

Effect of Bio-fertilizers & Chemical fertilizers on productivity & quality parameters of Wheat: A Review

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Abstract

Plant nutrient plays significant role in the production of the crop as well as for the environment. The use of organic and inorganic fertilizers for the production of wheat crop is excellent. The only use of chemical fertilizers have disadvantages because they are not ecological friendly they pollutes our environment as well as kills the useful soil microorganisms, while on the other hand the use of biofertilizers are very beneficial for the crop growth and these are environmental friendly because they do not pollute our environment. The combined use of farmyard manure, chemical fertilizer and bio-fertilizer has beneficial effect on crop plants. The use of farmyard manure is very good because it increases the water holding capacity of soil, improves the infiltration rate of water. As a whole it increases the water holding capacity of soils. The research on various aspects of integrated nutrient on wheat is received.

Keywords: *Fertilizers, Nutrients, Microorganisms, Wheat.*

Date of Submission: 18-08-2022

Date of acceptance: 02-09-2022

I. Introduction

Wheat is the most important cereal crop worldwide and meets about two-third of the protein-energy needs of the world population 1. It is grown organically as well as inorganically, The demand of organically grown wheat is increasing in the world due to its high nutritional value 2. Organic farming has received attention during the last two decades due to its high-quality products 3, high price, and low market availability of inorganic fertilizers, especially in developing countries like Pakistan. Certified organic grains have higher values than inorganic products 4. Similarly, organic cropping system has higher nutrient use efficiency than conventional system 5. In contrast to mineral fertilizers, the organic manures add organic matter to soil improving its fertility, microbial activity, and water infiltration moisture holding capacity 6.

In most countries, agricultural systems are often incapable of supplying adequate micronutrients to efficiently attain the requirements of their populations 7. It is partially due to increasing grain yield demand from agricultural systems over the past 50 years. Therefore, to fill the gap between demand and supply, cropping intensity and fertilizer application have increased resulting in reduction of soil fertility 8. Moreover, excessive chemical fertilizers applications in an agricultural system may negatively affect surface water, groundwater, and atmosphere through leaching, runoff, and volatilization of nitrogen (N), respectively 9.

II. Literature Review

Effect of Bio-Organic fertilizers on wheat

Bio-fertilizers being essential components of organic farming play vital role in maintaining long term soil fertility and sustainability by fixing atmospheric nitrogen. Keep the soil environment rich in all kinds of micro- and macro-nutrients via nitrogen fixation, phosphate and potassium solubilization or mineralization, release of plant growth regulating substances, production of antibiotics and biodegradation of organic matter in the soil 10. These also play very important role to enhance the growth as well as the yield of crop plants. They involves in various biotic activities and sustainable for crop production 11. In the past the use of nitrogen fertilizers, green revolution, mono-cropping systems use to obtain maximum yield in less time. But now days there is judicious use of chemical fertilizers with nitrogen fixing inoculants and Rhizobium 12. Bio-fertilizers bring down the cost of chemical fertilizers e.g phosphorous, nitrogen and potassium. Bio-fertilizers contains microscopic microorganisms which are used as fertilizers for the growth of plants e.g *Azospirillum sp.* and *Azotobacter sp* 13. *Azotobacter* plays a very important role in the growth of plants especially it improves the yield of wheat. It is evident the bio-fertilizers like *Azotobacter* in combination have great prospect for increasing productivity of wheat. When seeds are inoculated with bio-fertilizers, they multiply and participate in nutrient cycling and improved crop productivity 14. Bio-fertilizers are the safe alternative to the use of chemical fertilizers because these are environmental friendly and they do not have any effect on animals and human

beings and they also help in the reduction of pollution from the environment. If bio-fertilizer apply to any crop it improves the absorption availability of many nutrients to plant, create resistance to root diseases, it reduce the 25% of nitrogen requirement to the plants 15.

The integrated use of bio-fertilizer and inorganic sources increase the yield of crop plants as well as the properties of soil may also improves. 16. The combine use of organic fertilizer, chemical fertilizer and bio-fertilizers all are increase the physical properties of soil as well as the structure of soil also improve 17. The optimum uses of fertilizers are achieved to maintain the balance management of crop for better yield 18. If the wheat seed was inoculated with *Azotobacter* it increases the yield up to 1.92 – 2.0 % as compared to non-inoculated seed 19. The use of plant growth promoting rhizobacteria which containing the strains of ACC-deaminase (*Pseudomonas fragi*, *Pseudomonas Jessenii*, *Serratia Fonticola*) and rhizobium under the anoxic condition increases the yield of lentil. It increases the number of pods per plant, no of nodules per plant, dry nodules weight, grain yield and straw yield up to 76%, 196%, 109%, 150% and 164 % under the pot experiment 20. There are many reports available on legume inoculation with rhizobium increase the yield and growth and growth of legume crop 21. Inoculation of *Azospirillum* plus PSB significantly recorded 23.2 and 11.9, 21.6 and 9.9, 32.3 and 15.7 % higher grain and straw yield and net returns over control and *Azospirillum* correspondingly in wheat crop 22. Tillering boosted significantly due to application of biofertilizers either alone or in combination. Similar trend was found in yield components of wheat i.e. ears/m², grains/ ear and 1000 grain weight (g) enlarged significantly when the crop received bio-fertilizers either alone or combined 23.

Organic Manure

Organic manures are keys to enhance soil quality and crop yield since they perform numerous functions in agroecosystems 24. Their inputs are in general beneficial for the overall health of the agroenvironment 25. Organic sources of nutrients include farmyard manure (FYM) generated from sheep, poultry litter (PL), green manures, sewage sludge, and press mud 26. Municipal solid-waste compost, FM and chemical fertilizers have been tested previously for their beneficial role for wheat growth and soil bacterial characteristics under arid climatic condition 27.

Preparation of Farmyard Manure (FYM)

Farmyard manure prepared in the pits under the shed. Its width about two meters wide, depth not more than 90 centimeters and length about seven meters. In the pit the cow dung, urain, leaf litters, when this section is filled up to 60 centimeters above the ground level plastered with the dung of cow soil-slurry. The pit is containing farmyard manure and it ready for the field.

Effect of FYM on Yield of Wheat

Farm yard manure is very important for the growth of plants. It improves the soil physical properties; increase the infiltration rate and soil absorb maximum quantity of water. Farmyard manure is environmental friendly it do not have any bad effect on soils and crops and it helps in the uptake of nutrients as well 28. The yield of wheat was obtained maximum when nitrogen and farmyard manure was applied as 75:25, the biological (10952 kg-1ha) straw (7710 kg-1ha) and grain (3242 kg-1ha) yield of wheat was obtained 29. The yield of maize was obtained maximum when 25% poultry manure + 75% mineral nitrogen added; due to this 1000 grain weight was high due to the application of poultry manure and mineral nitrogen, also the use of farmyard manure (FYM) + poultry manure (PU) + vermicompost (VC) and seed inoculation with *Azotobacter* increases the shoot, plant height, dry matter, leaf area index and as a whole increase the yield of potatoes from 240.07 q-1ha in the year respectively. The use of different combination of farmyard manure + Green manure + NPK increases the yield of rice such that the use of farmyard manure @ 12.5 t-1ha; NPK @ 66 – 42-31 kg N, P₂O₅, K₂O t-1ha; green manure @ 12.5 t-1ha give maximum yield of rice 30. While the use of inorganic fertilizers like green manure, crop residue, poultry manure and farm yard manure plays an vital role in the physical properties of soil and reducing the bulk density of soil as well and significantly very important for the wheat crop it increases the grain weight as kg grains/tones in a year 31.

Effect of Chemical Fertilizers on productivity of Wheat

Chemical fertilizers place an important role in the growth of any crop plants. These have beneficial effect on the growth and biological yield of plants but on the other hand chemical fertilizers have some disadvantages they pollute our environment and also damage the surface of soil. The use of chemical fertilizers with organic fertilizers had beneficial effect on crop growth and soil health as compared to the alone use of organic fertilizers 32. While the alone use of chemical fertilizers were also non-significant; thus the use of organic matter + chemical fertilizers increases the absorption of NPK in several ratoon crops and sugarcane crop 33.

The increase in yield and yield parameters of wheat with the increase in successive N levels from 0, 60, 120 and 180 kg N ha⁻¹. Increase in grain yield was from 27 to 81 % at N rates of 120 and 180 kg ha⁻¹,

respectively 34. Presently, DAP is the major source of P used in wheat in South Asia; it accounts for nearly 65% of the P used in India. The other sources of P are SSP, ammonium nitro phosphates (ANP), and compound fertilizers. The efficiency of a P source varies depending upon proportion of water soluble P and soil properties such as pH. In neutral to alkaline soils; materials containing water-soluble P have proved more efficient than materials containing citric acid-soluble or citric acid-insoluble P, Muriate of potash (KCl) is the major fertilizer K source for wheat because of its low cost and high K analysis. At planting of wheat, fertilizer K is generally applied by drilling, placement or broadcast followed by incorporation. Application of full dose of K at planting of wheat is the commonly followed practice in South Asian wheat growing regions. As sustained supply of K is necessary up to heading stage, split application of fertilizer potassium in wheat in coarse-textured soils may give higher K use efficiency than its single application due to reduction in leaching losses and luxury consumption of K have cited several references showing a distinct benefit of applying fertilizer K in split doses. In a sandy loam soil, obtained a wheat yield advantage of 440-490 kg grain/ ha by split application of fertilizer K over single application 35.

Combined Effect of Farmyard Manure, Bio-fertilizers and Chemical Fertilizers on Wheat productivity

The combined use of chemical fertilizer, farmyard manure and biofertilizer plays a significant role on the growth of crop plants. Almost the combined use have significant effect on crop growth as compared to the alone use of chemical fertilizers. The use of 25 % nitrogen + 25 farmyard manure / poultry manure / city waste + 50 % NPK increase the grain yield of 3.5 t-1ha in wheat 36. The combined use of *Arbuscular mycorrhizal* fungi, plant growth promoting rhizobacteria (PGPR) *Bacillus polymyxa*, *Azospirillum* mixed with phosphorous increased the growth of crop plants 37. The application of farmyard manure @ 5 and 10 t-1ha to the wheat crop it increases the yield of crop 38. The use of farmyard manure 15 t-1ha + 100% NPK increases the yield of wheat crop as compared to the use of 75% NPK + 15% farmyard manure 39. The application 100% NPK + farmyard manure @ 10 t-1ha increases the biological parameters like soil microbial biomass dehydrogenises activity 9.8 and 9.0 % 40. The use of 100 % NPK + 50 % nitrogen has beneficial effect on plant height and dry matter in wheat 41. The use of chemical fertilizers + farmyard manure + organic fertilizers increases the yield of crop. The use of farmyard manure + chemical fertilizers increase the absorption of NPK which is present in the soil as compare to the alone use of chemical fertilizers. Efficient plant nutrient management plays an important role in the growth of plants as well as has no any bad effect on the environment. The addition of different fertilizers like organic fertilizers, chemical fertilizers have some advantages and disadvantages while the use of farmyard manure, green manure, poultry manure, city waste and bio-fertilizers have no any negative impact on soil and environment 42.

III. Conclusion

As per above sited assessments on diverse features of wheat it is determined that use of bio-fertilizers in the wheat crop not only improve wheat productivity but also improve the soil health. Use of bio-fertilizers in agriculture will have greater influence on organic agriculture and also on the control of environmental pollution, soil health development and decrease in input use. So, the combined application or the single use of bio-fertilizers also improved quality of grain and can be considered as the beneficial for the growth and yield of wheat.

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