Effect of Bio fertilizers and Phosphorus on Growth and Yield of Pearl millet (*Pennisetum glaucum* L.)

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ABSTRACT

A field experiment was conducted at Crop Research Farm in Department of Agronomy during kharif season of 2022 on pearl millet. SHUATS, Prayagraj (U.P). the treatments consisted of 3 levels of biofertilizers (20 g/kg *Azotobacter*, 20 g/kg *Azospirillum,* 20 g/kg *Azotobacter+ Azospirillum)* and phosphorus (35,40,45 kg/ha) and a control.The experiment waslaid out Randomized Block Design with ten treatments each replicated thrice.The results showed that application of 20 g/kg *Azotobacter+ Azospirillum+* 45 kg/ha Phosphorus was recorded significantly higher plant height (200.13 cm), Plant dry weight(40.33 g/plant), Ear headlength(25.25cm),grains/earhead(2010.9),Grainyield(3.25t/ha),Strawyield(6.27t/ha)ascom paredtoothertreatments.

Keywords:*Azospirillum*,*Azotobacter*,phosphorus, Growth attributes and Yield attributes.

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INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is the staple cereal of arid and semi-arid drierregionsofthecountry.IndiaisthelargestPearlmilletgrowingcountrycontributing42percentof production in the world. In India, pearl millet is pre-dominantly cultivated as a rainfed cropin diverse soils, climatic condition and indispensable arid zone. In India pearl millet wascultivated in 7.12 million hectares with 8.06 million ~~tones~~tonnes production and productivity of1132 kg/ha during 2015-16. The major pearl millet producing states in India are Rajasthan,Maharashtra, Gujarat, Uttar Pradesh and Haryana. Therefore, there is need to improve fertility management along with optimum plantdensityofcurrenthybridsforsustainableproductionandproductivity **(Venkata*et al.*,2001).**

Bio fertilizersarecommonlycalledmicrobialinoculantswhicharecapableofmobilizing important nutritional elements in the soil from non-usable to usable form by thecrop plants through their biological processes. Bio fertilizers due to its renewable, cheap andeco-friendly nature has gained increasing popularity in the past one decade in the field of

agriculture and food production. The use of chemical fertilizers and pesticides has causedtremendouseffecttotheenvironment.Bio fertilizerswillhelptosolvesuchproblemsa increased salinity of soil and chemical run off from the Agricultural field. It has been found tominimize the use of chemical fertilizers, improved soil fertility status and enhancing the cropproductionbytheir biologicalactivityintheRhizosphere.AzotobacterandAzospirillumarethetwo examples of these microorganisms. Mycorrhizal symbiosis increases absorption of someelements such as phosphorus, nitrogen and micronutrients, improves water uptake, produceshormones,reducesdamagescausedbyenvironmentalstress.Improvesqualityofsoilaggregate.

Azotobacterisabeneficialfreeliving(nosymbiosis)nitrogenfixingbacteriawhichis reported to fix 20-60 kg/ha nitrogen in soil annually. Azotobacter was the first and is themost common biofertilizer for some plants such as maize, wheat, sorghum and rice whichproduces some plant growth promoting metabolites, enzymes and hormones (auxin, cytokininand gibberellin)inadditiontofixingairnitrogen**(Forlaine*tal*.,1998).**

Azospirillum enhance the growth of the plant by influencing the mineral uptake, enhances the dry matter production. Further it also helps in improving the uptake of water and increase the yield of crops. Azotobacter is a N fixing bacteria which improves the crop growth through absorption of N which is fixed near the soil root zone **(Goud *et al*., 2021)**. *Azospirillum* is a rhizosphere bacterium colonizing the root of the crop plants making use of root exudates and fixes substantial amount of nitrogen and is benefit to plants by mechanisms related to enhancement of plant growth, increase the mineral uptake, increase the dry matter, improve the water absorption and improve the yield. Azotobacter is a ~~free living nitrogen fixation bacteria~~free-living nitrogen fixation bacterium which has been reported to fix about 20 kg N/ha in non-legumes **(Goud et al.,2021).** Phosphorus is the most limiting factor next to nitrogen in crop's growth and development. It plays an important role in plant's energy metabolism, photosynthesis process, nitrogen fixation, synthesis of nucleic acids and enzyme regulations. Phosphorus enhances the crops growth by influencing the root growth, flowering and yield attributes. And its uptake is limited because of the low solubility of P in soil **(Singh *et al*., 2017).**

Phosphorus is widely called as "Bottleneck of world hunger" and an essential element with plays vital role in plant's growth and development. Adequate phosphorus nutrition enhances many aspects of plant growth development including flowering, fruiting, roots growth and yield components of different crops. P uptake in plants is often constrained by the very low solubility of P in the soil. In agricultural systems, Phosphorus in the harvested crops is removed from the system, resulting in P deprived soils if no P is supplemented as fertilizer **(Jain 2005).**

Phosphorus is essential for all living organisms. Plants must have phosphorus for normal growth and maturity. Phosphorus plays a role in photosynthesis, respiration, energy, storage and transfer, cell division enlargement and several other processes in plants. A Plant must have phosphorus to complete its normal production cycle. Phosphorus is a vital component of DNA, the genetic memory unit of all living things. It is also component of RNA, the compound that reads the DNA genetic transfer **Anonymous, (2016).**

Beside N, phosphorous also plays a vital role in increasing the yield. It is an important nutrient in energy transfer for the living cells by means of high-energy phosphate bonds of ATP. Phosphorous deficit is the most important restrictive factor in plant growth because it promotes root development that in turn enhances uptake of other essential elements **(Dharmendra and Umesha 2022).**

MATERIALSANDMETHODS

A field experiment was conducted during kharif season of 2022. The experiment was conducted in randomized block design and it consist of 10 treatment combinations with three replications and was laid out variously with different treatments assigned randomly in each replication. The soil in experimental field was sandy loam texture, having alkaline reaction (pH 7.7) with very low organic carbon (0.44%), available higher N (171.48 kg/ha), P (27.0 kg/ha) and higher level of K (291.2 kg/ha). treatment combination were T_1 - 20 g/kg Azotobacter + 35 kg/ha Phosphorus; T_2 - 20 g/kg Azotobacter + 40 kg/ha Phosphorus : T_3 - 20 g/kg Azotobacter + 45 kg/ha Phosphorus; T_4 - 20 g/kg *Azospirillum* + 35 kg/ha Phosphorus ; T_5 -20 g/kg Azospirillum + 40 kg/ha Phosphorus; T_6 - 20 g/kgAzospirillum + 45 kg/ha Phosphorus ; T_7 - 20 g/kg Azotobacter + Azospirillum + 35 kg/ha Phosphorus ; T_8 - 20 g/kg Azotobacter +Azospirillum + 40 kg/ha Phosphorus ; T_9 - 20 g/kg Azotobacter +Azospirillum + 45 kg/ha Phosphorus ; T_{10} - Control (RDF – 80 – 40 - 40 NPK kg/ha) . The observations were recorded on growth parameters at harvest yield i.e. plant height(cm), dry weight (g/plant), Ear head length (cm), Number of Grains/ear head, Test weight (g), Grain yield (t/ha), Stover yield (t/ha), Harvest index (%).

3. RESULTSANDDISSCUSIONS

Growth attributes

3.1 Plant height (cm)

At80DAS,significantly highestplantheight(200.13cm)wasobservedinthetreatment with 20 g/kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorus over alltheothertreatments.However,thetreatmentswithapplicationof 20 g/kg *Azotobacter*+ *Azospirillum*+40 kg/ha Phosphorus (196.40 cm) whichwerefoundto beat parwithtreatment20 g/kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorus.

The probable reason for increase in plant height due to application of biofertilizer and phosphorus were biofertilizer play crucial role in a free-living nitrogen-fixing bacterium termed *Azotobacter* has been reported to fix about 20 kg/ha of nitrogen in non-legumes The results were found inaccordance with**Ramdev *et al* (2017).** Thesignificantincreaseintheheightmaybeduetoinoculationofbacterialpreparationaccelerate plant growth provide biologically fixed nitrogen to the inoculated plant and alsostimulate plant growth by excreting plant growth promoting substances like auxins, kinetins,vitaminsandgibberellins assimilarlyobservedby**PatidarandMali(2004)**.Phosphorus plays a pivotal role in extensive root systems efficient utilization of nutrients under conditions of sufficient P application similar results was observed by **Lakhan *et al* (2017)**

3.1.2 Dry weight (g/plant)

At80DAS,treatmentwith 20 g/kg *Azotobacter* + *Azospirillum* +45 kg/ha Phosphoruswas recorded with significantly maximum dry weight (40.33 g/plant) over all thetreatments.However,thetreatmentswith20 g/kg *Azotobacter* + *Azospirillum* + 40 kg/ha Phosphorus(37.67 g/plant) whichwerefoundtobestatisticallyatpar20 g/kg *Azotobacter* + *Azospirillum* +45 kg/ha Phosphorus.

The significant increase in a plant dry weight at different stages of growth due to application of biofertilizers and phosphorus was might be due to crucial role of *Azotobacter* can transforms elemental nitrogen into ammonical form (NH4 +), which plant life uses. In addition, Azotobacter has a distinct benefit due to its capacity to synthesize auxins, vitamins, growth factors, and antifungal antibiotics. The roots absorbed the nitrogen that was being fixed by Azotobacter in the soil near the root zone (rhizosphere), which may have increased the crop's growth parameters. These findings closely match those of **Kumar et al.,**

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(2012) Inoculationofbiofertilizersstimulatesactivationofhormoneswhichhelpsinshootandroot elongation and high dry matter production, similar results were observed by **Rathore *etal.*(2006)**

3.2 Yield

3.2.1 Earheadlength(cm)

The application of 20 g/kg Azotobacter + Azospirillum + 45 kg/ha Phosphorous significantly increased the maximum ear head length (25.25 cm) over all other treatments. However, the treatments of 20 g/kg Azotobacter + Azospirillum + 40 kg/ha Phosphorous (23.87 cm) and 20 g/kg Azotobacter + Azospirillum + 35 kg/ha Phosphorous (22.55 cm) were statistically comparable to 20 g/kg Azotobacter + Azospirillum + 45 kg/ha Phosphorous.

The yield characteristics were significantly enhanced, and the biofertilizer and phosphorus application significantly increased the ear head length response. Azotobacter that helped roots grow better. Accordingly, better root advancement and energetic plant development, which thus came about to more dry matter lastly better blossoming and ear head improvement, may have been helped by the expanded accessibility of

nitrogen. findings are in line with the obtained results (**Patel et al2014**). A greater accumulation of dry matter as a result of a higher supply of phosphorus may indicate a connection between the application of phosphorus and an overall improvement in plant growth. Similar findings were found (**Patel et al2022)**.

3.2.2 Grains /earhead

The application of 20 g/kg Azotobacter + Azospirillum + 45 kg/ha Phosphorous produced the highest grains/ear head (2010.9) of any of the treatments. Notwithstanding, the treatment 20 g/kg Azotobacter + Azospirillum+ 40 kg/ha Phosphorous (1981.0) which were found to be statistically at par with 20 g/kg Azotobacter + Azospirillum+ 45 kg/ha Phosphorous. A significant increase in the number of grains per ear head is the result of an increase in the availability of nitrogen through bio fertilizer inoculation, which also results in an increase in the number of ear heads produced as a result of increased rates of spikelet primordial production; Marngar and Dawson (2017) found results that were comparable.

3.2.3 Testweight(g)

Therewasnosignificantdifferenceamongthetreatments.However, highest test weight (6.63 g) was recorded with the treatments 20 g/ kg *Azotobacter* + *Azospirillum* + 35 kg/ha Phosphorous whereas,the minimumTest weight(5.47g)wasrecordedwith20 g/ kg *Azotobacter* + 35 kg/ ha Phosphorus.

3.2.4Grain yield (t/ha)

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SignificantlyhighestGrainyield(3.25t/ha)wasrecordedwiththetreatmentapplicationof20 g/ kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorous overallthetreatments.However, the treatments with (3.15 t/ha) in 20 g/ kg *Azotobacter* + *Azospirillum* + 40 kg/ha Phosphorous which were found tobe statistically at par with 20 g/ kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorous.

The application of biofertilizer and phosphorus recorded significantly higher grain yield, This could mainly be ascribed to the increased availability of the nitrogen to the plants through biological nitrogen fixation in rhizosphere by Azotobacter that caused better root development. Thus, the greater availability of nitrogen might have helped in better root proliferation and vigorous plant growth, resulting in more dry matter and ultimately better flowering and ear head development. The increase in yield might be due to the cumulative effect of increased growth and yield attributes noted under this treatment. The results obtained are in close agreement with the findings of **Sushila and Giri (2000)**

3.2.5 Strawyield (t/ha)

SignificantlyhighestStrawyield(6.27 t/ha)wasrecordedwiththetreatmentapplication of 20 g/ kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorous overallthetreatments.However, the treatments with (5.64 t/ha) in 20 g/ kg *Azotobacter* + *Azospirillum* + 40 kg/ha Phosphorous (5.43 t/ha) which were found to be statistically at par with 20 g/ kg *Azotobacter* + *Azospirillum* + 45 kg/ha Phosphorous.

Straw yield is dependent on vegetative growth as use of balanced and optimum use offertilizerincreasedplantheight,greenleavesperhill,anddrymatterproduction,whichfinallyresultedinhigherstrawyield, similar resultswereobtainedby**Zothanmawii*etal* (2018)**

Phosphorus plays an important role in the production of pearl millet. The significant increase in pearl millet grain and stover yield was mainly a result of higher growth and the subsequent rise in the various yield attributes mentioned above. This major benefit could be due to P, which is

Formatted: Font: Font color: Auto, English (United States) well known for its function as "Energy currency" and plays a crucial part in the development and energy transformation in many crucial metabolic processes in the plant. Similar outcomes were reported by **Singh *et al* (2019)**

3.2.6Harvest index (%)

Therewasnosignificantdifferenceamongthetreatments. However,highest Harvest index (36.94 %) was recorded with the treatments 20 g/ kg Azotobacter + 35 kg/ha Phosphorous whereas,minimumHarvest index(32.55 %)wasrecordedwithControl (RDF 80-40-40 N-P-K kg/ha) .

The results of this study are consistent with previous studies of tropical soil quality, which have shown that the use of biofertilizers and P can significantly improve soil fertility and crop productivity (Araya-Alman et al. 2020; Olivares et al. 2022). Biofertilizers are known to improve soil fertility by fixing atmospheric nitrogen and solubilizing phosphorus, while P is an essential nutrient for plant growth and development. However, the effectiveness of biofertilizers and P may vary depending on soil type (Hernandez et al. 2020; Olivares and Hernandez, 2019; Rey et al. 2022; Lobo et al. 2023), climate (Orlando and López, 2019; Cortez et al. 2018), and crop species (Campos, 2016; Hernández and Olivares, 2020).

In conclusion, the application of biofertilizers and P can significantly improve the growth and yield of pearl millet. The results of this study support the use of biofertilizers and P as a sustainable agricultural practice for improving soil fertility and crop productivity in tropical regions. Further studies are needed to investigate the long-term effects of biofertilizers and P on soil fertility and crop productivity and their interactions with other management practices.

CONCLUSION

From the results, it is concluded that with the application of 20 g/kg Azotobacter + Azospirillum and 45 kg/ha Phosphorus (treatment 9) was found more productive (3.25 t/ha)in Pearl millet crop and it can be recommended to farmers after further trails.

REFERENCES:

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Araya-Alman, M., Acevedo-Opazo, C.,Olivares, B., et al. (2020). Relationship Between Soil Properties and Banana Productivity in the Two Main Cultivation Areas in Venezuela. J Soil Sci Plant Nutr. 20 (3): 2512-2524. https://doi.org/10.1007/s42729-020-00317-8

Anonymous, (2016). What's the function of Phosphorus (P) in plants? https://www.greenwaybiotech.com.

Campos, B. (2016). Descripción del manejo de suelos en sistemas de producción agrícola del sector Hamaca de Anzoátegui, Venezuela. La Granja: Revista de Ciencias de la Vida. 23(1): 14–24. https://n9.cl/ycp08

Cortez, A., Olivares, B., Parra, R., Lobo, D., Rodríguez, M.F., Rey, J.C. (2018). Descripción de los eventos de sequía meteorológica en localidades de la cordillera central, Venezuela. Ciencia, Ingenierías y Aplicaciones. I (1):22-44. http://dx.doi.org/10.22206/cyap.2018.vlil.pp23-45.

Dharmendra, K., & Umesha, C. (2022). Influence of nitrogen and phosphorus on growth and yield of finger millet (Eleusine coracana L.). *The Pharma Innovation Journal* 11(4): 1450-1453.

Forlain,G.,Pastorelli,R.,Branzoni,M.andFavilli,F.1998.Rootcolonizationefficiency,plantgrowth promotingactivityandpotentiallyrelatedpropertiesinplantassociatedbacteria.*JournalofGenetics andBreeding*,**49**:343-351.

Goud, B. S. S., Singh, R., & Kan, W. (2021). Effect of seed inoculants and organic manures on growth and yield of organic pearl millet (*Pennisetum glaucum* l.). *Asian J Microbiol Biotechnol Environ Sci*, *23*(2), 253-7.

Gurrala, S.,Guru, G.andLokanadan, Subbalakshmi, 2018. Effect of nutrient levels andplant growth regulators on growth parameters of pearlmillet. *International JournalPure andAppliedBioscience*.**6**(1):1520-1525.

Hernandez, R.; Olivares, B.; Arias, A; Molina, JC., Pereira, Y. (2020). Eco-territorial adaptability of tomato crops for sustainable agricultural production in Carabobo, Venezuela. Idesia, 38(2):95-102. http://dx.doi.org/10.4067/S0718-34292020000200095

Hernández, R., Olivares, B. (2020). Application of multivariate techniques in the agricultural land's aptitude in Carabobo, Venezuela. Tropical and Subtropical Agroecosystems, 23(2):1-12. https://n9.cl/zeedh

Jain, N. K., & Dahama, A. K. (2005). Residual effect of phosphorus and zinc on yield, nutrient content and uptake and economics of pearlmillet (*Pennisetum glaucum*)-

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wheat (*Triticum aestivum*) cropping system. *Indian journal of agricultural science*, *75*(5), 281-284.

Kumar, P., Hooda, R. S., Kumar, S. U. R. E. S. H., & Singh, K. A. R. M. A. L. (2012). Effect of nitrogen levels and biofertilizer strains on dry matter production and attraction index in pearl millet. *Haryana Journal of Agronomy*, *28*(1/2), 34-37.

Lakhan, S., PK Sharma, M Jajoria, P, D., and R Verma. (2017). Effect of Phosphorus and Zinc Application on Growth and Yield Attributes of Pearl millet (Pennisetum glaucum L.) under Rainfed Condition .6(1): 388-391.

Lobo, D; Olivares, B; Rey, J.C; Vega, A; Rueda-Calderón, A. (2023). Relationships between the Visual Evaluation of Soil Structure (VESS) and soil properties in agriculture: A meta-analysis. Scientia agropecuaria, 14(1): 67 - 78.https://doi.org/10.17268/sci.agropecu.2023.007

Marngar,E.andDawson,J.2017.Effectofbiofertilizers, levelsofnitrogenandzincongrowthandyieldofhybridmaize(*Zeamays*L.).*InternationalJournalofCurrentMicrobiology andApplied Sciences*,**6**(9):3614-3622.

Olivares, B., Hernández, R. (2019). Ecoterritorial sectorization for the sustainable agricultural production of potato (*Solanum tuberosum* L.) in Carabobo, Venezuela. Agricultural Science and Technology. 20(2): 339-354. https://doi.org/10.21930/rcta.vol20_num2_art:1462

Olivares, B.O., Calero, J., Rey, J.C., Lobo, D., Landa, B.B., Gómez, J. A. (2022). Correlation of banana productivity levels and soil morphological properties using regularized optimal scaling regression. Catena, 208: 105718. https://doi.org/10.1016/j.catena.2021.105718

Orlando, B., López, M. 2019. Normalized Difference Vegetation Index (NDVI) applied to the agricultural indigenous territory of Kashaama, Venezuela. UNED Research Journal. 11(2): 112-121. https://doi.org/10.22458/urj.v11i2.2299

Patidar,M.andMali,A.L.2004.EffectofFarmyardmanure,fertilitylevelsandbiofertilizersongrowth,yieldandqualityofsorghum.IndianJournalofAgronomy49(2):117-120.

Patel PR, Patel BJ, Vyas KG, Yadav BL. Effect of integrated nitrogen management and bio-fertilizer in Kharif pearl millet (Pennisetum glaucum L.). Adv. Res. J. Crop Improv. 2014; 5(2):122-125.

Ramdev, T., LR Yadav, SL Choudhary and GV Shisuvinahalli. (2017). Effect of Azotobacter on growth, yield and quality of pearl millet (*Pennisetum glaucum* L.). Journal of Pharmacognosy and Phytochemistry,**6**(4): 889-891.

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Rathore, V.S., Singh, P. and Gautam, R.C. 2006. Productivity and water-use efficiency ofrainfed pearl millet(*Pennisetum glaucum*) as influenced by planting patterns andintegratednutrientmanagement.*IndianJ.Agron*.,**51**(1):46-48.

Reddy, V. S. N., Singh, R., & Deepika, C. L. (2022). Effect of phosphorus and zinc on growth and yield of pearl millet (*Pennisetum glaucum* L.). *The Pharma Innovation Journal* 11(4), 542-545.

Rey, J.C.; Olivares, B.O.; Perichi, G.; Lobo, D. (2022). Relationship of Microbial Activity with Soil Properties in Banana Plantations in Venezuela. Sustainability 14, 13531. https://doi.org/10.3390/su142013531

Singh, L., Sharma, P. K., Jajoria, M., Deewan, P., & Verma, R. (2017). Effect of phosphorus and zinc application on growth and yield attributes of pearl millet (*Pennisetum glaucum* L.) under rainfed condition. *Journal of Pharmacognosy and Phytochemistry*, *6*(1), 388-391.

Singh, S., Singh, V., Shukla, R. D., & Yadav, B. (2019). Effect of planting geometry and phosphorus levels on pearl millet (Pennisetum glaucum). *An International Journal*, *14*(1), 18-22.

Sushila,R.andGiri,G.2000.Influenceoffarmyardmanure,nitrogenandbiofertilizerson growth, yield attributes and yield of wheat (*Triticum aestivum*) under limited watersupply.*IndianJournalofAgronomy*,**45**(3):590-595.

Venkata Lakshmi, K., Integrated nutrient management for dryland fodder sorghum (*Sorghumbicolor*L.Moench)-chickpea(*Cicerarietinum*L.)+coriander(*Coriandersativum*L.)croppingsystem.*M.Sc.(Ag.)Thesis.TamilNaduAgriculturalUniversity*,Coimbatore,India.(2001).

Zothanmawii.,EdwinLuikhamandMariamAnal,P.S.2018.Growthandyieldofhybridmaizeas influence by levels of nitrogen and biofertilizer. *International Journal of CurrentMicrobiology andApplied Sciences*,**7**(8):

Table 1. Effect of Bio fertilizers and Phosphorus on Yield attributes and Yield of Pearl millet

Sr.no	Treatments	Plant height (cm) 80 DAS	Dry weight (g/plant) 80 DAS
1	20 g/ kg Azotobacter + 35 kg/ ha Phosphorus	171.23	30.70
2	20 g/ kg Azotobacter + 40 kg /ha Phosphorus	179.80	31.19
3	20 g/ kgAzotobacter + 45 kg/ ha Phosphorus	185.43	33.59
4	20 g /kg Azospirillum + 35 kg /ha Phosphorus	175.03	34.22
5	20 g/ kg Azospirillum + 40 kg/ ha Phosphorus	183.17	34.30
6	20 g/ kg Azospirillum + 45 kg/ ha Phosphorus	188.70	33.88
7	20 g/ kg Azotobacter + Azospirillum + 35 kg/ha Phosphorous	192.10	34.87
8	20 g/ kg Azotobacter + Azospirillum + 40 kg/ha Phosphorous	196.40	37.67
9	20 g/ kg Azotobacter + Azospirillum + 45 kg/ha Phosphorous	200.13	40.33
10	Control (RDF 80-40-40 N-P-K kg/ha)	168.13	31.87
	F-test	S	S
	SEm(±)	1.40	0.93

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CD (p=0.05)	4.15	2.75

Table 2. Effect of Bio fertilizers and Phosphorus on Yield attributes and Yield of Pearl millet

Sr.no	Treatments	Ear head Length (cm)	No.of Grains/Ear head	Test Weight (g)	Grain yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
1	20 g/ kg Azotobacter + 35 kg/ ha Phosphorus	17.29	1597.2	5.47	2.38	4.15	36.94
2	20 g/ kg Azotobacter + 40 kg /ha Phosphorus	19.44	1682.9	6.03	2.31	4.30	35.49
3	20 g/ kgAzotobacter + 45 kg/ ha Phosphorus	20.81	1796.17	6.13	2.22	4.47	33.66
4	20 g /kg Azospirillum + 35 kg /ha Phosphorus	18.05	1613.4	6.00	2.70	4.98	36.22
5	20 g/ kg Azospirillum + 40 kg/ ha Phosphorus	19.85	1747.5	6.43	2.75	5.15	35.23
6	20 g/ kg Azospirillum + 45 kg/ ha Phosphorus	21.52	1891.8	6.40	2.61	5.20	33.80
7	20 g/ kg Azotobacter + Azospirillum + 35 kg/ha Phosphorous	22.55	1902.0	6.63	2.98	5.32	36.79
8	20 g/ kg Azotobacter + Azospirillum + 40 kg/ha Phosphorous	23.87	1981.0	6.53	3.15	5.64	36.05
9	20 g/ kg Azotobacter + Azospirillum + 45 kg/ha Phosphorous	25.25	2010.9	6.27	3.25	6.27	34.26
10	Control (RDF 80-40-40 N-P-K kg/ha)	15.84	1404.8	5.47	1.96	4.13	32.55
	F-test	S	S	NS	S	S	NS
	SEm(±)	0.27	32.00	0.61	0.04	0.27	1.17

CD (p=0.05)	2.33	95.06	-	0.13	0.80	-