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Effect of biofertilizers seed treatment on growth and yield of wheat in North-Western Plain Zone

Avdhesh Pratap Singh*[1], Archana Verma[1], Rajpal Singh[2] and Rohit Kumar[3]

[1]Department of Agricultural Chemistry, Amar Singh College, Lakhaoti, Bulandshahr 203 407, U.P., India
[2]Department of Agronomy, Amar Singh College, Lakhaoti, Bulandshahr 203 407, U.P., India
[3]Faculty of Agricultural Science, GLA University, Mathura 281 404, U.P., India

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ABSTRACT

A field Experiment was carried out to study the effect of biofertilizers on growth and yield of wheat at agriculture farm of Amar Singh College, Lakhaoti, Bulandshahr. In the experiment, six treatments were undertaken where different doses and types of biofertilizers and decomposers viz., seed treatment without any inoculant (T_1), seed treatment with Azotobactor (T_2), soil treatment with PSB (T_3), soil treatment with Azotobacter + PSB (T_4), soil treatment with Pusa decomposer (T_5), seed treatment with Azotobactor + PSB + Pusa decomposer (T_6) were studied. It was found that growth parameters, which were plant height (cm), dry weight (g), number of tillers, number of spikes per plant, grains per spike was found significantly higher under the effect of T_6, where Azotobactor, PSB and Pusa decomposer were applied in combined manner. Grain yield and straw yield was also found to be significantly higher under the effect of T_6.

Key words: *Biofertilizers, Decomposer, PSB, Azotobactor, Pusa decomposer etc.*

Introduction

Wheat is one of the most important cereal crops in India and is grown in about 30 mha of area which is approximately 14% of the global area .The total wheat production in India is estimated to be 112.18 million tonnes, which is higher by 4.44 million tonnes than the production achieved during, 2021-22 (Ministry of Agriculture and Farmers Welfare).

The population all around the world is on hike while the food production is quite stagnant. Thus, to meet the increasing demand of the raising population scientists are now focusing towards the techniques that can lead to increase in food production. Due to climate change, increased population pressure and detrimental environmental impacts on agriculture fields are constantly facing many detrimental effects, which finally lead to scarcity of food production. To overcome the situation, new mechanism must be developed to meet the increased food demands with sustainable food production that has the potentiality to provide adequate food nutrition without hampering the fields. One such mechanism that is used to meet the agricultural need is "Biofertilizer". The dependency on the increased dose of inorganic fertilizer for higher productivity can be reduced. Among the benefits of using bioferilizers is the reduction in cost of cultivation as compared with the use of full dose of inorganic fertilizers (Zaveri and Lobel, 2019).

Use of biofertilizer in crop not only fixes the biological nitrogen but also solubilizes the insoluble phosphates in soil and thus improves fertilizers-use efficiency (MeCarty *et al.*, 2017). These microorgan-

isms play an important role in increasing the availability of N, P and K. Keeping this in view, present investigation was undertaken to find out effect of consortium of Azotobacter, PSB and Pusa decomposer on yield of wheat.

Materials and Methods

The research was carried out during *Rabi season* of the year 2019-20 at agriculture farm of Amar Singh College, Lakhaoti, Bulandshahr. The field trial consisted of 6 biofertilizer treatments viz., seed treatment without any inoculant (T_1), seed treatment with Azotobactor (T_2), soil treatment with PSB (T_3), soil treatment with Azotobactor + PSB (T_4), soil treatment with Pusa decomposer (T_5), soil treatment with Azotobactor + PSB + Pusa decomposer(T_6).The six treatments including one control were tested using 4 replicates in RBD to assess the growth and yield of wheat at different levels in a plot size of 3 x 4 m^2(each plot). Seed treatments were used for assessing the plant growth and yield.

The soil had a sandy loam texture with organic carbon content of 0.47 percent. pH, EC, available N, available P and available K content were 7.78, 0.53 mmhos/cm at 25 °C, 213.3 kg ha^{-1}, 14.5 kg ha^{-1} and 187.2 kg ha^{-1} respectively.

The growth and yield attributes were recorded viz. Plant height (cm), No. of Tillers/meter row length,, No. of spiklets/spike, No. of grains/Spike, Grain yield, straw yield and 100 grain weight to know the influence of the inoculants.

Results and Discussion

In the present study, seed and soil treatment with different biofertilizer exhibit significant effect on growth, yield and soil parameters. Various growth parameters such as plant height, number of tillers, number of spikelets per spike and number of seeds per spike are present in Table 1. Plant height increased with the advancement in crop growth. Plant height was found non-significant in initial growth period but at the time of harvesting, plant height was significantly higher under the combined effect of Azotobactor, PSB and Pusa decomposer in treatment T_6 than T_1 and T_5 and it was at par to T_2, T_3 and T_5. Number of tillers were found significantly higher under the effect of T_6 than T_1 and T_3 and it was at par to T_2, T_4 and T_5 at 60 DAS, while no of tillers were significantly higher in the plot T_6 than T_1 and it was at par to rest of the treatments. No. of spiklets/spike were found significantly higher under the effect of T_4, which was at par to T_6. Number of seeds per spike was found significantly higher under the effect of T_6 than the other treatments.

Effect of biofertilizers on yield parameters, such as grain yield, straw yield and 100 grain weight (g) is presented in Table 2. Grain yield was found significantly higher under the effect of T_6, which was at par to T_3 and T_4. Straw yield was found significantly higher under the effect of T_6, which was at par to T_4. 100 grain weight showed similar results and it was found significantly higher under the effect of T_6, which was at par to T_4.

Similar kind of results were kind of results was found by other researchers too. Naserirad *et al.* (2011) found that inoculation with biofertilizers comprised of Azotobacter and Azospirillum increased plant height, number of tillers and yield as compared to control (without biofertilizer). Com-

Table 1. Effect of Azotobactor, PSB and Pusa decomposer on growth of wheat crop

Treat. No.	Treatments	Plant height (cm)			No of tillers/ meter row length		No. of spiklets/ spike	No. of seeds/ spike
		30 DAS	60 DAS	at harvest	60 DAS	at harvest		
T_1	Control	30.6	81.2	97.0	115.5	104.4	12.4	42.2
T_2	Seed treatment with Azotobactor	31.5	82.5	106.4	123.8	109.5	13.0	46.9
T_3	Soil treatment with PSB	31.0	82.0	109.0	116.5	106.3	13.0	44.1
T_4	Soil treatment with Azotobactor + PSB	31.8	82.8	112.7	125.3	109.8	14.8	52.8
T_5	Soil treatment with Pusa decomposer	31.2	81.8	102.8	124.3	110.5	13.8	50.4
T_6	Seed treatment with Azotobactor + PSB + Pusa decomposer	32.3	82.7	113.1	132.5	111.0	14.6	55.6
	SE(m) (±)	0.724	1.89	2.53	3.632	1.632	0.243	0.377
	CD (5%)	NS	NS	7.696	11.048	4.963	0.74	1.146

bined application of biofertilizers might have increased the growth and resistance of plants in water deficit conditions (Kumar *et al.,* 2003).

Effect of biofertilizers on soil physico-chemical properties, such as pH, EC, available N, available P and available K is present in Table 3. pH, EC and available K was found non-significant. Available N content was found significantly higher under the effect of T_6 than the other treatments, although it was at par to T_4. The favourable soil conditions under these treatments might have helped the mineralization of soil N which further lead to higher available nitrogen content in soil (Rai *et al.,* 2014). Available P was also found significantly higher under the effect of T_6 than the other treatments and it was at par to T_4. The increase in available phosphorus content of soil due to the incorporation of PSB and other biofertilizers which might be attributed to the direct addition of phosphorus as well as solubilization of native phosphorus through release of various organic acids during the decomposition of organic matter (Rai *et al.,* 2014). Similar results were obtained by Kumar *et al.* (2003).

Conclusion

A combination of Azotobactor, PSB, and Pusa decomposer applied to seeds shown a noteworthy effect on soil physiochemical parameters, as well as wheat development and yield. A combination of Azotobactor, PSB, and Pusa decomposer applied to seeds (T6) was found to have a substantial influence, resulting in significantly greater plant height at harvest, as well as numbers of tillers/plant, spiklets/spike, and grains/spike, as well as grain yield, straw yield, and 100 grain weight. Plots with seed treatment and combined Azotobactor, PSB, and Pusa decomposer application (T6) exhibited notably greater available N and P content. We may draw the conclusion that seed treatment, in conjunction with the application of Azotobactor, PSB, and Pusa decomposer, significantly affects soil physiochemical parameters as well as wheat growth and yield. The study suggests that the application of biofertilizers, such as Azotobactor, PSB, and Pusa decomposer, can significantly improve the growth and yield of wheat in sandy loam soil.

Conflicts of Interest: The authors declare no conflict of interest.

Table 2. Effect of Azotobactor, PSB and Pusa decomposer on yield of wheat crop

Treat. No.	Treatments	Grain yield (kg/ha)	Straw yield (kg/ha)	100 grain weight (g)
T_1	Control	2457.51	2720.26	3.64
T_2	Seed treatment with Azotobactor	3124.56	3409.94	3.72
T_3	Soil treatment with PSB	3275.57	3544.68	3.78
T_4	Soil treatment with Azotobactor + PSB	3464.88	3716.82	3.87
T_5	Soil treatment with Pusa decomposer	2764.75	2929.60	3.7
T_6	Seed treatment with Azotobactor + PSB + Pusa decomposer	3488.75	3819.78	4.14
	SE(m) (±)	86.982	81.347	0.089
	CD (5%)	264.582	247.44	0.269

Table 3. Effect of Azotobactor, PSB and Pusa decomposer on soil properties

Treat. No.	Treatments	pH	EC (mmhos/cm)	Available N (Kg/ha)	Available P(Kg/ha)	Available K(Kg/ha)
T_1	Control	7.77	0.54	217.0	14.8	186.1
T_2	Seed treatment with Azotobactor	7.88	0.56	224.7	15.7	189.2
T_3	Soil treatment with PSB	7.57	0.57	241.0	16.6	190.5
T_4	Soil treatment with Azotobactor + PSB	7.82	0.55	258.7	17.7	192.7
T_5	Soil treatment with Pusa decomposer	7.54	0.57	223.4	15.4	188.5
T_6	Seed treatment with Azotobactor + PSB + Pusa decomposer	7.66	0.57	265.7	18.4	193.6
	SE(m) (±)	0.18	0.012	5.984	0.386	4.367
	CD (5%)	NS	NS	18.203	1.174	NS

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