Review Form 1.7

Journal Name:	**International Journal of Environment and Climate Change**
Manuscript Number:	**Ms_IJECC_104950**
Title of the Manuscript:	**Impact of Bioinoculants on Grain yield and economics of wheat (Triticum aestivum L.) during Rabi season**
Type of the Article	**Original article- review with case reports**

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PART 1: **Review Comments**

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments **1. Is the manuscript important for scientific community?** (Please write few sentences on this manuscript) **2. Is the title of the article suitable?** (If not please suggest an alternative title) **3. Is the abstract of the article comprehensive?** **4. Are subsections and structure of the manuscript appropriate?** **5. Do you think the manuscript is scientifically correct?** **6. Are the references sufficient and recent? If you have suggestion of additional references, please mention in the review form.** **(Apart from above mentioned 6 points, reviewers are free to provide additional suggestions/comments)**	**1. The article is beneficial for community with a lot of effects.** **2. The title is well defined and suitable** **3. The abstract needs to be modified and more comprehensive** **4. The subsections are competing and well organised** **5. It is scientifically correct** **6. References are enough** **7. I add some comments down with full details;-** - This is an interesting study and the authors have collected a unique dataset using cutting edge methodology, literature reviews. - The paper is generally well written and structured. - However, in my opinion the paper has some shortcomings in regards to some data analyses and text, and I feel this unique dataset has not been utilized to its full extent -it needs alphabetical review, adjust fonts, spaces, paragraphs, do all same font with same design -adjust abstract as in form of introduction, methods, result, and conclusion. -remove all graphs, tables, legends or figures from inside article and put all after references at end of article -review all references and adjust font, design for all references and organize in numerical order -review discussion paragraph as a whole -the research Is relevant and interesting -the paper is well written, the text is clear and easy to read but needs some font, design and alphabetical review with corrections -the conclusion is consistent with the evidence and arguments presented - Maximum 1000 words allowed per research	
Minor REVISION comments **1. Is language/English quality of the article suitable for scholarly communications?**	1. I think English language is well adjusted and suitable for the article. - Where improvements are needed, a recommendation for major revision is typical. - I am ready to do the post-revision review too. -Review title as first. -Add name of author, affiliation, qualifications abbreviations after title -the English is understandable but the paper has some typographical and grammatical errors	

	- Keep images, graphs and data tables in clear view at end of article - You need to check referencing for accuracy, adequacy and balance. -limit research article to maximum 1000 words. -add more keywords.	

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Optional/General comments	- Good research, worthy for study - the Abstract highlights the important findings of the review of fertilizers. -the tables or figures, aid understanding and superfluous - the research Is relevant and interesting - good sampling in analytical papers -clarify the validity of questions, the use of a detailed methodology and the data analysis being done systematically (in qualitative research) - good reviews of all types and modalities of fertilizers used for agriculture in India - the paper's premise is interesting and important - the methods used are appropriate - the data support the conclusions Article after Grammar and paraphrasing corrections:- Impact of Bioinoculants on Grain yield and economics of wheat (Triticum aestivum L.) during Rabi season Abstract Field experiments were conducted to Studies effect of integrated nutrient management on yield and economics of wheat during the Rabi season of 2020-21 and 2021-22 at student's instructional farm, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur. The experiment consists of 11 treatments combinations in a randomized block design with three replications consisted of three replications consisted of different combination of inorganic fertilizer, organic manure and biofertilizers .Wheat variety HD-2967 was grown with the recommended agronomic practices. On the basis of results emanated from investigation it can be concluded that among the productivity parameters viz. The maximum grain yield was 48.60 and 49.93 q ha-1, straw yield was 63.15 and 67.53 q ha-1 and biological yield was 111.75 and 117.46 q ha-1 during the both years of experimentation are associated with the treatment T10 [100 % NPK + S40 + Zn5 + Fe10 + Azotobacter + PSB + 5 ton FYM]. Maximum gross return ₹ 140190 and ₹ 141127, during the first year (2020-21) and second year (2021-22) of experimentation were recorded under treatment T10 [100%NPK + FYM + S30+ Zn5 +Azotobacter + PSB]. Maximum benefit cost ratio (B:C ratio) 2.26 and 2.08 were recorded under treatment T7 [100 % NPK + Zn5]. The maximum cost of cultivation during the first year is ₹ 53805 and the second year is ₹ 59816 were recorded under treatment T10 [100 % NPK + S40 + Zn5 + Fe10 + Azotobacter + PSB + 5 ton FYM] Key Words: Azotobacter, Economics, FYM, Phosphorous, PSB, Wheat and Yield. Introduction Wheat being an energy rich winter cereal contributes around 35% to the food grain basket of the country. Globally wheat (Triticum aestivum L.) is grown in 124 countries and occupied an area of about 215 million hectares with a production of 734.50 mt. of grain during 2019-20 (Anonymous, 2020). In India the area under wheat has increased since the start of the green revolution in 1967 and the production and productivity has also increased. The area under wheat increased from 12.8 mha. In 1966-67 to 31.45 mha. in 2019-20. In this period production has also increased from 11.4 to 107.59 mt. and the productivity was increased from 887 to 3421 kg ha-1 (Anonymous, 2020). Wheat (Triticum aestivum L.) is one of the major cereal crops with a unique protein, which is consumed by humans and is grown around the world in different environments (Abedi et al., 2010). Wheat is foremost among cereals as a main source of carbohydrates and protein for both human beings and animals; it contains starch (60-90%), protein (11-16.5%), fat (1.5-2%), inorganic ions(1.2-2%) and vitamins (B	

	complex and vitamin E) (Rueda-Ayala et al., 2011). In recent year the food grain production have been stagnated or even declined for both rice and wheat crops (Dawe and Dobermann, 1999) and there has been a wide gap between the target and actual production (Pathak et al., 2003). There are many reasons of low productivity of wheat out of which imbalance and excess fertilizer application is major one and changes in physico-chemical composition of the soil, a depletion and diminution in bioavailability of soil nutrients, a scarcity of good groundwater, buildup of pests and attack of various diseases of wheat greatly affected its yield and quality. Injudicious application of chemical fertilizers not only harms the biological power of soil but also decreases the soil fertility and crop productivity (Parewa et al. 2014). Thus, integrated nutrient management advocates balanced and conjoint use of inorganic fertilizer, organic manure, and bio-inoculants in order to maintenance or adjustment of soil fertility and plant nutrient supply to an optimum level for sustaining desired crop productivity (Rakshit et al. 2008). Nitrogen (N) is a major factor for yield of wheat. The efficiency of wheat cultivars to N use has become increasingly important to allow reduction in N fertilizer use without decreasing yield. Wheat is an important cereal crop and requires a good supply of nutrients especially nitrogen for its growth (Mandal et al., 1992) and yield (Krylov and Pavlov, 1989). Nitrogen rate, type of nitrogen, and timing of its application are important factors to increase wheat yield (Garrido-Lestache et al., 2005). Some studies showed that N fertilization increases the total quantity of flour proteins, resulting in an increase in both gliadins and glutenin (Dupont and Altenbach 2003). Phosphorus is essential for enhancing seed maturity and seed development (Ziadi et al. 2008). Phosphorus plays a significant role in several vital functions such as photosynthesis, transformation of sugar to starch, protein information, nucleic acid production, nitrogen fixation and formation of oil. It is also, the part of all biochemical cycles in plants (Mehrvarz and Chaichi, 2008). Potassium (K+) is of unusual significance because of its live role in biochemical functions of the plant like activating various enzymes, improvement of protein, carbohydrates and fat concentration, developing tolerance against drought and resistance to frost, lodging, pests and disease attack. Therefore, potassium is known as a "quality element" and it was considered as a key factor in crop production (Moussa, 2000). It is thus necessary to devise a fertilizer technology facilitating use of NPK in apt combination for enhancing wheat yield (Jabbar et al., 2009). Zinc is also reported as an important micronutrient for wheat production because it is required in a large number of enzymes and plays an essential role in DNA transcription. . It is reported that a high amount of zinc is contained in pollen and mostly zinc is inverted to seed only during seed formation and an application of zinc improves grain formation (Choudhary et al., 2007). Generally, crops needs less sulphur like cereals, still start suffering more and more from sulphur deficiency even though there are some crops which need more sulphur as well. The baking properties of wheat and the biological value of proteins can also be improved by increasing sulphur fertilization which has been reported many times (Marschner, 1997; Jarvan et al., 2006). Judicious use of FYM with chemical fertilizers improves soil physical, chemical and biological properties and improves the crop productivity (Sharma et al., 2007). Application of organic manures may also improve the availability of native nutrients in soil as well as the efficiency of applied fertilizers (Sawrup, 2010). The need of the hour is to evolve an integrated plant nutrient supply system, comprising balanced use of chemical fertilizer, organic manures and bio-fertilizers. An improvement in crop performance might be attributed to the N2 -fixing and phosphate solubilising capacity of Azotobacter as well as the ability of these microorganisms to produce growth promoting substances. Azotobacter and graded doses of nitrogen increase phosphorus and potassium uptake by plants significantly Wheat poses a problem for the establishment of Azotobacter in its rhizosphere. The inoculation of crop plants with bacterial preparation is recommended because a selective and compatible strain is supposed to accelerate plant growth. Phosphate solubilizing bacteria (PSB) as bio-fertilizers have been found effective in solubilizing the fixed soil P and applied phosphates resulting in higher crop yields (Panhwar et al., 2014). Availability of iron plays a critical role in wheat crop productivity and economics. Ensuring an adequate supply of iron to wheat plants is essential for chlorophyll formation, photosynthesis, nutrient uptake, stress resistance, grain development, and overall yield. Iron deficiency can lead to decreased yield, lower grain quality, and additional costs associated with corrective measures. Balancing the costs of iron fertilizer application with the potential economic benefits of improved yield and grain quality is an important consideration for wheat farmers. (Saquee et al., 2023) Resources and Methods Experimental Site The experiment was conducted during the rabi season of 2020-21 and 2021-22 at student's Instructional farm, C.S.A. University of Agriculture and Technology, Kanpur Nagar (U.P.). The field was well levelled and irrigated by a tube well. The farm is situated at main campus of the university,	

	in the west northern part of Kanpur city under sub-tropical zone in vth agroclimatic zone (central plain zone). Edaphic Condition The soil was moist, well drained with uniform plane topography. The soil of the experimental field was alluvial in origin, sandy loam in texture and slightly alkaline in reaction. Analytical data of the experimental soil and the method employed in the estimation was given in the Table-1 Table No. 1: Analytical data of the experimental soil (pre-sowing) At the crop production trial site, pre-sowing irrigation (Paleva) was carried out to obtain optimal moisture conditions to obtain good seedlings. For proper cultivation, the field was plowed once with a tractor chisel plow and plowed twice with a cultivator. Half the nitrogen dose, along with the full dose of phosphorus and potassium, was applied as a basis for inoculation with urea, DAP and MOP, respectively. The other half dose of nitrogen was applied from above in two split doses at 30 and 55 days post-seeding (DAS). Sowing seeds of wheat varieties. HD-2967 was sown by hand in rows 2-3 cm deep into the soil with row spacing of 22.5 cm to maintain uniform plant populations. FYM application and soil treatment with Azotobacter and PSB were performed. Harvesting and threshing: The crops were harvested as they ripened and sun-dried. A separate bundle was made and weighed for each plot. After drying, the crop was threshed by hand. Data Collection Grain Yield After threshing, the grain yield in each plot was individually weighed, converted to cents per hectare, and recorded. Straw yield after subtracting the plot's grain yield from the total biological yield. After recalculating the yield in cents per hectare, the yield was registered. Biological Yield (q ha-1) Grain yield and Stover yield were taken together as biological yield. Biological yield was calculated using the formula: Biological Yield = Grain Yield Straw Yield Yield (%): Grain recovery out of total dry matter was considered as the yield expressed as a percentage. It has been calculated by the following formula: Harvest Index (%) = [Seed Yield (q ha-1) / Biological Yield (q ha-1)] x 100 Economics: The economics of different treatments was worked out on the basis of average yield (seed and stover) of 2021-22 and 2022-23. Cost of cultivation (₹ ha-1): The cost of cultivation was worked out on the basis of input rates at the farm. Treatments cost was calculated separately. The common cost of cultivation (₹ ha-1) was worked out by considering all the expenses incurred in the cultivation and added variable cost due to treatments (including interest of working capital) in order to get the total cost of cultivation. Gross return (₹ ha-1): It was calculated by taking the income from the grain and straw produced on the basis of market rates. The yield of the chickpea crop was converted into gross return in rupees per hectare on the basis of the current price of the produce . Gross return (₹ 〖ha〗^(-1))= Total income from grain and straw yield Net return (₹ ha-1) Net profit is the outcome received by subtracting the cost of cultivation from gross income (₹ ha-1). The net return was worked out by using the following formula- Net return (₹ ha-1) = Gross return (₹ ha-1) - Cost of cultivation (₹ ha-1) Benefit Cost ratio (B:C) Net income of each treatment was divided by cultivation cost of the respective treatment and cost benefit ratio was recorded. There was calculated with the help of the following formula. Benefit:cost ratio = (Net Return (₹ 〖ha〗^(-1)))/(Cost of cultivation (₹ 〖ha〗^(-1))) Statistical analysis: The growth parameters and yields were recorded and analyzed as per Gomez and Gomez (1984) the tested at 5% level of significance to interpret the significant differences. Result and Discussion Productivity Parameters It is visualized from the data given in Table-3 & Table-4 clearly indicate that among the productivity parameters viz. grain yield (q ha-1), straw yield (q ha-1) and biological yield (q ha-1) significantly increase due to the application of NPK, Zinc, Iron, Sulphur, FYM, Azotobacter and PSB. Grain yield varied from 18.87 to 49.27 q ha-1, straw yield varied from 29.15 to 65.34 q ha-1 and the biological yield varied from 48.02 to 104.63 q ha-1 on a pooled basis. The maximum grain yield (49.93 q ha-1), straw yield (67.63 q ha-1) and biological yield (114.61 q ha-1) were recorded in the treatment T10 [100 % NPK S40 Zn5 Fe10 Azotobacter PSB 5 ton FYM] during the second year (2022-23) of experimentation. The minimum grain yield (17.90 q ha-1), straw yield (26.87 q ha-1) and biological yield (44.77 q ha-1) was recorded in the treatment T1 [control] during the first year (2021-22) of experimentation. The surge in seed and stover yields under adequate nutrients supply might be attributed to mainly to the collective effect of a greater number The spikelet ear-1, grain ear-1and 100 grain weight (gm), which was the result of improved translocation of photosynthates from source to sink ultimately yield is increased. The increase in productivity under adequate nutrients supply mainly due to more yield attributes ultimately resulted in more grain yield. Grain, straw and biological yield of wheat significantly increased due to FYM application over their controls. Application of Azotobacter and PSB further increased grain & straw yield of wheat significantly over	

	without application of Azotobacter and PSB. Inoculation of Azotobacter and PSB further increased grain & straw yield of wheat significantly over without inoculation. This may be due to soil treatment with bioinoculum that fixes atmospheric nitrogen and increases the supply of other nutrients to plants, ultimately increasing the yield of grain and wheat straw. These results are also supported by Singh and Jat (2016), Kumar et al. (2022) and Sachan et al. (2022) complex application of nutrients did not significantly affect yield indices. The returns ranged from a total of 39.34% to 41.04%. The highest yield index (43.49%) was associated with T10 [100% NPK S40 Zn5 Fe10 Azotobacter PSB 5 t FYM] treatment during the first year of the experiment (2021–22). At the same time, the lowest yield indicator (38.69%) was recorded for the T1 [control] strain in the second year of the experiment. These results are also consistent with Verma et al. (2022), Sirohiya et al. (2022) and Kumar et al. (2022). Economics Economic viability depends on profit or loss. Any practice that is economical and feasible must strike a significant balance of costs. Developed to ensure net profit and profitability at a B:C ratio. While studying the economics of wheat cultivation during the two years of the experiment, all economic parameters such as gross margin, net profit and cost-benefit ratio excluding the cost of cultivation were NPK, Zn. , iron, sulfur, FYM, Azotobacter and PSB. From the data extracted from Tables 4 and 5, it can be concluded that the maximum gross revenue ($141127) was recorded when processed according to T10 [100% NPK S40 Zn5 Fe10 Azotobacter PSB 5 tons FYM] during the second year (2022) . -2022 gg.). 23) Experiment. During the first year of the experiment (2021-2022), a minimum gross profit (£54,162) was recorded for the T1 [control] option. The highest net profit (£89,209) was recorded for T9 [100% NPK S40 Zn5 Fe10] treated in the first year of the trial (2021-2022). During the first year of the experiment (2021-2022), minimal net profit ($23511) was recorded for the T1 [control] strain. Similarly, the maximum B:C ratio (2.26) was recorded with the T7 [100% NPK Zn5] treatment during the first year of the experiment (2021–2022). The minimum B:C ratio (0.76) was recorded in the treatment T1 [control] during the second year (2022-23) of experimentation. In the similar pattern, in the case of cost of cultivation it can concluded that the maximum cost of cultivation (₹ 59816) was found in the treatment T10 [100%NPK FYM S30 Zn5 Azotobacter PSB] during the second year of experimentation and minimum cost of cultivation (₹ 30651) was recorded in the treatment T1 [control] during the first year (2021-22) of experimentation. If it is economically viable in modern farming maximum profit is more important than maximum profit the real comparison of different treatment can only judge on the basis of economic viability. The cost and gross return varied markedly due to different application of inorganic, organic and bio-inoculant nutrients which ultimately influence the net return and B:C ratio. The consequences of the current investigation are additionally in concurrence with the investigation of Dwivedi et al. (2014), Patra et al. (2019), Verma et al. (2022) and Gupta et al. (2022) concluding study showed that the use of NPK, Zinc, Sulfur, FYM, Azotobacter and PSB increased wheat grain yield and increased net profit and B:C ratio. Thus, it will help to increase the socio-economic status of farmers. The use of NPK, Zinc, Iron, Sulfur, FYM, Azotobacter and PSB requires special attention to increase wheat yield and profitability.	

PART 2:

	Reviewer's comment	Author's comment *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Are there ethical issues in this manuscript?	*(If yes, Kindly please write down the ethical issues here in details)*	

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