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Integrated Nutrient Management and Soil Fertility

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INTRODUCTION

The intensification of agricultural production and productivity necessitates the increased rate of nutrient application and current fertilizer production levels are insufficient to meet the entire plant nutrient requirement. At present the gap of 10 million tons is likely to widen further in view of higher prices of diammonium phosphate (DAP), potash and other nutrients. Moreover, long term trials on integrated nutrient management (INM) revealed that neither inorganics nor the organics alone can achieve sustained production under intensified cropping. The interactive advantage of conjoint application of organic and inorganic sources of nutrients in INM have proved better than single source of nutrients.

INM is the best way to get optimized benefits from all sources of plant nutrients in an integrated manner for maintaining soil fertility and nutrient supply for plant at any optimum level for sustaining desired crop productivity. INM is not a new concept, but an old-time practice when almost all the nutrients need were met through organic resources only to supply secondary and micro- nutrients besides primary nutrients. The major concept of integrated nutrient management is maintaining and improving the soil fertility through integrating different nutrient resources along with fertilizers for sustaining crop productivity on long term basis.

Major components of INM are

1. Integration of crops with green manures and legumes which help to restore the soil fertility
2. Balanced application of fertilizer nutrients to achieve yield.
3. Application of organic manures like FYM, compost, vermicompost, biogas slurry, press mud and poultry manures.
4. Use of biofertilizers.
5. Recycling of crop residues.

Fertilizers: Fertilizers play a vital role in INM. The dependence on fertilizers has been increasing due to poorly managed organic resources and increasing depletion of soil fertility. The fertilizers used are not only indiscriminate but imbalanced also. In Haryana, farmers are using excessive nitrogen through urea, whereas depletion of nutrients such as phosphorus, potassium and micro-nutrients is increasing. In India at present, more than nine major and micro-nutrients are deficient. Efficient use of fertilizer nutrients by the crop needs proper attention based on crops to be grown, available nutrient status and fertilizer use on soil test basis. Use of fertilizers conjointly with organic sources will increase nutrient use efficiency (NUE). Enhancing NUE should therefore, be a priority area for improvement of soil health and to economize the crop production.

Organic Manures: Organic manures such as farm yard manure (FYM), crop residues, city waste, press mud, vermicompost and other agricultural wastes have large potential for providing nutrients. There are various other industrial byproducts like nonedible oil cakes and wastes which if properly evaluated can be a good source of nutrients along with their favorable effects on soil properties. (**Table 1**). These organic manures not only provide all essential nutrients but also improve soil physico-chemical and biological properties of the soil.

Table 1. Nutrient status of some organic sources, FYM, compost, cakes and residues

Name	Source	Nutrient content (%)		
		N	P_2O_5	K_2O
Animal Wastes	Cattle dung	0.3-0.4	0.10-0.15	0.15-0.20
	Cattle urine	0.80	0.01-0.02	0.50-0.70
FYM Composts	Farm Yard Manures	0.5-1	0.15-0.20	0.5-0.6
	Poultry manure	2.87	1.0	1.5
	City compost	1.5-2.0	1.0	1.5
Oil Cakes	Castor	5.5-5.8	1.8	1.0
	Neem	5.2	1.0	1.4
	Rapeseed	5.1	1.8	1.0
	Linseed	5.5	1.4	1.2
	Sesame	6.2	2.0	1.2
Animal meals	Blood	10-12	1.2	1.0
	Meat	10.5	2.5	0.5
	Fish	4-10	3-9	1.8

Green Manuring and Legumes: These crops are known for soil fertility restorers due to their potential to fix atmospheric nitrogen (N_2) in root nodules of legume crops in symbiosis with rhizobium bacteria. Legumes can play a greater role in INM when included in cropping system. Green manure crops like dhaincha (*Sesbania aculeata*) in paddy-wheat cropping sequence can be a boon to the farmers as Department of Agriculture, Government of Haryana is providing 90 % subsidy on dhaincha seed for enhancing soil fertility, thus soil health. Introduction of crop rotation or legumes in rotation improve soil health along with save underground water. Crops like gram, lentil, moong, sun hemp, dhaincha, methi, berseem. Cowpea are very good restorers of soil fertility besides natural resource conservation.

Bio-fertilizers: Bio-fertilizers play a significant role in improving soil fertility and boosting crop productivity due to their capacity to fix atmospheric nitrogen, solubilize or mobilize phosphorus in symbiotic and non-symbiotic ways in root nodules. Bio-fertilizer like rhizobium in pulses and azotobacter and azospirillum in non-legumes are widely known for nitrogen addition to the soil, whereas phosphate solubilizing bacteria (PSB), phosphotika help in phosphorus solubilization. These bio-fertilizers impart soil fertility buildup in the long run. These are easy, economical and cost effective. These may be used as seed treatment, root dipping or soil treatment but seed treatment is the best method. At present, these are available in liquid form which are available at Department of Microbiology, Chaudhary Charan Singh Haryana Agricultural University, Hisar, IFFCO & KRIBHCO sale centers at district level. Other biofertilizers like BGA (Blue Green Algae), Azolla, VAM needs to be evaluated for their response in different agroclimatic conditions in different crops. In Haryana, rhizobium, azotobacter, phosphotika is being used but there is urgent need to popularize in all crops to make a dent in INM on long term basis.

Crop Residues: Management of crop residues is one of the critical issues in Haryana and Punjab due to their role in environmental pollution as crop residues left in the fields after combine harvesting of wheat and paddy are burnt. A large amount of nutrients is lost resulting in depletion in soil fertility due to loss of organic matter and micro-organisms. Recycling of these residue back to fields help to build organic matter in the soil to sustain soil heath. Use of new generation technology machine like Happy Seeder for sowing of wheat in standing crop residues remaining after combine harvesting of paddy have resulted in excellent wheat crop besides controlling population and resource conservation. Burning of crop residue results in loss of biomass and plant nutrients resulting in deterioration of soil fertility and soil health. Burning must be avoided at any cost to save soil fertility.

Thus, INM facilitates the implementation of plant nutrition and soil fertility management practices in farming systems, using both organic and inorganic sources to meet food production demands. All of the sources must be properly handled to achieve the highest degree of performance. It regulates the overall management of the farming system, including cattle, poultry, animals, and plants. The advantage of INM can be restoration and sustaining soil health, prevention of macro and micro-nutrient deficiencies, enhancing fertilizer or nutrient use efficiency and favorable effect on physico-chemical and biological health of the soil. INM is ecological, social and economically viable and environment friendly technique which must be practiced by farmers to sustain soil fertility along with soil health to meet continuously growing demand of food production.

CONCLUSION

In present days, crop residues recycling and organic farming have been recognized as efficient mean for sustaining soil health and environmental quality. However, due to its limited availability, INM is gaining immense importance, not just to attain higher productivity but in achieving maximum stability in crop production under intensive farming systems.