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Effect of chemical and biofertilizers on yield attributes of wheat (*Triticum aestivum* L.)

VK Singh, Rajesh Kumar, Rajesh Dutt Singh, Alok Kumar Singh and Dileep Kumar Gupta

Abstract
The field experiment was conducted during Rabi season of 2019-20 at the Research farm Brahmanand Post Graduate College Rath (Hamirpur) U.P. to evaluate the effect of chemical and bio-fertilizers on yield attributes of wheat (*Triticum aestivum* L.). There were three chemical levels including control i.e. C_0 (control), C_1 (60:30:30 kg NPK ha^1) and C_2 (120:60:60 kg NPK ha^{-1}) and five bio-fertilizers including control *viz*; B_0 (control), B_1 (Biopline @ 1.00 litre ha^{-1}), B_2 (Phosfert @ 0.375 litre ha^{-1}), B_3 (Vitromone @ 2.5 litre ha^{-1}) and B_4 (Biopline @ 1.00 litre + Phosfert @ 0.375 + Vitromone @ 2.5 litre ha^{-1}) were arranged in factorial R.B.D design with three replications. Amongst the chemical levels, the C_2 (120:60:60 kg NPK ha^{-1}) and Bio- fertilizers B_4 (Biopline @ 1.00 + Phosfert @ 0.375+ Vitromone @ 2.5 litre ha^{-1}) were found to Produce higher values of yield attributes such as number of effective tillers plant^{-1}, average length of ear, average weight ear^{-1}, number of grains ear^{-1}, average of ear, average weight of grains ear^{-1} and number of fertile spikelets spike^{-1}.
The B_4 treatment (biopline @ 1.00 + phosfert @ 0.375 + vitromone @ 2.5 litre ha^{-1}) was found to produced the maximum values of yield attributes over all the treatments. The interaction effect of chemical and bio-fertilizers was recorded significant on average weight of ear, average weight of grains ear^{-1}, sterile spikelets ear^{-1} and test weight.

Keywords: Chemical, biofertilizers, yield attributes, wheat, *Triticum aestivum* L.

Introduction
Wheat is the most important crop both in regard to its antiquity and as source of human food. Wheat serves as a staple food for about billions on people in most of the countries of the world. It provides about 20 percent of the total food calories for the human race. Wheat is grown primarily for the grain which is ground and utilized in the form of flour or whole meal called "Atta" for the manufacturing of various kind of food. The flour is the principal ingredient in many kinds of breads, checks, cookies breakfast cereals etc. It is also an ingredient in noodles, pancakes ice-cream canes and baby foods. In the industry the wheat grain in used for the manufacturing of pastes, alcohol, oil and gluten. The wheat straw forms an important ingredient of dry fodder for cattle in India.
In the last five decades fertilizers have played an important role in making country self sufficient in food production. Urea is widely used as nitrogenous fertilizers and contributes about 80 percent of 'N' produced in India.
No doubt modern crop production technology has considerably raised output but has created problems of land degradation, pesticide residues in farm produce, gene erosion atmospheric and water pollution. The natural resource base is degraded and diminished quality of the environment sustaining human life is adversely affected. The task of meeting the needs of the present generation without eroding the ecological assets of the future generations is receiving top priority by environment planners.
Considering the above facts under sustainable agriculture the bio fertilizers are getting prime importance in modern agriculture because of their low coast, high use efficiency and least damage to ecosystem. Bio- fertilizer, a preparation of living micro organism, plays significant role as one of the important component of IPNS (integrated plant nutrient system) system in maintaining soil fertility and increasing crop productivity. There are a number of bio-fertilizers like Rhizobium, Azotobacter, Azospirillum, Blue green algae, phosphate solubilising bacteria and microbes, which have already been recognized as essential input for plant from nutritional point of view. First commercial bio-fertilizer started as Rhizobium in 1895 with the product 'nitragin' in U.S.A. in India, use of Rhizobium inoculants was initiated

in 1920, but systematic production began after 1950 with gradual introduction of other bio fertilizers.

There are more than 130 bio- fertilizers production units in the country who are producing and supplying different bio-fertilizers.

The Government of India is taking needful action to promote organic farming throughout the country. In the initial stage of conversion from chemical farming to organic farming supplemental fertilizer application is necessary until equilibrium of nutrient cycle are established.

The present study was carried out to work out the suitable amount of chemical and bio-fertilizers for obtaining maximum yield of wheat under Bundelkhand conditions.

Materials and Methods

The experiment was carried out at the Research farm of Brahmanand post Graduate college, Rath, Hamirpur (U.P.) during the Rabi season of 2019-20 with three chemical levels including control i.e. Co (Control), C_1 (60:30:30 kg NPK ha^{-1}) and C_2 (120:60:60 kg NPK ha^{-1}) and five bio -fertilizers including control *viz*; Bo (Control), B_1 (Biopline @ 1.00 litre ha^{-1}) B_2 (Phosfert @ 0.375 litre ha^{-1}), B_3 (Vitromone @ 2.5 litre ha^{-1}) and B_4 (Biopline @ 1.00 litre+Phosfert @ 0.375 litre + Vitromone @ 2.5 litre ha^{-1}). The above treatments were tried in all possible combinations and arranged in Randomized Block Design with three replications. The soil of the experimental site was silty loam in texture having 0.54% organic carbon, 0.061% available nitrogen, 26.5 kg ha^{-1} available phosphorus, 205.00 kg ha^{-1} available potassium and pH was 7.7. Line sowing of var. K-8434 was done on 22th October 2019 at 22.5 cm apart. The distance between plant to plant was kept 3-5 cm. The application of fertilizers were done as per treatments in case of chemical fertilizers the full dose of phosphorus and Potash were applied as basal in furrows along with 1/3 part of nitrogen. Remaining 2/3 part of nitrogen was divided into two equal parts that is i.e. that 1/3rd nitrogen was top dress at the time of S.R.I. and 1/3rd at the Panical initiation stage after irrigation. Bio- fertilizer are also applied as Biopline @ 1 litre ha^{-1} was sprayed at 30 DAS (1 litre Biopline + 500 litre of water), Phosfert @ 0.375 litre ha^{-1} with 500 litre of water at 7 DAS, Vitromone @ 2.5 litre ha^{-1} with 500 litre of water at 7 DAS and Biopline @ 1 litre ha^{-1} at 30 DAS+ phosfert @ 0.375 litre ha at 7 DAS + vitromone @ 2.5 litre ha^{-1} at 7 DAS sprayed with the addition of 500 litre of water.

Result and Discussion

Effect of chemical fertilizers

The yield attributes such as number of effective tiller plant^{-1}, average length of ear, average weight of ear, average number of grains ear^{-1}, average weight of grains ear^{-1}, average number of spikelets spike^{-1} (fertile and sterile) and test weight were found to differ significantly. The maximum values of above parameters were recorded with C_2 (120:60:60 kg NPK ha^{-1}) level of chemical fertilizers which was significantly higher over lower levels except number of sterile spikelets and 1000 grain weight. The significantly lowest values were recorded with C_0 (Control). It may be due to the role of nitrogen, phosphorous and potash in plant growth which ultimately results higher values of yield attributes. The result are in conformity with those Brij Mohan *et al*. (2018) [2], B.H. Panchal (2018) [1], Upadhyay and Dubey (1991) [8], Maliwal *et al*. (1992) [6] and Das *et al*. (2001) [3].

Table 1: Yield Attributes as affected by chemical and bio fertilizers

Treatment	No. of effective tiller plant^{-1}	Average length of ear (cm.)	Average weight ear (g)	No. of grains ear^{-1}	Average weight of grains ear^{-1} (g)	Average number of spikelets spike^{-1}		Test weight (1000) grain weight (g)
						Fertile	Sterile	
Chemical Fertilizers								
C_0 (Control)	2.63	7.87	1.83	32.56	1.27	10.91	0.69	39.06
C_1 (60:30:30)	3.30	8.64	1.98	35.84	1.42	11.79	0.55	39.57
C_2 (120:60:60)	3.39	8.86	2.04	36.77	1.48	12.11	0.49	40.16
S.E(d) +	0.06	0.072	0.012	0.86	0.012	0.14	0.68	0.41
C.D. at 5%	0.17	0.15	0.024	0.84	0.024	0.29	0.11	0.86
Bio-Fertilizers								
B_0 (Control)	2.78	7.59	1.74	31.48	1.00	10.08	0.67	34.90
B_1 (Biopline)	3.30	7.98	1.86	33.12	1.25	11.01	0.68	37.80
B_2 (Phosfert)	3.22	8.74	1.99	36.26	1.44	12.10	0.66	39.72
B_3 (Vitromone)	2.89	8.94	2.07	37.13	1.57	12.37	0.42	42.20
B_4 (Biopline+Phosfert+Vitromone)	3.37	8.99	2.09	37.33	1.62	12.43	0.46	43.22
S.E(d) +	0.11	0.083	0.015	0.69	0.015	0.183.	0.72	0.64
C.D. at 5%	0.22	0.18	0.030	1.21	0.031	0.38	0.148	1.10

Effect of Bio-fertilizers

Table – 1 show all the yield attributing characters such as number of effective tillers plant^{-1}, average length of ear, average weight of ear, average number of grain ear^{-1}, average weight of grains ear^{-1}, number of fertile spikelts spike^{-1} and test weight were found maximum with B_4 (Biopline @ 1.0 litre + Phosfert @ 0.375 litre + Vitromone @ 2.5 litre ha^{-1}). The minimum sterile spikelets spike^{-1} was recorded with B_3 (Vitromone @ 2.5 litre ha^{-1}). The increase in all yield attributing characters may be due impact of bio-fertilizers which leads proper plant growth similar results were also reported by Ramhari *et al*. (2021) [7], Vishal Guleria *et al*. (2021) [9], Ghosh (1996-97) [4] and Gosh (1997-98) [5].

Interaction effect

The Significant interaction effect were observed for average weight of ear, number of sterile spikelets spike^{-1}, average weight of grains and test weight only.

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