

SOIL HEALTH MANAGEMENT AND PRACTICES KEY FACTOR FOR CROP PRODUCTIVITY

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Suitable crop management practices can increase the productivity of the crop, out of which soil fertility and health management play a vital role in crop production. Due to the extensive cultivation of crops, nutrients in the soil get degraded. In order to fulfil the crop nutrient requirement, an integrated approach to nutrient management is necessary. Nutrients to the crop are supplied through organic manures, biofertilizers, green manuring, chemical fertilizers, and Nano fertilizers. Effective utilization of all these components surely fulfils the crop requirement without affecting soil health and fertility. So that better crop yield can be expected from healthy soil in a sustainable way.

India produces 281.4 million tonnes of food grains in the year 2018, from a net cultivated area of 143 million hectares. But the population of our country is increasing in geometric progression, but food production is increased in arithmetic progression. In order to meet food requirement and maintain self-sufficiency in food grains like oilseeds, pulses, cereals, an adaptation of sequential cropping is essential. Up adopting a sequential cropping system and extensive use of soil for cultivation causes overexploitation of soil nutrients, and excessive use of only chemical fertilizers as nutrients reduces the interaction between useful soil microbes and crop plants and makes the soil less productive. Hence it is necessary to maintain the balance between crop productivity and soil nutrient providing capacity, and to get higher productivity, better crop and soil management is essential. And all 17 nutrients are essential at the optimum concentration for a crop to complete its life cycle and to give higher production.

In order to provide all major and micronutrient in optimum dosage, an approach called integrated nutrient management should be followed where organic, inorganic and biological amendments are combined used as nutrient sources. This helps to increase nutrient use efficiency, soil health and prevent nutrient losses, and they're by sustainable crop production

can be achieved. The main principle of integrated nutrient management includes the use of all possible source of nutrient to optimize their inputs, match soil nutrient supply with crop demand spatially and temporally, reduce nutrient loss while improving crop yield.

Components of integrated nutrient management

All 17 essential nutrients and few beneficial nutrients are supplied to the crops through organic manures, green maturing, chemical fertilizers, biofertilizers, concentrated organic manuals like blood meal, born meal, oil cakes and the use of nano fertilizers play an important role in crop nutrient management.

Organic manures: organic manure is a low analysis fertilizer, and they supply plant nutrients in small quantity and organic matter in large quantity, and hence they are supplied in larger quantity to meet the nutrient requirement of the crops. Ex: FYM, Compost.



Fig 1: Fully decomposed FYM

Bulky organic manures increase organic matter content and thereby improve the soil physical property. They supply major nutrient along with micronutrient and provide food for beneficial soil microorganisms and increase the suppressive of soil. They have a high residual value, chilling effect and supply the nutrients in a balanced ratio.

Concentrated organic manure contains high plant nutrient and a considerable amount of organic matter. They can influence direct plant growth they contain nitrogen varies from 2.5% - 7.9%, Phosphorus 0.8 to 2.9%, and potash 1.2 to 2.2%. Ex: Groundnut oil cakes, sesame oil cakes, coconut oil cakes, cotton oil cakes.

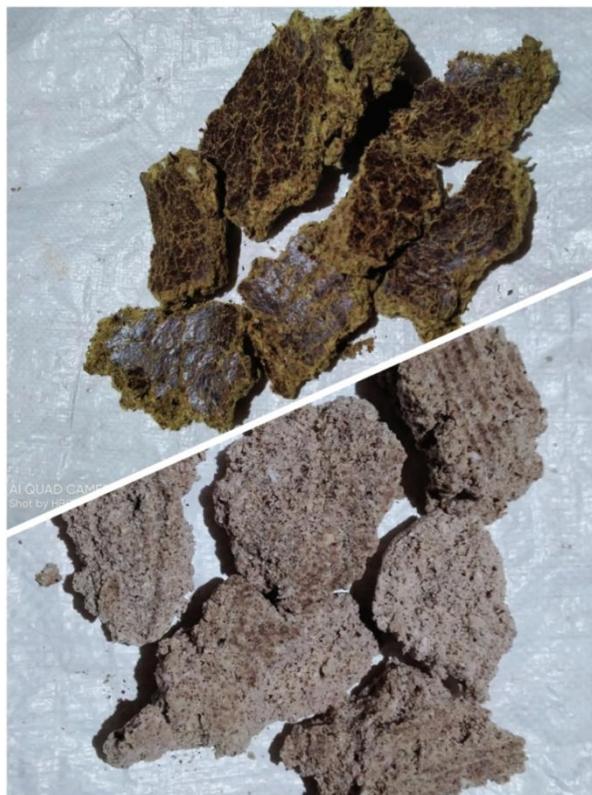


Fig 2: Cotton and coconut oil cakes

A combination of bulky organic manure and concentrated organic manure gives a good quantity of macronutrient and required micronutrient so that crop requirement can be fulfilled.

Green Manuring

The incorporation of green leaf or cover crop, green manuring crop to the soil. Then they become green manure. They are incorporated with a view to improving soil fertility,

physical property. And cover crop plays a major role in preventing excess moisture evaporation and reduces soil and water loss. Either insitu or excitu can do green manuring.

In insitu green manuring crops are grown and buried in the same field as they are leguminous and succulent in nature and have a lower C:N ratio. Ex: *Crotalaria juncea*, *Sesbania aculeata*, *Phaseolus trilobus*, *Cyamopsis tetragonbia*, *Indigofera tinctoria*, *Tephrosia purpurea*, *Dolichus biflorus*. *Crotalaria juncea* have good green manuring value with the nutrient composition of 2.3 % of nitrogen, 0.2 % of phosphorus, and 1.4 % of potash with 15 to 30 tons of green leaf per hectare. In Excitu green manuring turning the soil with green leaf, tender twigs of green manuring crops. Ex: *Glyricidia maculata*, *Leucaena leucocephala*, *Sesbania rostrata*, *Pongamia pinnata*.



Fig 3: Excitu green manure plant - *Glyricidia maculata*

Chemical Fertilizers

They are inorganic, high analysis fertilizers that provide a higher quantity of primary nutrients like N, P, K, Mg, S.

Ex: Urea-46% N, Calcium nitrate- 16% N, Rock phosphate, SSP- 16% P, KCl, K₂SO₄.

Complex and mixed fertilizers contain two or more major nutrient, DAP-18% nitrogen and 46% phosphorus. They should be applied in the recommended dosage to the crop; variation in the dosage causes an imbalance of nutrients in the crop. In order to prevent nutrient loss, they should be supplied in the required dosage. Here micronutrients can be applied with the chelating agent for slow release.

Biofertilizers

Biofertilizers are the bio-inoculant and contain living organisms as nitrogen fixers, P solubilizers which are useful for increasing nutrient use efficiency, thereby help in crop production. They fix atmospheric nitrogen both in association with plants and without plants and solubilize insoluble soil phosphate to soluble phosphate. So that fixed phosphorus in the soil can be effectively utilised.

Rhizobium inoculant: They are symbiotic in nature with legumes. They fix 50-100 kg of nitrogen per hectare. They supplement 80-90% of the nitrogen requirement of the crop, and hence they are applied during sowing as a seed treatment.

Azotobacter inoculant: They can be applied to non-leguminous crops like cotton, Tobacco, sugarcane. They are free-living, non-symbiotic; they can reduce the nitrogen application by 10- 20% and increase the yield by 10-15% of the normal crop yield.

Azospirillum inoculant: They are effectively used in cereals like sorghum, wheat, maize. They increase the yield by about 15- 30% and reduce nitrogen application by 20-30 kg/ha.

Azolla: It is effectively used in paddy, fixes atmospheric nitrogen. They are recommended as green manure as they have large biomass and 4-6% of nitrogen, 0.5-0.9% of phosphorus, 2- 6% of potash. It will increase the yield of paddy by 15 to 20%.

VAM: VAM fungi enhance the nutrient uptake of phosphorus, zinc and Sulphur. And enhance water uptake under drought, gives resistance to the root damage. They can be used in forest trees, forage grasses, sorghum, millets and citrus etc. They can substitute 560 kg of fertilizers per hectare for citrus.

Crop Residue Management

Residence of crop gives organic matter to soil and influence on physical, chemical and biological properties and affect soil quality and nutrient cycle. Retention of crop residue on the soil surface will increase the cation exchange capacity of the soil and P content of the top layer of soil. It plays a role in nitrogen availability; legume crops residue will have a low C:N ratio and results in nitrogen mineralization. Cereals will have a higher C:N ratio, which will result in temporary nitrogen immobilization. To fulfil the nitrogen requirement at this time, add 20% extra nitrogen sources to the crop than the recommended dosage.

Nano fertilizers as source of nutrient in crop production

In order to increase nutrient uptake and use efficiency, Nano fertilizers are used, as normal fertilizers have low nutrient use efficiency. They are manufactured in such a way that they are target-oriented and not easily lost. The utilisation of these nano fertilizers will also influence increasing plant nutrient content; biologically synthesized Nano fertilizers are preferred for agricultural purposes in order to reduce toxicity issues associated with chemically synthesized.

Conclusion

Nutrient requirement of the crop can not be fulfilled by using any one source of nutrient, but it can be fulfilled by integrating all the component of the nutrient like green manuring, biofertilizer, organic manures, chemical fertilizers and effective use of nano fertilizers, a combination of all these as nutrient source maintain the better ecological balance in the soil and helps in maintaining interactions of beneficial microbes and crops in plants. Effective utilisation of all these components increases the suppressiveness of soil. So that effectively biotic stress can be easily managed. Thereby proper nutrient requirement of the crop is satisfied without causing any environmental pollution, and hence better soil health, soil physical-chemical and biological property can be well maintained, which is a prerequisite for crop productivity.

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