Enhancing Crops Productivity and Profitability through Using of Organic Fertilizers

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Continuous use of chemical fertilizers alone in intensive agriculture has resulted in numerous problems like degradation causing major threat to the food security and sustainable agriculture. Therefore, there is urgent need of judicious and efficient use of organic manures, crop residues, legumes and biofertilizers in integrated manner within ecological, social and economical possibilities in pulse crop and cropping systems for maintaining the soil fertility and crop productivity with farmer’s profitability.

Introduction

The introduction of high yielding varieties during the green revolution era has been the major outbreak in Indian agriculture in increasing the food grain production. These high yielding varieties though highly responsive to fertilizer are heavy nutrient feeder with almost twice the quantity of plant nutrients being removed from the soil than what is added through fertilizers, thus possessing a major threat to sustain the soil health and the productivity. Organic manures like FYM and compost have been traditionally important inputs for maintaining the soil fertility and ensuring yield stability. As these nutrient sources are bulky in nature with low nutrient content and short supply, they lost their relative importance over time in pulse production to readily available chemical fertilizers due to energy crisis and their limited supply made it necessary to search for alternative and renewable source of plant nutrients leading to major interest in organic recycling. Organic manures play a direct role in supplying macro and micro-nutrients and an indirect one by improving the physical, chemical and biological properties of soils. These manures besides supplying nutrients to the current crop very often leave substantial residue effect on succeeding crop in system. The integrated use of chemical fertilizers and FYM has marked influence on higher production and improvement in soil fertility status. Continuous use of chemical fertilizers alone in intensive agriculture has resulted in numerous problems like degradation causing major threat to food security and sustainable agriculture. Therefore, there is urgent need of judicious and efficient use of organic manures, crop residues, legumes and biofertilizers in integrated manner within ecological, social and economical possibilities in pulse crop and cropping systems for
The components of organic fertilizers are:

- Organic manures
- Bio fertilizers
- Green manures/Green leaf manure
- Crop residues
- Legumes in cropping system

**Organic Manures**

The introduction of HYVs of rice, wheat and other cereals and their heavy nutrient NPK requirements made farmers to ignore use of organic manures like FYM and compost. Various research studies have reported that use of manures in combination with chemical fertilizers significantly improved the crop yields and soil health on long term basis. Organic manures not only supply the major nutrients, it also supplies micronutrients, secondary nutrients to the soil and improve physical, chemical and biological properties of the soil. It saves 20-50% of chemical fertilizer use in crop production.

**Biofertilizers**

Biofertilizers have an important role to play in improving the nutrient supplies to Indian agriculture in search for alternate sources of soil fertility build up through renewable sources. Biofertilizers are the preparation containing primarily active strains of micro-organisms. They are ready to use as live formulations of such beneficial micro-organism which on application to seed or root or soil, fix atmospheric nitrogen or solubilise or mobilize plant nutrients or stimulate plant growth substance. These biological activity in particular helps to build up the micro-flora and in turn the soil health in general. Treatment of Rhizobium inoculants fixes 20-25%, especially in pulses and treatment of non-leguminous crops with
Azotobacter and Azospirillum may increase yield by 5-15% and N contribution of 20-25 kg N ha\(^{-1}\). Apart from nitrogen fixation, these microorganisms are known to produce growth-promoting substances, which favour better growth of crop plants. BGA and Azolla are of greater significance in N economy of rice cultivation under water logged condition. Their use may contribute 25-35 kg N ha\(^{-1}\) to rice crop. Biofertilizer can help in increasing biologically fixed atmospheric N or increase native P availability to crop plants. Among the biofertilizers, N fixing bacteria (Rhizobium) and P solubilising bacteria (PSB) and mycorrhiza play significant role in pulses.

Fig. Biofertilizers

**Green Manures**

Green manuring is the addition of green plant tissue to soil for increasing its fertility and soil physical properties. Green manures may be grown in-situ generally by raising the legumes such as dhaincha, sunhemp and cowpea, etc. for 40-60 days during the summer period before rice transplanting and followed by its incorporation in the soil. Green manuring can bring a saving of about 50-60 kg N ha\(^{-1}\), which is half the dose of recommended fertilizers for high yielding varieties. In intensive cropping system, it is generally grown in summer season in irrigated areas, when the temperature is high and the legume growth is ample to add the organic matter to the soil. Green manuring not only adds the N to the soil, but it also improves physical and biological properties of the soil to sustain crop yields.

Fig. Sunhemp  Fig. Daincha  Fig. Cowpea

**Crop Residues**

Besides supplementing the fertilizer, incorporation of residues of pulse crops are important for improvement of the soil properties and thereby increasing productivity and fertilizer use efficiency. Judicious use of crop residues has another important consideration of reducing nutrient losses through leaching, volatilization or fixation especially under adverse soil conditions. Pulse crop residues have low C/N ratios and therefore, they degrade faster and
help build up soil fertility with good amount of available form of nutrients. Incorporation of crop residues of these short growing legumes could easily substitute 50% NPK needs of post rainy season crop. Growing a short duration grain legume like green gram or black gram and incorporating residue into soils after harvesting the grains/pods is also suggested not only for increasing the system productivity but also for making a considerable saving on chemical fertilizer. Several researches reported that crop residue application in organic farming through efficient incorporation technology along with use of cellulolytic fungi for its rapid decomposition, improves the soil physico-chemical and biological properties besides saving 25-50% plant nutrients applied through fertilizers in crop production.

**Legumes in Cropping System**
Legumes can act as soil fertility restorers in cropping system due to their ability to fix atmospheric N in symbiosis with Rhizobium. Legume crops leave a substantial amount of residual N which may vary from 30-60 kg N ha⁻¹. This inclusion of legumes in intensive cropping system not only restores the soil fertility but also increases the farmer’s profitability.

**Conclusion**
Since use of chemical fertilizers is the quickest and surest way of boosting the crop production to achieve the food security but their escalating costs, diminishing resources, deterioration of soil health and environmental degradation has necessitated use of potential alternative sources of plant nutrients. Thus, use of organic sources of plant nutrient has proved as a boon not only in sustaining the soil productivity and soil health but also in meeting out a part of chemical fertilizer requirement of intensive cropping system.