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Understanding the variability effect of bio-fertilizer on microbial consortium of soil & physical cha racter of wheat (*Tritium aestivum*) Lucknow condition

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Abstract
An experiment was conducted in the field at Integral University in Lucknow, Uttar Pradesh *rabi* season 2020 and India to study the Understanding the variability effect of bio-fertilizer on microbial consortium of soil & physical character of wheat (*Tritium aestivum*).
The study utilized a randomized block design with three replications to investigate the effects of different permissible hand weeding timings at 25 and 45 days after transplanting (DAT) on rice (*Oryza sativa* L.). The result revealed that application of (100% more than RDF) significantly increase the plant height (88.8 and 108.6 cm), no. of tillers (206.8 cm)) and Dry matter accumulation (1170.2 DMA (kg^{-1}) at). The identical approach also demonstrated its effectiveness in enhancing the yield and various parameters related to yield, such as Spike length (10.4), number of grains per spike (40.6), test weight (39.06g), grain yield (2.17 t ha^{-1}), straw yield (67.52 t ha^{-1}), Harvest index (49.5%). Thus application of hand weeding at 25 and 45 DAT helped in increase in yield over control. However, application (100% more than RDF) significantly increase gross return (₹104630) net returns (₹74232) and benefit: cost ratio (2.44). These results indicate that (100% more than RDF).

Keywords: Wheat, *Azotobacter,* microbial yield, growth

Introduction
Wheat (*Triticum aestivum* L.) stands as one of the primary food crops globally, holding a significant position among cultivated cereals. Its cultivation symbolizes the green revolution, which played a crucial role in transforming nations into food surplus ones. Belonging to the poaceae family with 42 chromosomes, wheat is a self-pollinating crop. It holds the top position among world food crops in terms of both cultivated area (223.813 million hectares) and production (733.144 million tonnes), boasting a productivity of 3280 kilograms per hectare (USDA 2016). In India, wheat ranks as the second most important cereal crop after rice, marking its significance in both the green revolution and post-green revolution eras. India stands as the second-largest wheat-producing country after China. During the crop year 2013-14, wheat was cultivated over millions of hectares with a production of 95.91 million tonnes and an average productivity of 3.07 tonnes per hectare (DAC 2014-15). The projected demand for wheat in India by 2020 is estimated to be between 105-109 million tonnes, contrasting with the current production of 93.88 million tonnes. Uttar Pradesh state in India holds the top rank in both area (9.67 million hectares) and production (27.52 million tonnes), albeit with a lower average productivity (2846 kilograms per hectare) compared to Punjab (4307 kilograms per hectare) and Haryana (4213 kilograms per hectare), respectively (DAC, 2011). Biofertilizers, containing beneficial microorganisms aiding in nitrogen fixation, phosphorus solubilization, and nutrient mobilization, play a crucial role in enhancing soil fertility and crop yields. Despite the documented potential of biofertilizers in boosting crop production, widespread adoption of biofertilizer technology is yet to occur at a large scale. In India, most manufacturers currently produce carrier-based inoculants using materials such as charcoal, lignite, and coal. However, the production cost of these carrier-based inoculants is high due to the energy and labor-

intensive processes involved. These processes include transportation, mining, drying, milling, sieving, sterilization, and pH correction (Somasegaran and Hoben, 1994) [1]. Yadav *et al*. (2006) [6] conducted a study comparing carrier-based and liquid inoculants of Rhizobium on pigeon pea, finding that liquid-based inoculants outperformed carrier-based ones in terms of nodulation and grain yield. Similarly, Deokar and Sawant (2002) [3] concluded that the application of *Azotobacter* liquid bioinoculants resulted in better grain yield, fodder yield, and yield-contributing components in hybrid sorghum compared to carrier-based inoculants. Sahai and Chandra (2011) [2] also noted.

Materials and Methods

An experiment was carried out in the Rabi seasons of the year 2019-2020 the present investigation entitled ‘‘Understanding the variability effect of bio-fertilizer on microbial consortium of soil & physical character of wheat (*Triticum aestivum*)” The experiment took place at the Agricultural Farm Unit-6 of the university (IIAST) during the Rabi seasons of 2019-2020. The farm house is located in the nearest Kursi Road, Dasauli Lucknow-226026. Geographically, it lies between 26.50° N latitude, 80.50° E longitude and at an altitude of 123 m above mean sea level. The experiment was laid in well- drained soil. The experiment was arranged using a randomized block design with three replications. The experiment was comprised of ten treatment *viz*., T_0 100% less than RDF T_1 75% less than RDF 50, T_2 50% less than RDF T_3 25% less than RDF, T_4 RDF (5.0 kg ha^{-1}) T_5 25% more than RDF, T_6 50% more than RDF T_7 75% more than RDF, T_8 100% more than RDF.

The wheat variety 'HD-2967' was planted following pre-sowing irrigation using a seed rate of 35 kg per hectare. Farmyard manure (FYM) was applied in accordance with the treatment specifications before planting and incorporated into the soil. Subsequently, the seeds were inoculated with rhizobium and PSB (phosphate-solubilizing bacteria). Statistical analysis of the data recorded for each parameter was conducted using the Analysis of Variance (ANOVA) technique. Overall differences were assessed using the "F" test of significance at a 5 percent level, as recommended by Cochran and Cox (1959). Critical differences at a 5 percent level of probability were calculated to compare treatments.

Results and Discussions

Effect on growth parameters

Significantly highest plant height (111.9 cm). Dry matter accumulation **(**1170.2 cm): Leaf area index **(**4.29 cm): Number of tiller (337.0417.) was recorded in the treatment T_8. (100% more than RDF) However, the treatments T_7 (75% more than RDF) was found to be statistically at par with T_8 (100% more than RDF).

Spike length (10.4 cm): Number of spikes (337.0417) Number of grains per spike**:** (40.6). Spikelet’s weight (2.38) Plant dry Matter (850.75 and 1170.2) was recorded in the treatment T_8. (100% more than RDF) However, the treatments T_7 (75% more than RDF) was found to be statistically at par with T_8 (100% more than RDF).

Effect on yield and yield attributes

The statistical analysis of the data revealed that maximum Spike length **(**10.4cm): Number of spikes (337.0417) Number of grains per spike**:** (40.6). Spikelet’s weight (2.38) Plant dry Matter (850.75 and 1170.2) was recorded in the treatment T_8. (100% more than RDF) However, the treatments T_7 (75% more than RDF) was found to be statistically at par with T_8 (100% more than RDF).test weight (39.06). Grain weight (2.17 t/ha^{-1}), straw yield (67.52) Grain yield (49.5qha^{-1}**)**, harvest index (49.5%).) was recorded under treatment T_8 (100% more than RDF).

Table 1: Plant height (cm) 30, 60, 90 DAS and at harvest stage as influenced by different treatments of bio-fertilizer (*Azotobacter*)

T. No.	Treatment combination	At harvest		
		Plant height (cm)	Dry matter accumulation (cm)	Leaf area index (cm)
T_0	100% less than RDF	91.4	850.75	3.27
T_1	75% less than RDF	95.2	928.47	3.58
T_2	50% less than RDF	98.9	961.15	3.88
T_3	25% less than RDF	102.1	986.75	3.53
T_4	RDF (5.0 kg ha^{-1})	102.5	1027.65	3.86
T_5	25% more than RDF	105.1	1055	4.11
T_6	50% more than RDF	109.9	1097.15	3.61
T_7	75% more than RDF	110.5	1141	3.94
T_8		111.9	1170.2	4.29
	SEm ±	3.903	40.072	0.135
	CD (p=0.05)	11.701	120.137	0.404

Table 2: Effect of herbicide combination on weed management in transplanted rice (*Oryza sativa* L.)

Tr. No.	Treatment combination	Spike length (cm)	Number of spikes (m2)	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest Index (%)
T_0	100% less than RDF	8.2	278.1526	39.06	34.2	50.87	42.84
T_1	75% less than RDF	8.8	299.3288	39.2	38.16	54.68	43.35
T_2	50% less than RDF	9	303.3209	39.51	39.6	56.51	43.25
T_3	25% less than RDF	9.3	307.308	39.7	40.95	57.72	42.72
T_4	RDF (5.0 kg ha^{-1})	9.6	315.2703	39.78	42.75	60.01	43.04
T_5	25% more than RDF	9.9	318.9743	40.15	44.1	61.40	42.84
T_6	50% more than RDF	10.1	327.1111	40.5	46.08	63.63	44.66
T_7	75% more than RDF	10.2	331.2711	41.58	48.15	65.94	43.63
T_8	100% less than RDF	10.4	337.0417	39.06	49.5	67.52	42.31
	SEm ±	0.43	0.43	1.70	1.77	2.32	1.67
	CD (p=0.05)	1.29	1.29	5.24	5.31	6.98	NS

Fig 1: Soil Application of Carrier Bio fertilizer @ 100% Less Than RDF

Fig 2: Soil Application of Carrier Bio fertilizer @ 25% Less Than RDF

Fig 3: Soil Application of Carrier Bio fertilizer @ 100% more than RDF

Conclusion

Based on the experimental results of the current study, the following conclusions are drawn

Application of T_8 (100% more than RDF) The highest growth parameters, yield attributes, growth and straw yield, net returns, and B:C ratio were observed in the recorded maximum, followed by a similar trend in T_7 (75% more than RDF), T_5 (50% more than RDF), T_6 (25% more than RDF), these treatments significantly superior over other treatments.

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