Role of manures and fertilizers in crop production – agronomic interventions for enhancing FUE - Inter cultivation - Thinning - Gap filling and other intercultural operations

MANURES

Manures are plant and animal wastes that are used as source of plant nutrients. They release nutrients after their decomposition. Manures can be grouped into bulky organic manures and concentrated organic manures.

a. Bulky organic manures - Farm Yard Manure (FYM), compost from organic waste, night soil, sludge, sewage, green manures.
b. Concentrated organic manures - oilcakes (edible, non-edible), blood meal, fishmeal and bone meal.

FERTILIZERS

Fertilizers are industrially manufactured chemical containing plant nutrients. Nutrient content is higher in fertilizers than organic manures and nutrients are released almost immediately. The fertilizers has three groups;

Straight fertilizers – supplies single nutrient Ex: Urea, Muriate of Potash

Complex fertilizers - supplies two or more nutrient Ex: 17:17:17 NPK complex

Mixed fertilizers- supplies two or more nutrient Ex: Groundnut mixture

ROLE OF MANURES AND FERTILIZERS

1. Organic manures bind the sandy soil and improve its water holding capacity.
2. Organic manures open the clayey soil and help in aeration for better root growth.
3. Organic manures add plant nutrients in small percentage and also add micronutrients, which are essential for plant growth.
4. Manures increases the microbial activity which helps in releasing plant nutrients to available form.
5. Organic manures should be incorporated before the sowing or planting because of slow release of nutrients.
6. Fertilizers play an important role in crop production as they supply large quantities of essential nutrient to crops
7. Fertilizers are manufactured in forms that are readily utilized by plants directly or after rapid transformation.
8. Fertilizers dose can be adjusted to suit the requirement as determined by soil testing.
9. Balanced application of nutrient based on crop requirement is possible by appropriate mixing of fertilizers.
10. Fertilizers applied as straight fertilizers (providing single nutrient) or complex and mixed fertilizers (supplies two or more nutrients) based on crop requirement.

AGRONOMIC INTERVENTIONS FOR ENHANCING FUE

The following are the agronomic measures to improve the Fertilizer use efficiency (FUE).

1. Using best fertilizer source
2. Using adequate rate & diagnostic techniques
3. Usage of balanced fertilization
4. Integrated nutrient management
5. Utilization of residual nutrients

1. Using best fertilizer source:

Identification of best source of fertilizer is pre-requisite for better crop production. Source of fertilizer depends on crop and variety, climatic and soil condition, availability of fertilizer, etc.

- Nitrogen: Ammoniacal or Nitrate
- Phosphorus: Water soluble or Citrate soluble
- Potassium: Muriate of potash
- Sulphur: Sulphate or Elemental S
- Multinutrient fertilizers: MAP, DAP, SSP, Nitrophosphates
- Multi-nutrient mixtures: Several combinations of NPK
- Fortified fertilizers: Neem-coated urea, Zincated urea, Boronated SSP, NPKS mix.

2. Using adequate rate & diagnostic techniques:

The fertilizer recommendation must be in adequate quantity so as to meet the demand of crop at any point of growth. The fertilizer supply is made by diagnosing its requirement by any of the following method.

- State recommended generalized fertilizer dose or blanket recommendation
- Soil-test based fertilizer recommendations
- Soil-test crop response based recommendation
- Plant analysis for diagnosing nutrient deficiencies
- Chlorophyll meter and Leaf colour charts, etc.

3. Balanced fertilization

Balanced fertilization includes adequate supply of all essential nutrients, proper method of application, right time of application and nutrient interrelationships.

a. Adequate supply of all essential nutrients: Due to more concentration and application on primary nutrients (NPK), soils developed deficiency symptoms for secondary and micro-nutrients. Hence, ignored elements must be added with the NPK (may be in minor quantity) to get higher yields in crops. Experimental results shown that about 20-25 kg of micro-nutrient application or two foliar sprays increases the yield of crops up to 20%.

b. Proper method: N and K can be applied as broadcasting and band placement. Water soluble P fertilizers are preferred to apply as band placement in neutral & alkaline soils. Citrate soluble P fertilizers are applied as broadcast method in acidic soils. Sulphate forms of S fertilizers are applied as broadcasting or band placement, whereas, elemental S and pyrite are applied as broadcasting method. Micronutrients are applied in minor quantity as foliar sprays and water soluble fertilizers are applied in fertigation.

c. Right time: (according to physiology of crop)

- Upland crops - 2 splits (seeding, 3-5 weeks after first dose)
- Flooded rice - 3 splits (Transplanting, 3 and 6 weeks after first dose)

d. Nutrient interrelationships:

Antagonistic nature of fertilizers is to be considered while applying into the soil. Some of the fertilizer application in excess, cause loss of yield and quality of crops. Ex. Application of excessive 120 kg P ha^{-1} created an imbalance and reduced the seed and oil yields in soybean compared to 80 kg P ha^{-1}.

4. Integrated nutrient management

Organic manures, crop residues, green manures, bio-fertilizers etc. are to be blended in right manner along with inorganic fertilizers to meet the crop demand. All the possible and available organic sources are to be utilized efficiently to reduce the usage of inorganic fertilizers.

5. Utilization of residual nutrients

Some of the strategies to utilize the crop residues in efficient manner are,

- Knowledge on climatic conditions & carry-over effects of residues.
- Blending rightly on cereal-legume rotations
- Mixing shallow-deep rooted crop rotations

INTER CULTIVATION

Cultivation practices taken up after sowing of crop is called inter-cultivation. It is otherwise called as after operation. There are three important after cultivation processes viz., Thinning and gap filling, weeding and hoeing and earthing up.

1. Thinning and Gap filling

The objective of thinning and gap filling process is to maintain optimum plant population. Thinning is the removal of excess plants leaving healthy seedlings. Gap filling is done to fill the gaps by sowing of seeds or transplanting of seedlings in gap where early sown seed had not germinated. It is a simultaneous process. Normally, these are practiced a week after sowing to a maximum of 15 days. In dryland agriculture, gap filling is done first. Seeds are dibbled after 7 days of sowing. Thinning is done after gap filling; in order to avoid drought. It is a management strategy to remove a portion of plant population to mitigate stress is referred to as mid season correction.

2. Weeding and Hoeing

Weeding is removal of unwanted plants. Weeding and hoeing is a simultaneous operation. Hoeing is disturbing the top soil by small hand tools and helps in aerating the soil.

3. Earthing up

It is a dislocation of soil from one side of a ridge and to be placed nearer the cropped side. It is carried out in wide spaced and deep rooted crops. It is done around 6-8 weeks after sowing / planting in sugarcane, tapioca, banana, etc.

4. Other inter cultivation practices

Harrowing

Stirring or scraping the surface soil in inter and intra row spacing of the crop using tools or implements.

Roguing

Removal of plants of a variety admixed with other variety of same crop. Ex. In IR 50 rice field, the other rice varieties are rogue. It is practiced in seed production to maintain purity.

Topping

Removal of terminal buds. It is done to stimulate auxillary growth. Practiced in cotton and tobacco.

Propping

Provision of support to the crop is called propping. Practiced in sugarcane commonly. It is done to prevent lodging of the crop. Cane stalks from adjacent rows are brought together and tied with their own trash and old leaves.

De-trashing

Removing of older leaves from the sugarcane crop.

De-suckering

Removal of axillary buds and branches which are considered non essential for crop production and which removes plant nutrients considerably are called suckers. Ex. Tobacco.