www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(9): 1006-1008

www.thepharmajournal.com
Received: 15-07-2023
Accepted: 23-08-2023

L Sravankumar
Research Scholar, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

Pradeep Rajput
Assistant Professor, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

Pradeep Kr. Kanaujiya
Assistant Professor, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

K Akhil Kumar Gowd
Research Scholar, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

Mallikarjun
Research Scholar, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

Corresponding Author:
L Sravankumar
Research Scholar, Department of Agronomy, School of Agriculture, ITM University, Gwalior, Madhya Pradesh, India

Effect of nitrogen and phosphorus levels on growth and yield of maize (*Zea mays* L.)

L Sravankumar, Pradeep Rajput, Pradeep Kr. Kanaujiya, K Akhil Kumar Gowd and Mallikarjun

Abstract
An investigation on the "effect of nitrogen and phosphorus levels on growth and yield of maize (*Zea mays* L.)" was conducted during the *Kharif* season 2022 at the Crop research centre-1, School of Agriculture, ITM University Gwalior (M.P.). The experiment was carried out in Factorial randomized block design consisting 9 treatment combinations, which includes three Nitrogen Levels (N1-60, N2-120 and N3-180 kg N ha^{-1}), three levels of phosphorus (P1-30, P2- 60 and P3-90 kg P_2O_5 ha^{-1}) and one absolute control and each treatment was replicated thrice. Maize variety "JVM 421" was sown in this experiment. Result of the experiment disclosed that rise in nitrogen and phosphorus levels application had significantly increased the growth and yield of maize *viz*., plant height, no. of leaves plant-1, leaf area index (LAI), dry matter, no. of cobs plant-1, no. of grains cob-1, seed index, grain yield, stover yield and biological yield. Application of 180 kg N ha^{-1} and 90 kg P_2O_5 ha^{-1} was found significantly superior over the application of 60 kg N ha^{-1} and 30 kg P_2O_5 ha^{-1} but was on par with application of 120 kg N ha^{-1} and 60 kg P_2O_5 ha^{-1} levels.

Keywords: Nitrogen, phosphorus, growth and yield

Introduction
Maize, scientifically known as *Zea mays* L., is one of the most extensively grown cereal crops across the world and serves as a crucial ingredient in various food and industrial products. Maize, also known as corn, among the poaceae family and has been cultivated for thousands of years by various civilizations. Maize is widely grown for its nutritious and versatile grain, which is used for human consumption, livestock feed, and various industrial purposes.

The crop's adaptability, high yield potential, and versatility make it a staple in many agricultural systems. After rice and wheat, maize is ranked third among the cereals in terms of importance. (Mahapatra *et al.* 2018) [5].

It has sturdy stems, large leaves, and produces both male flowers (tassels) and female flowers (ears) on the same plant, which is known as a monoecious flowering habit. Maize is characterized by its tall, grass-like stalks that produce ears or cobs covered in rows of seeds known as kernels, the main product of the crop. The kernels can vary in colour, size, and shape, depending on the variety. They are rich in carbohydrates, essential vitamins (e.g., vitamin A, B vitamins), minerals (e.g., iron, zinc), and dietary fibre. Besides its use as a staple food in various forms, maize is also processed into various products like cornmeal, corn oil, corn syrup, corn starch, and animal feed. The following is the nutritional profile of maize (per 100 g): 4 g of protein, 30 g of carbohydrates, 3.5 g of dietary fibre, 1.5 g of fat, 3.6 g of sugar, 310 iu of vitamin A, 4 mg of calcium, 0.72 mg of zinc, etc. (Tiwari *et al*. 2022) [12].

Maize crop requires nutrients mainly nitrogen, phosphorus and potassium for good growth and higher yields. Nitrogen is a vital plant nutrient and a key element in production of yield that is required for maize cultivation. It contributes significantly to the photosynthesis process and aids in the production of the chlorophyll pigment, which is essential for crop development and reproduction. Since maize is a crop with a high nutritional need, nitrogen is crucial in determining the biochemical reactions and physiological processes that increase the crop's quality and productivity. Phosphorus participates in a variety of metabolic processes, ensures energy transfer and storage as ADP and ATP, permits genetic material transmission characteristics because it is constituent of both RNA and DNA.

Materials and Methods

At the Crop Research Center, ITM University, Gwalior, a study on the "Effect of Nitrogen and Phosphorus Levels on the Growth and Yield of Maize (*Zea mays* L)" was conducted during the Kharif season of 2022. The Research Center comes under the grid zone of agro-ecological zones of Madhya Pradesh. The experimental site is located in Madhya Pradesh, a subtropical region with scorching summers and moderately chill winters. The monsoon season, which lasts from June to September, brings 700 to 800 mm of rain on average each year.

Before preparing the layout, 5 samples were randomly collected from 0-15 cm depth of soil profile for the chemical analysis of experiment area soil in the field. The experimental field's soil was sandy loamy with a medium level of nitrogen availability (184.24 kg ha-^{1}), low in available phosphorus (25.33 kg ha-^{1}) and high available potassium (368.75 kg ha-^{1}) and low in organic carbon (0.42%) and having a pH of 7.4. The experiment was carried out in a Factorial randomized block design consisting 9 treatment combinations, which includes three Nitrogen Levels (*viz*., N1-60 kg N ha-^{1}, N2-120 kg N ha-^{1}and N3-180 kg N ha-^{1}), three phosphorus levels (*viz*., P1-30 kg P_2O_5 ha-^{1}, P2-60 kg P_2O_5 ha-^{1}and P3-90 kg P_2O_5 ha-^{1}) and one absolute control, and each treatment were replicated thrice. Maize variety "JVM 421" was sown by line sowing (seed drills) method. Observations are taken while carrying the experiment like growth parameters i.e., Plant height (cm), No. of leaves, Leaf area index (LAI) and dry matter, yield accrediting characteristics like number of cobs plant-1, number of grains cob-1, seed index, grain, stover and biological yields.

Result and discussion Growth attributes

The result of the current experiment showed that increased nitrogen and phosphorus levels gradually impacted on growth attributes like plant height (cm), no. of leaves, leaf area index (LAI) and dry matter(g). Regarding the growth parameters, maximum nitrogen level 180 kg ha-^{1} showed maximum growth like plant height (172.19 cm), number of leaves (13.11), leaf area index (4.08), dry matter (224.33 g) and was on par to 120 kg N ha-^{1} with plant height (160.54 cm), no. of leaves (12.86), leaf area index (3.86) and dry matter (213.61g). Both levels 180 and 120 kg N ha-1 are significantly superior over treatments 60 kg N ha-1 and absolute control. The lower growth parameters are recorded with absolute control. The increase in growth parameters with increased nitrogen levels likewise informed by Patel *et al*. (2006) [7], Bhatt (2012) [1], Jena *et al*. (2014) [3], Varma *et al*. (2022) [13], Kamsu *et al*. (2022) [4] and Singh *et al*. (2021) [10].

In phosphorus levels same trend was found as with nitrogen. Maximum readings regarding growth characters like Plant height (168.80 cm), number of leaves (13.08), LAI (3.99) and dry matter (221.93 g) are recorded with 90kg P_2O_5 ha-^{1} level and on par to 60 kg P_2O_5 ha-^{1} which recorded plant height (162.21 cm), number of leaves (12.81), leaf area index (3.85) and dry matter (213.31g). Both levels 90 and 60 P_2O_5 ha-^{1} are found significantly superior over 30 kg P_2O_5 ha-^{1} and absolute control regarding growth attributes. The numerous metabolic and physiological functions are improved by phosphorus fertilization, which is also referred to as "energetic currency". The increase in growth parameters with Phosphorus fertilizer increase was also reported by Sankadiya and Sanodiya (2021) [8].

Yield attributes

The maximum Nitrogen level of 180 kg ha-^{1} produced significantly higher no. of cobs plant-1 (2.01), no. of grains cob-1 (367.39), seed index (27.25 g), grain yield (4026.68 kg ha-^{1}), stover yield (8267.41 kg ha-^{1}) and biological yield (12294.09 kg ha-^{1}). The recorded yield parameters with 180 kg N ha-1 are was found on par to 120 kg N ha-1 with no. of cobs plant-1 (1.93), no. of grains cob-1 (347.26), seed index (25.70 g), yield of grain (3883.11 kg ha- ^{1}), yield of stover (8075.08 kg ha-^{1}) & biological yield (11958.19 kg ha-^{1}). Both levels 90 and 60 kg N ha-^{1} were significantly superior over 60 kg N ha-1 and absolute control regarding yield parameters. Lower yield recordings were found with absolute control. The increase in yield parameters with nitrogen fertilizer increase likewise informed by Pal *et al*. (2017) [6], Singh *et al*. (2017) [10], Sharma *et al*. (2019) [9] & Adhikari *et al*. (2021) [14].

Coming to phosphorus levels, same with nitrogen, as maximum phosphorus level 90 kg ha-^{1} recorded significant higher number of cobs plant-1 (1.90), number of grains cob-1(365.74), seed index (26.84), yield of grain (4026.02 kg ha-^{1}), yield of stover (8230.88 kg ha-^{1}) and biological yield (12256.89 kg ha-^{1}). The recorded yield parameters with phosphorus of 90 kg ha-^{1} are on par with 60 kg P_2O_5 ha-^{1} which recorded number of cobs plant-1 (1.82), number of grains cob- 1(346.63), seed index (26.05), yield of grain (3818.50 kg ha-^{1}), yield of stover (8015.24 kg ha- ^{1}) and biological yield (11833.74 kg ha-^{1}). Both levels 90 and 60 kg P_2O_5 ha-^{1} were found significantly superior over 30 and absolute control regarding yield attributes. The increase in yield parameters with phosphorus fertilizer increase likewise informed Varma *et al*. (2022) [13], Sharma *et al* (2019) [9] and Pal *et al*. (2017) [6].

Table 1: Effect of different levels of nitrogen and phosphorus on growth and yield attributes of maize

Treatments	Plant height (cm)	No. of leaves plant-1	LAI	Dry matter (g)	No. of cobs plant-1	No. of grains cob-1	Seed index (g) (100seed wt.)	Grain yield (Kg ha^1)	Stover yield (Kg ha^1)	Biological Yield (Kg ha^1)	Harvest index (%)
Absolute control	108.12	8.67	2.88	143.43	1.00	218.73	19.93	2548.04	5836.34	8384.38	30.40
Nitrogen levels (kg N ha^1)											
N1 – 60	147.51	11.58	3.36	192.99	1.43	302.90	22.87	3355.07	7296.29	10651.36	31.49
N2 – 120	160.54	12.86	3.86	213.61	1.93	347.26	25.70	3883.11	8075.08	11958.19	32.42
N3 – 180	172.19	13.11	4.08	224.33	2.01	367.39	27.25	4026.68	8267.41	12294.09	32.69
S.Em ±	4.14	0.34	0.11	5.48	0.05	13.73	0.94	122.01	208.49	315.59	0.43
C.D at 5%	12.30	1.02	0.33	16.27	0.14	40.81	2.78	362.51	619.45	937.67	NS
Phosphorus levels (kg P_2O_5 ha^1)											
P1 – 30	149.23	11.67	3.45	195.69	1.65	305.18	22.93	3420.35	7392.67	10813.01	31.57
P2 – 60	162.21	12.81	3.85	213.31	1.82	346.63	26.05	3818.50	8015.24	11833.74	32.22

P3 – 90	168.80	13.08	3.99	221.93	1.90	365.74	26.84	4026.02	8230.88	12256.89	32.81
S.Em ±	4.14	0.34	0.11	5.48	0.05	13.73	0.94	122.01	208.49	315.59	0.43
C.D at 5%	12.30	1.02	0.33	16.27	0.14	40.81	2.78	362.51	619.45	937.67	NS
Interaction (N*P)											
S.Em ±	7.17	0.59	0.19	9.49	0.08	23.79	1.62	211.33	361.11	546.62	0.75
C.D at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Conclusion

Nitrogen and phosphorus levels had significant impact on growth and yield attributes of maize. According to the conducted experiment, it was found that 180 kg N ha^{-1} and 90 kg P_2O_5 ha^{-1} application resulted in better growth and yield, and stood at par with 120 kg N ha^{-1} and 60 kg P_2O_5 ha^{-1}. So, use of 120 kg N ha^{-1} and 60 kg P_2O_5 ha^{-1} levels is helpful to get higher production and returns.

References

1. Bhatt PS. Response of sweet corn hybrid to varying plant densities and nitrogen levels. African Journal of Agricultural Research. 2012;7(46):6158-6166.
2. Chaudhary K, Debbarma V. Response of Nitrogen and Phosphorus on Growth, Yield and Economics of Fodder Maize (*Zea mays* L.). International Journal of Plant & Soil Science. 2023;35(14):330-337.
3. Jena N, Vani KP, Rao VP, Sankar AS. Effect of nitrogen and phosphorus fertilizers on growth and yield of quality protein maize (QPM). International Journal of Science and Research (IJSR). 2015;4(12):197-199.
4. Kamsu A, Kalasare RS, Maitra S, Adhikary R, Mahapatro S. Response of summer maize (*Zea mays* L.) to different doses of nitrogen and potassium. Crop Research. 2022;57(3):145-150.
5. Mahapatra A, Barik AK, Mishra GC. Integrated nutrient management on baby corn (*Zea mays* L.). International Journal of Bio-resource and Stress Management. 2018 Feb 1;9:044-048.
6. Pal B, Hirpara DS, Vora VD, Vekaria PD, Sutaria GS, Akbari KN, *et al*. Effect of nitrogen and phosphorus on yield and yield attributes of maize in South Saurashtra, India. International Journal of Current Microbiology and Applied Sciences. 2017;6(3):1945-1949.
7. Patel JB, Patel VJ, Patel JR. Influence of different methods of irrigation and nitrogen levels on crop growth rate and yield of maize (*Zea mays* L.). Indian Journal of Crop Science. 2006;1(1and2):175-177.
8. Sankadiya S, Sanodiya L. Effect of phosphorus and potassium levels on growth and yield of maize (*Zea mays* L.). Pharma Innov. J. 2021;10(10):1347-1350.
9. Sharma R, Adhikari P, Shrestha J, Acharya BP. Response of maize (*Zea mays* L.) hybrids to different levels of nitrogen. Archives of Agriculture and Environmental Science. 2019;4(3):295-299.
10. Singh J, Partap R, Singh A. Effect of nitrogen and zinc on growth and yield of maize (*Zea mays* L.). International Journal of Bio-resource and Stress Management. 2021 Jun 3;12:179-185.
11. Thirupathi I, Vidya Sagar GE, Suneetha Devi CPK, Sharma SHK. Effect of nitrogen and sulphur levels on growth, yield, quality and economics of single cross hybrid maize (*Zea mays* L.). International Journal of Science, Environment and Technology. 2016;5(5):2989-2998.
12. Tiwari DK, Chaturvedi DP, Singh T, Kumar T, Prachi Awadhiya Y. Effect of nitrogen and sulphur levels on growth, yield and quality of maize (*Zea mays* L.). Pharma Innovation J. 2022;11:418-22.
13. Varma DJ, Adhikary R, Reddy MD, Maitra S. Influence of nitrogen and phosphorus on growth and yield of summer maize (*Zea mays* L.). Crop Research. 2022;57(3):141-144.
14. Adhikari D, Albataineh H, Androic D, Aniol K, Armstrong DS, Averett T, *et al*. Accurate determination of the neutron skin thickness of Pb 208 through parity-violation in electron scattering. Physical review letters. 2021 Apr 27;126(17):172502.