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Integrated nutrient management in wheat crop: A review article

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Abstract
A review, gives concise information on Integrated Nutrient Management effects on various growth and yield attributes of wheat crop and its nutrient uptake rate by influencing the nutrient status in soil system. Soil as a source of nutrients, must be protected from all kinds of external factors, especially from the addition of fertilizers in excessive rates. Any degradation in the quality of soil can significantly produce many undesirable changes in the environment and also reduces the overall crop yield. Adoption of suitable and possible handy options available to curb its effect under wheat cultivation is highly necessary to enhance the productivity by sustaining the environment.

Keywords: INM, nutrient uptake, wheat, growth, yield etc.

Introduction
Wheat (*Triticum aestivum* L.) is one of the most important food crops in India and globally. In India it is second important staple food crop, rice being the first. It is consumed in the form of chapatis, puris, suji or rawa. Wheat grain has relatively high content of niacin and thiamine that is why wheat proteins are especially significant. Besides their significance in nutrition, they are principally concerned in providing the "glutein" which provides spongy cellular texture of bread and baked products. Wheat straw is a good source of feed for a large population of cattle in our country. Wheat grains are comparatively better source of proteins which are regularly consumed all over the India. About 10-12 percent protein is met by wheat. The demand for wheat in India by 2020 has been projected to be between 105 to 109 MT as against 72 MT production of present day. A long term imbalanced use of fertilizers like NPK and some micronutrients is adversely affecting the sustainability of agricultural production eventually causing environmental pollution. Soils which receive plant nutrients only through chemical fertilizers are showing declining productivity despite being supplied with sufficient nutrients. This can be attributed to the appearance of deficiency in secondary and micronutrients. The physical condition of the soil is deteriorated as a result of long-term use of chemical fertilizers. It also aggravates the problem of poor fertilizer nutrient use efficiency.

Integrated nutrient management
Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. The agriculture era has been changed from resource degrading to resource conserving technologies and practices which will enable help for increasing crop productivity besides maintaining soil health for future generations. The Integrated Nutrient Management provides an excellent opportunity not only for sustainability of the soil but also enhances the overall productivity. On account of continuing world energy crisis and spiralling price of chemical fertilizers, the use of organic manure as a renewable source of plant nutrients is assuming importance nowadays. The major issue for the sustainable agricultural production will be management of soil organic carbon and rational use of organic inputs such as animal manure, crop residues, green manure, sewage sludge and wastes known as integrated plant resource management. However, since organic manure cannot meet the total nutrient needs of modern agriculture, hence integrated use of nutrients from fertilizers and organic sources is highly essential in supplying the plant requirements and maintaining the soil health. Integrated nutrient management is the only possible approach in enhancing the soil productivity through a balanced use of mineral fertilizers combined with organic and biological sources of plant nutrients. It plays a vital role in improving the stock of plant nutrients in soil by increasing the efficiency of plant nutrients, thus limiting losses to the environment. It optimizes the function of the soil biosphere and ultimately sustaining the physical, chemical and biological functioning of soil.

Effect of integrated nutrient management on growth attributes
Organic and inorganic sources plays a significant role in growth parameters. The maximum plant height and number of tillers per plant was observed with (N-120, P-60, K-40, FYM-10, Zn-25 kg /ha) which was 86.43 cm and 7.33 respectively at 90 DAS (Sangma *et al*., 2017) [20]. The growth parameter (plant height) and crop dry matter were significantly affected with 100% NPK +FYM 10 t/ha treatment (Arvind *et al*., 2006) [7]. The results are in accordance with those of Singh *et al*.,

(2008) [23]. They reported that growth attributes (plant height, number of tillers and grains per spike) were significantly higher with FYM @7.5 t/ha +50% RDF + bio fertilizers treatments. The increase in plant height and number of effective tillers by INM treatments might be due to addition of nitrogen as well as other nutrients.

Effect of integrated nutrient management on yield attributes and yield

Total Dry matter accumulation, number of effective tillers, grains spike-1 and the test weight increased with the integrated use of fertilizers with vermicompost and phosphate solubilizing bacteria. Addition of vermicompost with or without PSB together with different fertilizer levels produced significantly higher grain and biological yields than the application of fertilizers alone. Maximum grain yield and biological yield were obtained with the application of 100% RDF+ vermicompost @ 1t/ha+ PSB and 75% RDF+ vermicompost @ 1t/ha+ PSB (4.89 t/ha). Similarly, the number of effective tillers, grains /spike and test weight produced by the application 100% RDF + vermicompost @ 1t/ha+ PSB and 75% RDF + vermicompost @ 1t /ha+ PSB were found to be significantly higher than the other treatments and the lowest from the control. (Devi *et al.*, 2011) [12]. Application of PSB along with organic manures or with other combinations significantly increased the number of tillers m^{-2}. These results are in line with the findings of Kumar *et al.* (1999) [3] who reported significant increase in number of plants per meter row by inoculation of *Azotobacter chrococcum* (Afzal *et al.*, (2005) [5]. A significant effects observed by INM in tillers and test weight of wheat. Among the different treatments, (75% RD + 10 t FYM/ha) registered maximum value for plant height (78.00 cm), number of effective tillers (82.77) and test weight (33.30 g 1000 $seeds^{-1}$) which was significantly more than RDF. The increase in the yield attributing characters by INM treatments might be due to addition of nitrogen as well as other nutrients and growth promoting substances through organic manure (FYM 10t/ha). Tej alben *et al.*, 2017 [5]. The yield attributes (number of ears, ear weight, 1000 seed weight) were significantly influenced with 5t/ha crop residue + 5t/ha FYM + 5 kg/ha Zn treatments. Totawat *et al*., (2001) [26]; Gawai and Pawar (2006 [13]; the 100% RDF + 5 t FYM/ha significantly gave higher wheat yield (Shivkumar and Ahlawat 2008) [22]. Parihar *et al*., (2010) [15] postulated that the FYM improving soil physical, chemical and biological properties and had synergistic relationship with N, P, thereby helping in mineralization of applied N and P helped in increasing the growth and mean while grain yield. From the above results, it can be concluded that supplementation of 75% RDF along with 10 t FYM/ha significantly improved the plant height and effective tillers which reflected in increasing grain and straw yield of wheat. Application of 150:75:00 NPK kg/ha + FYM @ 5t/ha + *Azotobacter*+ PSB + Sulphur @ 40 kg/ha (gypsum) produced a significant effect. The per cent increase in number of spikes per metre row length, length of spike and number of grains per spike were 34.35%, 28% and 31% respectively over the RDF 120:60:00 NPK kg/ha (Desai *et al*., 2015) [11]. Similar results were obtained by Singh, *et al.*, 2008 [23], Pandey *et al.*, 2009 [14], Mubrak and Singh, 2011 and Ali *et al.*, 2012. The magnitude of increase under the treatment [150:75:00 NPK kg/ha + FYM @ 5 t/ha + Azotobacter+ PSB + Sulphur @ 40 kg/ha (gypsum)] was 31.61% and 33.80% respectively with respect to grain and straw yield as compared to the treatment 120:60:00 NPK kg/ha (RDF)]. This is might be due to combined effect of organic manure (FYM), bio-fertilizers and chemical fertilizers with sulphur in balanced proportion played a very vital role in decomposition and easy release of different nutrients and their uptake by the crop which led to higher dry matter accumulation and its translocation in different plant parts of growth and yield parameters, which in turn resulted into higher yield (Desai *et al*., 2015) [11]. These results are in complete agreement with those of Pandey *et al*., 2009 [14], Sepat *et al*., 2010 [21]. The highest mean number of grains per spike (61.42), 1000 grain weight (44.76g), grain yield (50.93 q/ha) and straw yield (126.76 q/ha) were recorded in the treatment in which 100% N, P & K was clubbed with FYM and Zn. The lowest mean number of grains per spike (50.74), 1000 grain weight (42.66g), grain yield (40.51) q/ha) and straw yield (82.90 q/ha) were recorded with control (Sangma *et al*. 2017) [20]. Choudhary *et al*., (2003) [8] also documented the significant effect of INM on yield attributes. The combination of organic and inorganic N sources resulted in comparable rice yield to the application of inorganic nitrogen alone Rao *et al.*, (1996) [16]. The greatest grain yield of wheat was found with inoculation of bacteria Saad and Hamimad (1998) [4]. Application of phosphate solubilizing micro-organism in combination with phosphorus fertilizer and organic manure significantly improved grain and biological yield of wheat (Afzal *et al.* 2005) [5]. The grain and straw yield increased significantly due to various treatments over control. Grain yield further increased significantly when N-150 P-60 K-60 combined single either with FYM, sulphur or boron over sole use of N-150 P-60 K-60. Reducing the dose of NPK of recommended dose (N-150 P-60 K-60) by 25% and combining with Sulphur + boron +FYM significantly increased grain yield over sole use of N-150 P-60 K-60 and also significantly increased the straw yield over sole use of N-150 P-60 K-60. Highest grain 45.26 q/ha& straw yield 56.94 q/ha were noted with (75% NPK+S+B+10t FYM). The yield increase may be due to addition of individual FYM, sulphur or boron with 100% NPK (N-150 P-60 K-60), significantly influenced plant growth compared to sole NPK source. Increase grain & straw yield due to integrated use of FYM, sulphur and boron with 75% NPK may be due to synergistic effect of all inputs when combined together with 75% NPK (Reena *et al*., 2017) [19]. Similar results also reported by Reddy *et al.* 2009 [14] and Singh & Kumar 2010 [24].

Effect of integrated nutrient management on nutrient uptake

Application of vermicompost and PSB with fertilizer levels significantly increased the NPK uptake by the crop than the application of fertilizers alone or vermicompost alone. Maximum NPK uptake by the crop was recorded from 75% RDF + vermicompost @ 1t /ha + PSB and 100% RDF + vermicompost @ 1t /ha + PSB. The increased uptake of the nutrients was due to added supply of nutrient and well developed root system resulting in better absorption of water and nutrient (Devi *et al.*, 2011) [12]. These results are in agreement with the findings of Datt *et al*., (2003) [9]. The total (G+S) uptake of nutrients in question (NPKS&B) increased significantly due to various treatments over sole application of N-150, P-60, K-60 during both years. Maximum total uptake of NPK, S&B were observed with (75% NPK +S+B+10t FYM) and the NPK and S uptake were 101.21,31.60,79.15 & 21.56 kg ha^{-1} respectively during 1st year and corresponding uptake during 2nd year were 103.98,33.58,86.16,22.28 kg/ha. The boron uptake were 771.85 & 803.36 g /ha during 1st& 2nd year respectively at (75% NPK +S+B+10t FYM). The increase in uptake may be due to release of more native nutrients from the soil and transport to the plant body by combine use of S+B+FYM with 75%NPK. Similarly single use of sulphur, boron or FYM with 100% NPK (N-150, P-60, K-60) increased total nutrient uptake during both years (Reena *et al*., 2017) [19]. The results are correlated with the findings of Rathar & Sharma 2010. This may be due to yield attributes and yield of wheat increased due to use of S,B and FYM single with N-150, P-60, K-60& combine with 75% NPK and concentration of nutrient in grain & straw both increased with the use of S,B & FYM with inorganic fertilizer alone or conjoint use of all with 75% NPK. Nutrient uptake is a product of yield &concentration of nutrients. This finding is in line with the findings by Natan & Anurag (2011) [1].

Effect of integrated nutrient management on soil nutrient status

Application of vermicompost + PSB along with fertilizer levels significantly increased the available nitrogen, phosphorus and potash status of the soil. Available NPK of soil after the harvest of wheat were found to be maximum with the application of 100% RDF + vermicompost @ 1t /ha + PSB and 75% RDF +vermicompost @ 1t /ha + PSB and the lowest from control (Devi *et al*., 2011) [12]. Pandey *et al*., (2009) [14] also reported that addition of organic manure (l0t FYM) with fertilizer levels significantly increased the nutrient uptake by wheat, improved the organic carbon content N, P and K status as compared to chemical fertilizer alone. The increase in nitrogen, phosphorus and potash status of the soil is due to the application of vermicompost and PSB which enhances the activity of some microbial populations.

Conclusion

A review paper, it may be concluded that the wide spread nutrient deficiencies or toxicities are deteriorating the soil health day by day. Due to this, there is a low productivity &profitability in cereal crops; majorly driven by the low nutrient use efficiency. A judicious use of chemical fertilizers in combination with naturally available organic sources gives a breakthrough effect in maintaining the soil health and sustaining the environment. Thus, the adoption of INM practices involving major, secondary and micronutrients, organic manures, bio fertilizers and amendments in wheat cultivation enriches the soil fertility status and also accelerates the nutrient uptake; ultimately improves growth and yield attributes of crop and the quality of food as well.

References

1. Netam UP, Anurag CR. Residual effect of organic and inorganic fertilizer nutrients on sulphur content and uptake in wheat crop under rice-wheat cropping system. Journal of Soils and Crops. 2011; 21(10):82-85.
2. Mubarak T, Singh KN. Nutrient management and productivity of wheat (*Triticumaestivum* L.)- based cropping system in temperate zone. Indian Journal of Agronomy. 2011; 56(3):176-181.
3. Kumar V, Punia SS, Lakshminarayan K, Narula N. Effect of phosphate solubilizing analogue resistant mutants of *Azotobacter chroococcum* on sorghum. Indian Journal of Agricultural Sciences. 1999; 69:198-00.
4. Saad A, Hammad AMM. Fertilizing wheat plants with rock phosphate combined with phosphate dissolving bacteria and V. *Arnicorrhizae*as alternate for ca-superphosphate. Ann. Agric. Sci. Cairo. 1998; 43:445-60.
5. Afzal A, Ashraf M, Saeed AA, Farooq M. Effect of phosphate solubilizing microorganisms on phosphorus uptake, yield and yield traits of wheat (*Triticumaestivum* L.) in rainfed area. International Journal of Agriculture and Biology. 2005; 7:207-09.
6. Ali A, Arshadullah M, Ishtiaq HS, Ali MI. Effect of different levels of sulphur on the productivity of wheat in a saline sodic soil. Soil Environment. 2012; 31(1):91-95.
7. Arvind V, Nepalia V, Kanthaliya PC. Effect of integrated nutrient supply on growth, yield and nutrient uptake by Maize (*Zea-may* L.) - wheat (*Triticumaestivum* L.) cropping system. Indian journal of Agronomy. 2006; 51(1):3-6.
8. Choudhary PD, Jat RS, Sharma HS. Integrated effect of Phosphorus, Sulphur and PSB inoculation on growth yield and nutrient uptake of wheat. Annals of Agricultural Research. 2003; 24(1):12-16.
9. Datt N, Sharma RP, Sharma GD. Effect of supplementary, use of farmyard manure a long with chemical fertilizers on productivity and nutrient uptake
10. Lahualvalley of Himachal Pradesh. Indian Journal of Agricultural Sciences. 2003; 73:266-68.
11. Desai HA, Dodia IN, Desai CK, Patel MD, Patel HK. Integrated Nutrient Management in Wheat (*Triticumaestivum* L.) Trends in Biosciences. 2015; 8(2):472-475.
12. Devi KN, Singh MS, Singh NG, Athokpam HS. Effect of integrated nutrient management on growth and yield of wheat (*Triticumaestivum* L.) Journal of Crop and Weed. 2011; 7(2):23-27.
13. Gawai PP, Pawar VS. Integrated nutrient management in sorghum (*Sorghum bicolor*) – chickpea (*Cicerarietinum*) cropping sequence under irrigated conditions. Indian journal of Agronomy. 2006; 51(10):17-20.
14. Pandey IB, Dwivedi DK, Pandey RK. Integrated nutrient management for sustaining wheat (*Triticumaestivum* L.) production under late sown condition. Indian Journal of Agronomy. 2009; 54(3):306-309.
15. Parihar CM, Rana KS, Jat SL, Singh AK, Sigh DK, Pushpendra K. Effect of land configuration and nutrient management on productivity, economics and energy requirement of pearlmillet (*Pennisetumglaucum*)-mustad (*Brassica juncea*) cropping system. Ann. Agric. Res. New Series. 2010; 31(3&4):102-106.
16. Rao KS, Moorthy BTS, Pandalia CR. Efficient nitrogen management for sustained productivity in lowland rice

(*Oryza sativa*). Indian Journal of Agronomy. 1996; 41:215-20.
17. Rather SA, Sharma NL. Effect of integrated nutrient management (INM) on productivity and nutrient in wheat and soil fertility. Asian Journal of Soil Science. 2010; 4(2):208-210.
18. Reddy AR, Singh Balwan, Narwal RP. Effect of long term FYM and nitrogen application in bajra-wheat cropping system on yield and uptake of sulphur, iron and manganese by wheat crop. Annals of Biology. 2009; 25(2):113-120.
19. Reena, Pandey SB, Tiwari DD, Nigam RC, Singh AK, Kumar S. Effect of Integrated Nutrient Management on Yield and Nutrients Uptake of wheat and Soil Health. International Archive of Applied Sciences and Technology. 2017; 8(3):25-28.
20. Sangma B, David AA, Thomas T. Response of Integrated Nutrient on Soil Health (Physico-Chemical Properties) and Yield of Wheat (*Triticumaestivum* L.). International Journal for Scientific Research & Development. 2017; 5(3):865-870.
21. Sepat RN, Rai RK, Dhar S. planting systems an (*Triticum aestivum* L.) productivity. Indian Journal of Agronomy. 2010; 55(2):114-118.
22. Shivakumar BG, Ahlawat IPS. Integrated nutrient management in soybean (*Glycine max*)-wheat (*Triticumaestivum*) cropping system. Indian Journal of Agronomy. 2008; 53(4):273-278.
23. Singh R, Singh B, Patidar M. Effect of preceding crops and nutrient management on productivity of wheat (*Triticumaestivum* L.) based cropping system in aridregion. Indian Journal of Agronomy. 2008; 53(4):267-272.
24. Singh RV, Kumar R. Effect of organic and inorganic fertilizers on growth yield and quality and nutrients uptake of wheat under late sown condition. Progressive Agriculture. 2010; 10(2):341-344.
25. Tejalben PG, Patel KC, Vimal PN. Effect of integrated nutrient management on yield attributes and yield of wheat (*Triticumaestivum* L.) International Journal of Chemical Studies. 2017; 5(4):1366-1369.
26. Totawat KL, Jangir RK, Nagar GL, Jat SL. Effect of flyash on the performance of wheat on Ustochrepts of sub – humid plains of India, 2001-2002.