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A review on impact of integrated nutrient management practices on soil quality

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Abstract
Soil productivity is the results of its physical, chemical and biological properties and any change in these properties adversely affect the soil environment leading to decline in crop yield. In these concern of proper soil management practice is likely to be helpful which increase the properties of the soil. Complementary use of organic and inorganic fertilizer has an important role in the improvement of soil ecosystem resulting in higher crop productivity without deteriorating soil qualities.

Keywords: productivity, Soil, management, practices

Introduction: Physical characteristics of soil

Hati *et al.* (2006) [8] reported that application of 10 Mg farm yard manure and recommended NPK to soybean for three consecutive years had larger mean weight diameter and a higher percentage of water stable aggregates. Increase in percentage of macro aggregates and reducing in percentage of micro aggregates with FYM application was likely due to conversion of some of the micropores to macropores as a result of cementing action of organic acid, polysaccharides formed during the decomposition of organic residues (Mishra and Sharma, 1997) [14].

Significantly lower bulk density was recorded under 50% nitrogen through poultry manure + 25% N through urea + bio-fertilizer + Zn applied plot (Kumar *et al.*, 2018). Das and Patel (2012) [6] reported that integrated nutrient management treatments generally decreased the bulk density of soil as compared to these under inorganic treatment and the reason might be due to the higher soil organic carbon in these treatments. Similarly, working on acid clay loam soil under maize-mustard cropping system. Saha *et al.* (2010) [21] reported that a reduction in bulk density of soil with integrated nutrient management practices. Addition of NPK fertilizer along with FYM, lime and biofertilizer, resulted in an increase in the infiltration rate of the soil (Saha *et al.*, 2010) [21]. Similarly, Malik *et al.* (2014) reported an improvement in infiltration rate with the incorporation of vermicompost and chopped crop residue.

The results of a five year field experiment carried out to study the effect of continuous application of N, P and K alone or incombination with lime, FYM and biofertilizer revealed an increase in water retention capacity of soil with integrated nutrient management (Saha *et al.*, 2010) [21]

Chemical properties of soil

The soil pH at 0-15 cm soil depth varied significantly after twenty-ninth cycle of rice crop. The lowest pH in the surface soil was registered under control while the highest pH to the tune of 8.19 was recorded due to NPK + FYM. There was no remarkable variation in soil pH due to various treatments of nutrient management through chemical fertilizer alone or in combination with FYM (Bhatt *et al.*, 2017) [1]. Similarly, Chouhan *et al.*, 2017 [5] reported a slight increase in treatments of inorganic nutrient application alone while slight decrease in soil pH was recorded in the treatment receiving FYM along with inorganic nutrients.

The electrical conductivity of soil after harvest of soybean and wheat crop was not affected significantly by the treatments of long term application of nutrients. The value of electrical conductivity did not show remarkable alteration and this may be attributed to low residual effect of applied input and high buffering capacity of soil (Chouhan *et al.*, 2017) [5]. Similarly, Bhatt *et al.* (2017) [1] reported a lowest value of electrical conductivity (0.27 dSm^{-1}) in control plot and highest EC (0.33 dSm^{-1}) in treatments NPK + FYM. Addition of NPK fertilizer increases accumulation of salt concentration in soil which contributes to increased elemental conductivity. Kumar *et al.* (2012) also reported that application of FYM, rice straw and green manure along with inorganic fertilizer decrease soluble salt concentration compared to fertilizer alone in rice-wheat cropping system.

Sharma *et al.* (2000) reported that incorporation of crop residues and inorganic fertilizers showed significant increase in cation exchange capacity over the initial value. The increase in CEC was due to improvement in organic carbon content of the soil (Sharma *et al.*, 2000). Similarly, Chouhan *et al.* (2017) [5] reported that long term application of nutrient along with organic manure significantly increased the cation exchange capacity of soil. Higher CEC in the treatment of long term application of nutrient along with FYM was might be due to higher organic carbon under these treatments.

The addition of FYM and integrated nutrient use of FYM with chemical fertilizers resulted in significantly higher organic carbon accumulation over inorganic fertilizers alone after harvest of maize in an alfisols (Kumari *et al.*, 2013). Similarly, Ravankar *et al.*, 2005 [20] reported that maximum amount of organic carbon was found in the plot receiving inorganic fertilizer in combination

with organic and it was attributed to the direct incorporation of organic matter, better root growth and more plant residue addition. Jadhao *et al.* (2019) [9] also reported an improvement in the organic carbon status of the soil with conjoint use of organics and fertilizers.

Incorporation of FYM along with fertilizers enhanced the available N content in soil as compared to control and this may be attributed to mineralization of FYM (Chandel *et al.*, 2014) [2]. Kumar *et al.* (2008) reported that the application of crop residue along with FYM and green manure significantly increased the available N content of soil over 100% NPK alone in the treatment. Similar improvement in the availability of soil N with the conjoint use of inorganic fertilizer along with organics was also reported by Jadhao *et al.* (2019) [9].

Swarup and Yaduvanshi (2000) [25] reported that there was significant improvement in available phosphorus status of soil with addition of crop residue and FYM. The build-up of available phosphorus in the soil may be ascribed to the residual effect of applied fertilizers and the mineralization of FYM. Similarly, Chesti *et al.* (2015) [4] reported that incorporation of FYM along with 100% NPK recorded significantly higher available P as compared to all other treatments.

Higher value of available potassium in the treatment receiving chemical fertilizers, crop residue and compost may be due to higher organic matter content which retained available K^+ on exchangeable site (Kumari *et al.*, 2017). Chesti *et al.* (2015) [4] also reported that available K status declined in almost all the treatments except 100% NPK + FYM @ 10 t ha^{-1} as compared to initial status. The increase in available potassium under irrigated treatment might be due to addition of organic matter that reduces K fixation and released K due to interaction of organic matter with clay. Similar improvement in available K status of soil with integrated use of organic and inorganic fertilizers was also reported by Jadhao *et al.*, 2019 [9].

Maximum available sulphur (S) was noticed when 150% NPK of the recommended dose was applied in conjunction with compost and crop residue and this might be due to addition of sulphur through SSP and mineralization of organic S (Pandey and Kumar, 2018). The available calcium (Ca) and magnesium (Mg) were found superior when applied with organic and inorganic fertilizer. The increase in exchangeable Ca and Mg content of soil might be due to release of these nutrients from added organic sources (Sanjivkumar, 2014) [22].

Chandel *et al.* (2014) [2] concluded that under wheat maize cropping sequence combined application of 50 kg N + 10 t FYM was found to be beneficial in increasing the ability of zinc (Zn) status in soil as compared to sole application of fertilizers. The availability of boron (B) decrease significantly with increasing level of chemical fertilizers and incorporation of compost and crop residue alone or incombination significantly increased the soil available B (Chander *et al.*, 2007) [3]. Use of FYM, wheat straw and green manure along with chemical fertilizers significantly superior over alone and or recommended dose of chemical fertilizers application (Kumari *et al.*, 2017). Kumari *et al.* (2017) reported that highest iron (Fe) and manganese (Mn) content was recorded in the treatment with the application of 50% mineral fertilizers supplemented with 50% N through FYM as compared to control.

Microbiological properties of soil

The bacterial population increased by approximately whereas the fungal population almost doubled in the INM system in comparison to recommended dose of chemical fertilizers alone. The increase in microbial population is due to the conductive soil environment formed by the organic addition, increasing the magnitude of easily degradable carbonaceous compound in the INM system supporting nutrition of soil inhabitants (Sharma *et al.*, 2017). Ghosahl and Singh (1995) reported that maximum increase in microbial biomass due to the application of FYM and inorganic fertilizers alone or incombination was observed under the manure + fertilizer treatment followed in decreasing order by manure alone and fertilizer alone.

Application of 50% recommended dose of NPK + vermicompost @ 2 t ha^{-1} resulted in highest soil dehydrogenase enzyme activity and this might be due to increased microbial activity and microbial biomass carbon in the same treatment (Kumar *et al.*, 2017).

References

1. Bhatt MK, Labanya R, Joshi HC, Pareek N, Chandra R, Raverkar KP. Long-term effects of inorganic fertilizers and FYM on soil chemical properties and yield of wheat under rice-wheat cropping system. ENVIS Himalayan Bulletin, 2017; 25:28-35.
2. Chandel BS, Singh S, Singh H, Singh V. Direct and residual effect of nutrient management in wheat maize cropping sequence. Journal of the Indian Society of Soil Science. 2014; 62(2):126-130.
3. Chander Girish, Verma TS, Sharma Sandeep. Influence of boron and farmyard manure on available boron and exchangeable calcium and their removal by cauliflower in the boron- deficient soils of Himachal Pradesh. Journal of the Indian Society of Soil Science. 2007; 55(1):62-66.
4. Chesti MH, Kohli A, Aziz M, Safi JA, Quadin NT, Peer QJ, *et al.* Effect of integrated application of inorganic and organic sources on soil properties, yield and nutrient uptake of rice in Intermediate zone of Jammu and Kashmir. Journal of the Indian Society of Soil Science. 2015; 63(1):88-92.
5. Chouhan B, Rai HK, Suryawanshi A. Assessment of chemical properties of a Vertisol under long-term fertilizer experiment in soybean-wheat cropping system. International Journal of Chemical Studies. 2017; 5(6):2107-2111.
6. Das Amaresh, Patel GG. Dynamics of soil organic carbon, bulk density and water stable aggregates in relation to yield of rice-rice crop sequence as affected by exclusive inorganic and integrated nutrient management practices. Journal of Agricultural Physics. 2012; 12(2):124-132.
7. Ghosahl Nandita, Singh KP. Effect of farmyard manure and inorganic fertilizer on the dynamics of soil microbial biomass in a tropical dryland ecosystem. Biology and Fertility of Soils. 1995; 19(2):231-238.
8. Hati KM, Mandal KG, Misra AK, Ghosh PK, Bandyopadhyay KK. Effect of inorganic fertilizer and farm yard manure on soil physical properties, root distribution and water use efficiency of soybean in Vertisols of central India. Bioresource Technology. 2006; 97(16):2182-2188.

9. Jadhao SD, Mali DV, Kharche VK, Singh Muneshwar, Bhoyar SM, Kadu PR, *et al*. Impact of Continuous Manuring and Fertilization on Changes in Soil Quality under Sorghum-Wheat Sequence on a Vertisols. Journal of the Indian Society of Soil Science. 2019 67(1):55-64.
10. Kumar Balwinder, Gupta RK, Bhandari AL. Soil fertility changes after long term application of organic manures and crop residues under rice-wheat system. Journal of the Indian Society of Soil Science. 2008; 56(1):80-85.
11. Kumar Maneesh, Rai AK, Rai Sumit, Rani Priyanka, Anjum Mohsina. Effect of integrated nutrient management on physico-chemical soil properties under rice crop in hot sub humid ecoregion of middle Gangetic plains of India. Journal of Pure and Applied Microbiology. 2018; 10(4):3051-3056.
12. Kumar S, Dahiya Rita, Kumar P, Jhorar BS. Long - term effect of organic materials and fertilizers on soil properties in pearl millet-wheat cropping system. Indian Journal of Agricultural Research. 2012; 46(2):161-166.
13. Kumar V, Saikia J, Barik N, Das T. Effect of integrated nutrient management on soil enzymes, microbial biomass carbon and microbial population under okra cultivation. International Journal of Biochemistry Research Review. 2017; 20(4):1-7.
14. Kumari G, Thakur SK, Kumar N, Mishra B. Long term effect of fertilizers, manure and lime on yield sustainability and soil organic carbon status under maize (Zea mays) –wheat (Triticum aestivum) cropping system in Alfisols. Indian Journal of Agronomy. 2013; 58(2):152-158.
15. Kumari Madhavi, Pandey, Amit Kumar, Singh Ashutosh. Effect of continuous cropping and fertilization on distribution of potassium fractions under rice-wheat cropping system in Calciorthents. Chemical Science Review and Letters. 2017; 6(24):253-2359.
16. Kumari Richa, Kumar Sunil, Kumar Rajkishore, Das Anupam, Kumariv Ragini, Choudhary CD, *et al*. Effect of long - term integrated nutrient management on crop yield, nutrition and soil fertility under rice-wheat system. Journal of Applied and Natural Science. 2017; 9(3):1801-1807.
17. Malik Sudha Sambyal, Chauhan Ramesh C, Laura JS, Kapoor Tanvi, Abhilashi Raashee, Sharma Natasha, *et al*. Influence of organic and synthetic fertilizers on soil physical properties. International Journal of Current Microbiology and Applied Sciences. 2014; 3(8):802-810.
18. Mishra VK, Sharma RB. Percolation and evaporation rates of rice field as influenced by integrated nutrient management. Journal of the Indian Society of Soil Science, 1997; 45:220-223.
19. Pandey AK, Kumar V. Long term effect of organics and inorganics fertilizers on yield, uptake and nutrition of sulphur, zinc and boron in calcareous soil. International Journal of Current Microbiology and Applied Sciences Special Issue, 2018; 7:5048-5057.
20. Ravankar HN, Gajbhiye NN, Sarap PA. Effect of organic manure and inorganic fertilizer on yield and availability of nutrient under sorghum - wheat sequence. Indian Journal of Agricultural Research. 2005; 39(2):142-145.
21. Saha Ritesh, Mishra Vinay Kumar, Majumdar Bijan, Laxminarayana K, Ghosh PK. Effect of integrated nutrient management on soil physical properties and crop productivity under a maize (Zea mays) – mustard (Brassica campestris) cropping sequence in acidic soils of Northeast India. Communications in Soil Science and Plant Analysis. 2010; 41(18):2187-2200.
22. Sanjivkumar V. Effect of integrated nutrient management on soil fertility and yield of maize crop (Zea mays) in Entic Haplustart in Tamil Nadu, India. Journal of Applied and Natural Science. 2014; 6(1):294-297.
23. Sharma MP, Bali SV, Gupta DK. Crop yield and properties of inceptisol as influenced by residue management under rice - wheat cropping sequence. Journal of the Indian Society of Soil Science. 2000; 48(3):506-509.
24. Sharma TR, Agrawal SB, Singh NK. Effect of integrated nutrient management on soil fertility, organic carbon and productivity of okra. Horticulture Society of India. 2017; 74(1):142-145.
25. Swarup A, Yaduvanshi NPS. Effect of Integrated nutrient management on soil properties and yield of rice in Alkali soils. Journal of the Indian Society of Soil Science. 2000 48(2):279-282.