difference between manure and fertilizer. (0.5 Marks each)

Ans :

Manure	Fertilizer
1.Organic in nature	1.Inorganic in nature
2. Slow acting	2.Quick acting
3. Having low analytical value	3. Having high analytical value
4.Having no definite chemical composition	4.Having definite chemical composition
5. Obtained from plant and animal	5. Mined or manufactured
6. Improves physical properties of soils	6. Don't improve the physical properties of soils
7. Supply almost all major, minor and micronutrients	7. Supply one or very few plant nutrients.
8. Bulky in nature	8. Non-bulky in nature
9. Definition and examples	9. Definition and examples

Q. 6 Explain IPNS and give its advantages.

Ans: Integrated Plant Nutrient System: (1 Marks)

The basic concept of iPNS is the maintenance of soil fertility and supply of plant nutrients to an optimum level for sustaining desire crop productivity through optimization of benefits from all possible sources of plant nutrients in an integrated manner. It includes the intelligent use of inorganic, organic and biological resources so as to sustain optimum yield, improve or maintain the soil chemical and physical properties and provide crop nutrition packages which are technically sound, practically feasible and environmentally safe.

IPNS has following advantages – (3 Marks)

1. Increases soil organic matter through its application.
2. Efficiently cycle the nutrients and solibilizers unavailable nutrients, fixes atmospheric nitrogen.
3. Reduces leaching losses of nutrients
4. Increase number of favourable / beneficial microorganisms
5. Improves physico – chemical and biological condition of soil

6. Reduces erosion hazards

Q. 7 State different methods of reclamation of saline soil.

Ans: A. Mechanical Methods: (1 Marks)

1. Removal of excess salt to a desired level in the rooting zone is the basic principle of reclamation of saline soils.
2. Leaching with water of good quality and drainage are the two essential components.
3. Intermittent ponding is more efficient than continuous ponding in leaching salts water table must be sufficiently low.

B. Cultural Methods (3 Marks)

1. Providing proper drainage
2. Use of salt free irrigation water
3. Proper use of irrigation water
4. Planting or sowing of seeds in the furrow
5. Use of acidic fertilizer
6. Use of organic manures
7. Ploughing and leveling of the land
8. Growing of the salt tolerant crops

Q. 8 Define biofertilizer. Write importance of biofertilizers in agriculture.

Ans: Biofertilizer (1 Marks)

The preparation containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing or cellulytic microorganisms used for the application to seed, soil or composting areas with an objective of increasing numbers of such a micro-organisms and to accelerate certain microbial processes to augment the extent of availability of nutrients in a form which can be easily assimilated by plants.

Importance of Biofertilizer in agriculture. (3 Marks)

1. Supplement fertilizer supplies for meeting the nutrient needs of crops.
2. Add 20 to 200 kg N/ha (by fixation) under optimum conditions and solubilize / mobilise 30-50 kg P_2O_5/ha.
3. They liberate growth promoting substances & vitamins and help to maintain soil fertility.
4. They suppress the incidence of pathogens and control diseases.

5. Increase the crop yield by 10-50%. N_2 fixers reduce depletion of soil nutrients and provide sustainability to the farming system.

6. Cheaper, pollution free and based on renewable energy sources.

7. They improve soil physical properties, tilth and soil health.

Q. 9 Define fertilizers and classify NPK fertilizers with one example each.

Ans: Fertilizer: (1 Marks)

Fertilizer is any material of natural or synthetic origin added to the soil to supply one or more plant nutrients.

A. Nitrogenous fertilizers (1 Marks)

1. Nitrate fertilizer: *Ex.* Sodium nitrate, Calcium nitrate.
2. Ammonical fertilizer: *Ex.* Ammonium sulphate, Ammonium chloride, Anhydrous ammonium
3. Nitrate & ammonium fertilizer: *Ex.* CAN, Ammonium nitrate, ASN
4. Amide fertilizer : *Ex.* Calcium Cyanamide, Urea

B. Phosphatic fertilizers (1 Marks)

1. Water soluble fertilizers: *Ex.* SSP, DSP, TSP,
2. Citric acid soluble fertilizer: *Ex.* Dicalcium phosphate, Rhenania phosphate, Slag
3. Citric acid insoluble fertilizers: *Ex.* Rock phosphate, Raw bone meal

C. Potassic fertilizers (1 Marks)

1. K in the Chloride form : *Ex.* Muriate of Potash
2. K in Non-chloride form : *Ex.* Potassium nitrate, Sulphate of potash

Q. 10 What are different fertilizer recommended approaches? Describe STCR concept.

Ans: Following are the fertilizer recommended approaches **(2 Marks)**

1. Soil analysis and correlation
2. Critical soil test level approach
3. Agronomic approach
4. Soil fertility cum soil survey
5. Targeted yield concept approach

STCR concept (2 Marks)

STCR concept is aiming at obtaining a basis for precise quantitative adjustment of fertilizer doses under varying soil test values and response conditions of the farmers and for targeted levels of crop production. These are tested in follow up verification by field

trials to back up soil testing laboratories for their advisory purpose under specific soil, crop, and agro climatic conditions. The fertilizers are recommended based on the following criteria's.

- Fertilizer recommendations based on regression analysis approach
- Recommendations for certain % of maximum yield

SECTION 'B'

Q.11 Fill in the blanks:

1. The fertilizers containing two or more major plant nutrients, which are in chemical combination are called as **complex fertilizers.**
2. The organism, **Cunninghamella** is sensitive to the phosphorus status of the growing medium.
3. Long forms of DRIS is **Diagnosis and Recommendation Integrated System.**
4. **Nutrient Use Efficiency (NUE)** is defined as the extent to which the nutrients and management practices interact to give a specific yield level.

Q. 12 Match the pair:

"A"	"B"
1. Toxic Element	c. Arsenic
2. Beneficial Nutrient	d. Silicon
3. E. Gris	a. Iron
4. Cracking of fruit	b. Boron

Course Instructor
Name: - Dr. V.N. Palsande

Mob. 9822158075

Email: vjpalsande01@gmail.com

Associate Dean,
College of Horticulture, Mulde
Name: - Dr. P.C. Haldavnekar
Phone No.: (02362) 244272
Mob.: 9423048591
Email: cohmulde@gmail.com