MODEL ANSWERS
MAHARASHTRA AGRICULTURAL UNIVERSITIES
EXAMINATION BOARD, PUNE
SEMESTER END THEORY EXAMINATION
B.Sc. (Hort.)

Semester	: II (New)	Academic year: 2017-18	
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 Question 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 (a) Define soil fertility and soil productivity. Give the factors affecting soil fertility.

Soil fertility : The quality of soil that enables it to provide essential chemical elements in quantities and proportions for the growth of specified plants. **2 mark**

Soil productivity: The capacity of soil for producing a specified plant or sequence of plant under a specified system of management and it is expressed in terms of crop yields.

Factors affecting soil fertility : **2 mark**

1) Total nutrient content of soil
2) Available nutrients
3) Soil reaction
4) Soil moisture
5) Soil texture and structure
6) Microbial activity
7) Organic matter content,

Q.2 What is organic matter decomposition? Give the factors affecting decomposition

Decomposition **1 mark**

It is the decaying or rottening of organic materials by various groups of microorganisms and enzymes and converted in to simple inorganic elements or compounds. It helps to improve softness of the materials for further mineralization process. It is basically a burning or oxidation process.

Factors affecting decomposition **3 marks**

The most important conditions that affect the rate of decomposition are

1. **Temperature:** Cold periods retard the organic matter decomposition and there will be more accumulation of organic matter on the top soil compared to that of warm climates. The most suitable temperature is 30-40◦ C for proper decomposition.
2. **Soil moisture:** Near or slightly wetter than field capacity moisture conditions are most favorable for decomposition. About 60-75 % water holding capacity

(WHC) is optimum.
3. **Soil pH**: 6-8 pH or neutral pH is required for optimum growth of microorganisms. Bacteria at 6 - 7 pH, Actinomycetes is more at pH 8 -10. Algae pH of 5.5 - 7.5, Fungi- pH 4.0, Protozoa – pH 3.0
4. **Nutrients:** Lack of nutrients, particularly N reduces microbial growth and it slows decomposition. Addition of nutrients by N fertilizers (urea) increases the speed of decomposition
5. **Soil texture**: Soils higher in clays tend to retain larger amounts of humus, other condition being equal.
6. **Aeration**: Good aeration increases the rate of decomposition and supply oxygen.
7. **Nature of plant matter**: composition and age of plants and vegetations affect much their decomposition. It is fast in young, tender, and juicy material, But slow with more cellulose and hemicelluloses content.

Q.3 Define fertilizers. Give the advantages and disadvantages of mixed fertilizers.

Fertilizer **1 mark**

Fertilizers are defined as materials having definite chemical composition with a high analytical value that supply essential plant nutrients in available form. They are usually manufactured by industries and sold with a trade name. They are commonly synthetic in nature and also called as chemical fertilizers/inorganic fertilizers/commercial fertilizers other than lime and gypsum.

Advantages of fertilizer mixtures **3 marks**

1. Less labour is required to apply fertilizer mixture to soil. Individual crop wise fertilizer mixturecan be made.
2. Balanced nutrition can be achieved.
3. The residual acidity of fertilizers can be effectively controlled by adding liming materials in the mixtures.
4. Micronutrients can be incorporated in fertilizer mixtures.
5. They have a better physical condition and more easily applied.
6. There is no need of purchasing straight fertilizers separately.

Disadvantages of fertilizer mixtures

1. Does not permit application of individual nutrients according to the needs of crops during specific times.
2. The unit cost of plant nutrients is higher than of straight fertilizer.
3. Lack of knowledge about proper mixing and their use.
4. Fertilizer mixture of particular grade suitable for particular crop cannot be applied for all crops.

Q.4 What is integrated nutrient management? Give its importance in agriculture.

Definition:

1mark

Integrated nutrient management in reality is a system approach and gives equal emphasis to use of chemical fertilizers, biological sources and systems of nutrients and soil.

In this approach, all the possible sources of nutrients are applied based on economic consideration and the balance required for the crop is supplemented with chemical fertilizers.

Importance of INM

3 mark

There is a big gap between demand (requirement) of nutrients (NPK) for derived food production and supply of nutrients through chemical fertilizers.

This deficit will have to be met through supplementary and complementary use of organic and biological sources of nutrients in INM system.

The use of organic manures, crop residues, microbial fertilizers and green manuring has all the more become essential because of limited availability of chemical fertilizers and their high prices.

Q.5 Give the classification of nitrogenous fertilizers with two examples.

Nitrogenous fertilizers: There are 6 groups.

a. Ammonium fertilizers

i. Ammonium sulphate (NH4)2 SO4 – 20% N
ii. Ammonium chloride : NH4Cl2 -24-26%
iii. Ammonium phosphate : NH4H2 PO4 -20%N + 20% P2O5 or 16% N and 20% P2O5
iv. Anhydrous ammonium (82%N)
v. Ammonium solution- 20-25%N
vi. Ammonium carbonate- 21-24%N
vii. Ammonium bicarbonate- 17%N

b. Nitrate fertilizers

i. Sodium nitrate or Chilean nitrate : NaNO3 – 16%N
ii. Calcium nitrate: CaNO3 – 15.5% N
iii. Nitrophosphate

c. Both Ammonium and nitrate fertilizers

i. Ammonium nitrate: NH4NO3- 33-34%N
ii. Calcium ammonium nitrate (CAN) – 25, 26 and 28% N
iii. Ammonium sulphate nitrate (ASN) – 26%N

d. Amide fertilizers

i. Urea – 46% N
ii. Calcium cyanamide- 21 %N
iii. Urea phosphate
iv. Urea sulphate

e. Nitrogen solutions

i. Anhydrous ammonia
ii. Aqueous ammonia
iii. Solution containing one or more of the following urea, ammonium nitrate, ammonia

f. Slowly available nitrogenous fertilizers

i. Urea formaldehyde compounds
ii. Neem Cake coated Urea NCU
iii. Lac Coated Urea(LCU)
iv. Sulphur Coated Urea(SCU)
v. Urea super granules (USG)
vi. Prilled urea (PU)

(B) phosphatic fertilizer
(a) water soluble P
- SSP — 16 %
- DSP — 82 %
- TSP — 48 %
- DAP — 18:46:0

(b) citrate soluble P
- Basic Slag (3%)
- Dicalcic phosphate (31-40%)

(C) water insoluble P
- Rock phosphate - 20-30 %
- Bone meal — 18-20 %

(C) Potassic fertilizer
- Potassium chloride (MOP) - 60 %
- Potassium sulphate (SOP) - 50 %

Q.6 Define soil fertility evaluation. State the methods of soil fertility evaluation.

(2)

Soil fertility evaluation **1 mark**

The diagnosis of the nutrient status of the soil by using different techniques or methods is known as soil fertility evaluation.

Methods of soil fertility evaluation

There are various diagnostic techniques that are commonly used to evaluate fertility of the soils. **3 mark**

They are;

I Nutrient deficiency symptoms of plants

II Plant Analysis

Plant analysis consists of three methods

1. Rapid tissue tests

2. Total analysis:

III. Biological methods

It is conducted for calibrating the crop responses to added nutrients. Different methods are adopted for evaluating fertility status of soil.

1. Field tests

2. Indicator plants:

3. Microbiological test:

4. Laboratory and Green house Tests:

III. Soil Testing

V Modern approaches of soil fertility evaluation and fertilizer recommendation

1) Soil Test Crop Response (STCR)/Targeted Yield Concept

2) Diagnosis and Recommendation Integrated System (DRIS) Approach

Q.7 What is STCR? Give the advantages of STCR.

1) SOIL TEST CROP RESPONSE (STCR) **2 marks**

After introduction of high yielding varieties and hybrid crops, the need for systematic soil test crop response research in different soil agro-climatic regions become evident. ICAR established the AICRP on STCR in 1967 and the STCR concept was developed by Ramamoorthy,

in 1987. STCR provides the relationship between a soil test value and crop yield. The soil test values are needed to be correlated with actual crop response obtained under field conditions. Separate calibration charts are needed for each crop and soil. Fertility gradient and regression approach and targeted yield concepts were evolved.

Advantages: **2 marks**

1) Efficient and profitable site specific fertilizer recommendation for increased crop production

and for maintenance of soil fertility.

2) Aims to provide balanced, efficient and profitable nutrient application rates for pre- set yield

targets giving due consideration to basic fertility status of soil

Q.8 Write down the functions and deficiency symptoms of calcium as an essential plant nutrient.

Calcium

It is immobile in plants and exists as deposits of calcium oxalate, calcium pectate in the

middle lamella of cell wall and $CaCO_3$ and $CaPO_4$ in cell vacuoles. Although calcium is present in
plants in relatively higher proportion as compared with other elements, its actual requirement by plants is not much higher than that of a primary nutrient.

Functions: **2 mark**

1. It is a **constituent of the cell wall** and promotes early root development.
2. It is required for **cell divisions and chromosome stability**, cell wall construction, cell elongation of the shoot and root.
3. Stabilizing the pectin of the middle lamella in the cell wall by forming calcium pectate. Thus Ca brings resistance against diseases.
4. Effect on fruit quality and increases in the firmness of the fruit.
5. Indirectly influences many enzyme systems and maintain cation- anion balance (by acting as a counter ion).

Deficiency **2 mark**

- Deficiency is first observed on the young leaves and growing tips (immobile in plants).
- Leaves become small, distorted, **cup shaped, crinkled** and **malformation** of leaves (It resembles boron deficiencies)
- Terminal buds may deteriorate and die in fruits trees. Root growth is impaired.
- Destruction of cell well structure results in disturbance of nuclear and cell division.
- Fruit quality is reduced, loss of fruit fleshy, sometimes rotting of fruits and susceptible to fungal disease.

Q.9 What are micronutrient fertilizers ? Give the examples of micronutrient carrying fertilizers.

Micronutrient Fertilizers **1mark**

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; **3 marks**

Fe carrying fertilizers

1. Ferrous sulphate(19.0% Fe)
2. Ferric sulpahte(23.0% Fe)
3. Ferrous ammonium sulphate(29.0%Fe)
4. Ferric and ferrous oxide70.0 and 77.0% Fe)

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)

Manganese carrying fertilizers

1. Manganese sulphate (20.0 to 28.0% Mn)
2. Manganese carbonate (31.0% Mn)
3. Manganese chloride(17.0% Mn)

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)

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Molybdenum carrying fertilizers
1. Sodium molybdate (39.0% Mo)
2. Ammonium molybdate (54.0% Mo)

Copper carrying fertilizers: Copper sulphate.

Reference: Soil Fertility and Nutrient Management by S. S. Singh

Q.10 What are biofertilizers? State types of biofertilizers and explain any one.

Biofertilizer **1 mark**

These are also called as microbial inoculants which are biological material used as a source of supply of nutrients through various biological reactions in soil/plants.

Types of biofertilizers **1 mark**

Rhizobium, Azotobacter, Azospirilium, Blue green algae, Azolla, mycorrhiza, sulphur oxidising and phosphate solubalizing microorganisms.

Explain any one **2 mark**

SECTION "B"

Q.11 Match the pairs **4 mark**

1—b 2—c 3—d 4--a

Q.12 Do as directed. **4 mark**

1) State any two processes involved in transport of nutrients from soil to roots.

Ans: Mass flow, Diffusion,Root interception

2) Give two names of potassic fertilizers.

Ans: Muriate of potash,sulphate of potash,potassium nitrate

3) Define luxury consumption.

Ans: It is the tendency of some crops to absorb and accumulate nutrients far in excess of their actual needs if it is present in sufficiently large quantities in the soil.

4) Define alkalization process in soil.

Ans: Alkalization is the process of accumulation of exchangeable sodium in the soil

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