Original Research Article

Study of productivity and economics of Pearl millet (Pennisetum glaucum L.) variety

ABV -04 in relation to Nitrogen and Phosphorus

ABSTRACT

During the kharif season of 2021, a field experiment was conducted at the crop research farm of the Department of Agronomy at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, with the goal of studying the effect of nitrogen and phosphorus on yield and economics of Pearl millet (Pennisetum glaucum L.) Var. ABV - 04 under a Randomized block design with 9 treatments (T1-T The experimental results revealed that 120 kg N/ha + 60 kg P/ha produced ear head length (20.77 cm), number of grains/ear head (1972.0), grain yield (2.68 t/ha), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index (41.49 percent), harvest index ((41.49 percent). T9 120 kg N/ha + 60 kg P/ha produced greater net returns (95,132.00 INR/ha), gross returns (1,36,544.00 INR/ha), and benefit-to-cost ratios (2.30).

Key words- Pearl millet, Nitrogen , Phosphorus, Yield,

INTRODUCTION

The scientific name for the millet most commonly seen in India is Pennisetum glaucum. Cumbu is also known as bulrush, cattail, or spiked millet in English, bajra in Hindi, dukhn in Arabic, mil à chandelles or petit millet in French, and mhunga or mahango in regions of southern Africa, among other names. Despite the fact that this plant is native to Africa, millet is a staple food for many Indians from lower socioeconomic backgrounds. The bajra crop is used by some rural populations for thatching rooftops and as a feed grain for their cows. Bajra is mostly grown in arid and dry areas. Bajra is planted on more than 260,000 square kilometres around the world, and it produces half of the world's millet. The optimal temperature range for this crop is between 25 and 31 degrees Celsius, and it grows best in drier sections of the country. It requires 40-50 cm of rainfall per year to thrive.

Nitrogen is an essential macronutrient for plant growth and is a component of amino acids, the building blocks of plant proteins and enzymes. Proteins are the structural ingredients of all living things, and enzymes let plants perform a wide range of biochemical activities. Nitrogen is also a problem for the chlorophyll molecule, which allows the plant to capture sunlight energy through photosynthesis, boosting plant growth and output. Nitrogen is important in the plant because it ensures that electricity is available when and where the plant needs it to maximise yield. Proteins and enzymes help change water and nutrient uptake in the roots, thus they're a good source of this

PEER REVIEW

important nutrient. Now that we've established the position and realised how important nitrogen is to a crop, we need to figure out how to protect and utilise this vital nutrient during the nitrogen cycle. Unfortunately, the nitrogen cycle is a leaky system, which means it frequently strives for excessive nitrogen utilisation efficiency.

Phosphorus is a component of flowers' complex nucleic acid structure that governs protein production. As a result, phosphorus is essential in the cellular department and the production of new tissue. Phosphorus is also linked to a variety of internal plant strength disparities. Phosphorus is frequently recommended as a row-carried out beginning fertilizer for early boom growth. Early increase response to phosphorus was confirmed in fewer than 40% of the test fields in university of **Nebraska** starter fertilizer research carried out in the 1980s **(Penas, 1989**). Even while phosphorus does not boost grain output, starter packets may also boom early. Manufacturers must carefully weigh the aesthetic effects of fertiliser application against increased revenue from increased production..

UNDER PEER REVIEW

MATERIALS AND METHODS

During the kharif season of 2021, a field experiment was conducted out at the C.R.F of the wing of Agronomy in Shaits Prayagraj, which is located at 25o 24' 42" N latitude, 81o 50' 56" E longitude, and 98 m altitude over the mean sea degree (MSL). to see how phosphorus and nitrogen affect the growth and output of Pearl millet (Pennisetum glaucum L.). The trial was set up in a Randomized Block design with nine treatments that were reproduced three times. The length of each online plot for each therapy is 3m 3m. When given in combination, the treatment is classified as having a recommended dose of Potash via Muriate of Potash, as well as Nitrogen via Urea and Phosphorus via DAP. (T1) 80 kg N/ha + 20 kg P (T2) a 100 kg N/ha + 20 kg P/ha, (T3) one 120 kg N/ha + 20 kg P/ha, (T4) 80 kg N/ha + 40 kg P/ha, (T5) one hundred kg N/ha + 40 kg P/ha, (T6) 120 kg N/ha + 40 kg P/ha, (T7) 80 kg N/ha + 60 kg P/ha, (T8) 100kg N/ha + 60 At harvesting maturity, the pearl millet crop was harvested smartly. Plant height (cm) and dry rely accumulation g plant were manually recorded on five randomly selected consultant plants from each plot of each replication one at a time, and seeds were isolated from each internet plot and dried under solar for three days after harvesting. Later, the seeds were winnowed, washed, and the seed yield per hectare was calculated and expressed in tonnes per hectare. After 10 days of thorough drying in the sun, the stover production from each online plot was measured and expressed in tonnes per hectare. The statistics were calculated and analysed using the **Gomez** and **Gomez** statistical approach (1984). The benefit: the fee ratio was reworked after the fee value of seed was replaced with straw and the general value of crop cultivation was protected.

RESULTS AND DISSCUSIONS

Yield and Yield Attributes:

The statistical analysis of ear head length revealed the enormous impact of ear head period. The treatment of 120 kg N/ha + 60 kg P/ha resulted in a significant and maximal ear head duration (20.seventy seven). However, with 120 kg N/ha + 60 kg P/ha, no other treatment achieved statistical parity. Nitrogen utilisation increases the cytonins' activity in plants, resulting in increased cellular division and elongation. Because nitrogen is a component of chloroplast porphyrins, increased nitrogen fertilisation increased crop ear head length due to increased photosynthates synthesis. Munirathnam and **Gautam, 2002, and Reddy et al., 2016** have also shown different reactions in ear head duration due to differing degrees of vitamins. Phosphorus treatment will be attributed to a general improvement in plant growth as measured by increased dry count number accumulation, which could be due to quicker phosphorus and other nutrient delivery to plants. improved food availability to plants at the flower primordial intiation stage, which may have aided in the production of more robust tillers and, as a result, increased ear head length These findings are also consistent with those of **Azad (20101), Sharma et al (2012)**.

Number of grains/ear head

The statistical analysis of the amount of grains per ear head revealed a significant influence. Significant and the largest number of grains per ear head were recorded in the treatment of 120 kg N/ha + 60 kg P/ha (1972). The statistical parity between 100 kg N/ha + 60 kg P/ha and 120 kg N/ha + 60 kg P/ha was achieved, however. Cell division and elongation are boosted as a result of the increased activity of cytokinins in plants, which are activated by nitrogen. For this reason, enhanced nitrogen fertilisation boosted grain and ear head production via increasing photosynthate production, because porphyrins in chloroplasts contain nitrogen. Munirathnam and Gautam, 2002, and Reddy et al., 2016, have also found that the quantity of grains per ear head might vary depending on the amount of nutrients in the soil. As a result of increased phosphorus and other nutrient supplies to plants, the overall improvement in plant development can be linked to phosphorus application. Plants may have benefited from an earlier supply of nutrients during the floral primordial intiation stage, resulting in a greater number of functional tillers and ultimately more grains/ear heads. **Azad (2010), Sharma et al. (2012)**, and others have found similar results (2012).

Grain yield.

Different combinations of Nitrogen and Phosphorus with Potassium have a substantial impact on grain production. The treatment 120 kg N/ha + 60 kg P/ha (2.68 ta/ha) produced the maximum grain production, but 100 kg N/ha + 60 kg P/ha was shown to be statistically equivalent to 120 kg N/ha + 60 kg P/ha. The grain production of pearl millet grew dramatically as the amount of nitrogen and phosphorus applied increased. This is due to nitrogen application, which can be attributed to increased photosynthesis, which results in enhanced plant growth and dry matter production. As a result, an increase in nitrogen supply might have boosted all of the growth metrics and yield-attributing features, resulting in higher yields. **Munirathnam and Gautam, 2002,**

UNDER PEER REVIEW

Guggari and Kalaghatagi, 2005, and **Singh et al., 2010** all showed increased grain output as a result of altering nutrient levels. Increased vegetative growth could be linked to phosphorus fertilisation, presumably as a result of effective uptake and utilisation of other nutrients received through the plant's large root system. Grain yield is a function of biological yield. As a result, the higher grain yield features may be attributed to a considerable increase in biological yield with the application of phosphorus. These findings are also consistent with those of **Azad (2010), Sharma et al (2012)**.

Stover yield

The administration of nitrogen and phosphorus had a considerable impact on the pearl millet crop's stover yield. Although 120 kg N/ha + 60 kg P/ha produced the highest stover production (3.77 ta/ha), 100 kg N/ha + 60 kg P/ha was determined to be statistically equivalent to 120 kg N/ha + 60 kg P/ha. The yield of pearl millet stover increased dramatically as the amount of nitrogen and phosphorus applied increased. This is due to nitrogen application, which can be attributed to increased photosynthesis, which results in enhanced plant growth and dry matter production. As a result, an increase in nitrogen supply could have boosted all of the growth metrics and yield attributing features, resulting in a higher stover yield. Munirathnam and Gautam, 2002, Guggari and Kalaghatagi, 2005, and Singh et al., 2010 all found increased stover yield as a result of altering nutrient levels. Increased vegetative growth could be linked to phosphorus fertilisation, presumably as a result of effective uptake and utilisation of other nutrients received through the plant's large root system. The biological yield is determined by the amount of straw produced. As a result, higher straw yield features may be linked to a large rise in biological yield with the application of phosphorus. These findings are also in line with those of **Azad (2010)** and **Sharma et al (2012)**.

Economics:

1. Among the different combination of nutrient source 120 kg N/ha + 60 kg P/ha recorded higher net return (95,132.00 INR /ha), gross return (1,36,544.00 INR/ha) and benefit: cost ratio (2.30).

CONCLUSION

Treatment 120 kg N/ha + 60 kg P/ha produced the highest grain yield (2.68 ta/ha), gross return (1,36544.00 INR/ha), net return (95,132.00 INR/ha), and benefit:cost ratio (2.30), which may be more preferable for farmers because it is more economically profitable and thus can be recommended to farmers.

REFERENCES

Ali, E.A. 2010. Grain yield and nitrogen use efficiency of pearl millet as affected by the plant density, nitrogen rate and splitting in sandy soil. *American – Eurasian Journal of Agricultural and Environmental Science* **7**(3);327-335.

UNDER PEER REVIEW

Ansari, M.A., Rana, K.S., Rana, D.S and Kumar, P. 2011. Effect of nutrient management and antitranspiration on rainfed sole and intercropped pearl millet (*Pennisetum glaucum) and* pigeon pea (*Cajanus cajan)*. *Indian Journal of Agronomy***.** **56**(3): 209-216.

Azad, V.B., Bali, B.S and Saha, A.A.S. (2010). Effect of phosphorus levels and biofertilizers on yield, P-uptake and economics of wheat (*Triticum aestivum*). *Environment and Ecology*, **28**; 534 – 537.

Bhuva, H.M., Detroja, A.C. and Khanpara, M. D. 2018. Requirement of nutrients for pearl millet (*Pennisetum glaucum* L.) production under Saurashtra conditions. *International Journal of Environmental Sciences & Natural Resources* **9**(4): 2572-1119.

Bhuva, H.M and Sharma, S. 2015. Influence of nutrient uptake by irrigation, nitrogen and phosphorous and their effect on quality parameters of rabi pearl millet. *American – Eurassian Journal of Agriculture and Environment Science* **15** (3) : 324 -327.

Brar, B.S., Benipal, D.S and Singh, J. (2009). Response of wheat to different levels of Phosphorus and Sulphur in Alluvial soil of Punjab. *Indian Journal of Ecology*, **36**: 18-21.

Chand, B. and Gautam, R.C. (2000). Effect of organic manures. Biofertilizers and inorganic fertilizers on growth, yield and quality of rainfed pearl millet. *Annals of Agricultural Research*, **4**: 459-464.

Chaudhary, P.D., Jat, R.S and Sharma, H.S. (2003). Interaction effect of phosphorus, sulphur and PSB inoculation on growth, yield and nutrient uptake of wheat. *Annals of Agricultrual Research new Series*, **24**(1):12-16.

Chejara, V.K., Gupta, A.K. and Gupta, D.K. (2003). Effect of phosphorus and sulphur on yield, quality, nutrient concentration and their uptake by pearl millet. *Annals of Biology* **19**: 141-145.

Gomez, K. A. and A. A. Gomez.1984. Statistical Procedures for Agricultural Research. 2nd edn. John Wiley and Sons, Inc. London, UK

Guggari, A.K and Kalaghatagi, S.B. 2005. Effect of fertilizer and biofertilizer on pearl millet (*Pennisetum glacum)* and pigeon pea (*Cajanus cajan)* intercropping system under rainfed conditions. *Indian Journal of Agronomy*.**50**(1): 24-26.

Jadhav, R.P., Khafi, H.R and Raj, A.D. 2011. Effect of nitrogen and vermicompost on protein

UNDER PEER REVIEW

content and nutrient uptake in pearl millet. *Agricultural Science Digest.* **31**(4): 319- 321.

Jain, N.k. and Poonia, B.L. (2003). Integrated nutrient management in Pearl millet and optimizing fertilizer requirement in succeeding wheat. *Crop research* **26**:62-66.

Kumar, A. (2008). Direct and residual effect on nutrient management in Maize (Zea Mays) – wheat (Triticum aestivum) cropping system. *Indian Journal of Agronomy*, **53**: 37-41.

Munirathnam, P and Gautam, R.C. 2002. Response of promising pearl millet (*Pennisetum glaucum)* cultivars to levels and time of nitrogen application under rainfed conditions. *Indian Journal of Agronomy*.**47**(1): 77-80.

Pandey, I.B. Thakur, S.S. Singh, S.J and Mishra, S.S. (2000). Effect of fertilizer and weed management on nutrient economy and yield of wheat (*Triticum aestivum*). *Indian Journal of Agronomy*, **45**: 596-601.

Patel, N.I., Patel, J.J., Chatra Ram and Sutaliya, J.M. 2013. Effect of NPK fertilizers applied to pearl millet on the basis of soil test values. *Green Farming.* **4**(4): 433-437.

Piri, I. (2008). Effect of phosphorus fertilizer and micronutrients foliar application on sorghum yield. *Annals of Biological Research,* **3**: 3998-4001.

Parvesh, R. (2009). Response of Wheat to phosphorus level and weed control under different tillage practices in rice-wheat cropping system.Ph.D. Thesis, N.D., University of Agriculture & Technology. Faizabad (U.P).

Rathore, S.S. and Gautam, R.C. (2003). Response of direct seeded and transplanted pearl millet (*Pennisetum glaucum* L.) to nitrogen, phosphorus and biofertilizers in intercropping system. *Indian Journal of Agronomy*, **48**:153-155.

Rathore, V.S., Singh, P and Gautam, R.C. 2006. Productivity and water-use efficiency of rainfed pearl millet as influenced by planting patterns and integrated nutrient management. *Indian Journal of Agronomy*.**51**(1): 46-48.

Rathore, V.S., Rana, V.S an Nanwal, R.K. (2008). Effect of plant density and fertility levels on growth and yield of pearl millet (*Pennisetum glaucum* L.) hybrids under limited irrigation conditions in semi – arid environment. *Indian Journal of Agricultural Sciences* **78** (8): 667 -670.

Reddy, B. P. S., Madhuri, K.V., Venkaiah, K and Prathima, T. 2016. Effect of nitrogen and potassium on yield and quality of pearl millet (*Pennisetum glaucum* L.). *International Journal of Agricultural Innovations and Research*.**4**(4): 2319-1473.

UNDER PEER REVIEW

Sah, R.R., Rai, R.K. and Mukherjee, P.K. (2000). Effect of Dhaincha (*Sesbania aculeata*) and Phosphorus on growth, yield and Phosphorus uptake of wheat. *Indian Journal of Agronomy* **45**:707-710.

Sakarvadia, H. L., Golakiya, B. A., Parmar, K. B., Polara, K. B and Jetpara, P. I. 2012. Effectof nitrogen and potassium on yield, yield attributes and quality of summer pearl millet. *Asian Journal of Soil Science.***7**(2): 292-295.

Sharma, P.K., Kumar, Sudesh and Chaudhary, G. R. (2012). Effect of organic manure and nutrient management on productivity and soil fertility status in Pearl millet (Pennisetum glaucum). *Research on Crops*.**13**:503-506.

Sharma, R.P., Jha, R.N., Pathak, S.K. and Haque, M. (2003). Phosphorus management in Rice-Wheat cropping system. *Indian Journal of Agronomy*, **48**:67-72.

Singh, R.K., Chakraborty, D., Garg, R.N., Sharma, P.K and Sharma, U.C. 2010. Effect of different water regimes and nitrogen application on growth, yield, water use and nitrogen uptake by pearl millet (*Pennisetum glaucum). Indian Journal of Agricultural Sciences.* **80**(3): 213-216.

Singh, D., Raghuvanshi, K., Chaurasia, A and Datta, S.K. (2017). Biofertilizers: non chemical source for enhancing the performance of pearl millet crop (*Pennisetum glaucum* L.). *Bulletin of Environment, Pharmacology and Life Sciences*. **6**(11):38-42.

Singh, B., Rana, D.S., Joshi, U.N. and Dhaka, A.K. 2012. Fodder yield and quality of pearl millet genotypes as influenced by nitrogen levels. *Forage Research* **38**(1): 62-63.

Sonawane, P.D., Rodge, R.G and Attarde, D.R. 2007. Effect of fertilizer, biofertilizer, intercropping system on pearl millet under rainfed conditions. *Journal of Maharashtra Agricultural Universities.***32**(2): 176-178.

Tiwana, U.S., Puri, K.P and Singh, S. (2003). Fodder yield and quality off multicut pearl millet (*Pennisetum glaucum* L.) as influenced by nitrogen and phosphorus under Punjab conditions. *Forage Research*. **28**(4):190-193.

Tetarwal, J.P and Rana, K.S. 2006. Impact of cropping system, fertility level and moisture-conservation practice on productivity, nutrient uptake, water use and profitability of pearl millet under rainfed conditions. *Indian Journal of Agronomy.***51**(4): 263-266.

Vardana, S.S., Pahuja, S.K., Thakral, L. and Kumar, A. (2008). Nutrient content and their

UNDER PEER REVIEW

uptake in hybrid pearl millet as affected by organic and inorganic fertilizers. *Haryana Journal of Agronomy*, **1&2**:88-89.

Yadav, S.S., Abha Tikoo, Sulthan Singh and Bikram Singh 2011. Potassium fertilization in cluster bean – mustard and pearl millet – mustard cropping system. *Journal of the Indian Society of Soil Science*. **59**(2): 164 – 168.

Yakadri, M and Reddy, A.P.K. 2009. Productivity of pearl millet (*Pennisetum glaucum* L.) as influenced by planting pattern and nitrogen levels during summer. *Journal of Research* ANGRAU. **37**(1&2): 34-37.

UNDER PEER REVIEW

Table 1. Effect of Nitrogen and Phosphorus on yield and yield attributing characters of pearl millet var. 'ABV - 04'

T. No	Treatments	Ear head length (cm)	No. of grains/ear head	Grain Yield (t/ ha)	Stover Yield (t/ha)
T_1	80 kg N/ha + 20 kg P/ha	16.13	1671.00	2.21	3.26
T_2	100 kg N/ha + 20 kg P/ha	16.87	1699.00	2.28	3.36
T_3	120 kg N/ha + 20 kg P/ha	17.50	1784.67	2.42	3.50
T_4	80 kg N/ha + 40 kg P/ha	17.20	1747.33	2.36	3.44
T_5	100 kg N/ha + 40 kg P/ha	18.70	1861.33	2.51	3.59
T_6	120 kg N/ha + 40 kg P/ha	19.37	1885.00	2.55	3.64
T_7	80 kg N/ha + 60 kg P/ha	18.33	1833.33	2.47	3.56
T_8	100 kg N/ha + 60 kg P/ha	20.20	1942.67	2.63	3.74
T_9	120 kg N/ha + 60 kg P/ha	20.77	1972.00	2.68	3.77
	SEm (±)	0.18	14.56	0.024	0.024
	CD (P 0.05)	0.53	43.27	0.07	0.07

UNDER PEER REVIEW

Table 2. Effect of Nitrogen and Phosphorus on economics of pearl millet var. 'ABV – 04'

T.No.	Treatments	Cost of cultivation (INR/ ha)	Gross return (INR/ ha)	Net return (IN/ha)	Benefit: Cost ratio
T_1	80 kg N/ha + 20 kg P/ha	38,924.00	1,12,574.00	73.85	1.89
T_2	100 kg N/ha + 20 kg P/ha	38,185.00	1,16,433.00	77.44	1.97
T_3	120 kg N/ha + 20 kg P/ha	39,445.00	1,23,369.00	84.12	2.13
T_4	80 kg N/ha + 40 kg P/ha	39,908.00	1,20,258.00	80.55	2.01
T_5	100 kg N/ha + 40 kg P/ha	40,168.00	1,28,061.00	88.09	2.19
T_6	120 kg N/ha + 40 kg P/ha	40,429.00	1,30,186.00	89.95	2.22
T_7	80 kg N/ha + 60 kg P/ha	40,891.00	1,26,208.00	85.51	2.09
T_8	100 kg N/ha + 60 kg P/ha	41,151.00	1,34,419.00	93.46	2.27
T_9	120 kg N/ha + 60 kg P/ha	41,412.00	136,544.00	95.33	2.30

#Data not subjected to statistical analysis.

UNDER PEER REVIEW