Original Research Article

Effect of Nitrogen and Zinc levels on Yield and Economics of Mustard (*Brassica juncea* L.)

Abstract

A field experiment was conducted during *Rabi* season (2021-2022) at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (Allahabad) (U.P.). The soil of experimental plot was sandy loam in texture, nearly natural in soil reaction (pH 7.1), low in organic carbon (0.28 %), available N (225 kg/ha.), available P (19.50 kg/ha.) and available K (213.7 kg/ha.). The treatments consisted of 3 levels of Nitrogen N_1 (60 kg/ha.), N_2 (80 kg/ha.), N_3 (100 kg/ha.) and 3 levels of Zinc Zn_1 (5 kg/ha.), Zn_2 (10 kg/ha.) and Zn_3 (15 kg/ha.). The experiment was laid out in Randomized Block Design with 9 treatments and replicated thrice. The results revealed that the application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. recorded maximum plant height (188.10 cm), Number of branches/plant (10.90), plant dry weight (26.38 g/plant), siliqua length (5.20 cm), number of siliquae per plant (398.90), number of seeds per siliqua (24.40), test weight (3.53 g), grain yield (1.89 t/ha.), stover yield (3.11 t/ha.) and harvest index was found to be non-significant. Maximum Gross returns (103650.00 INR/ha.), Net returns (70264.08 INR/ha.) and B:C ratio (2.10) where also recorded with the treatment with the application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha.

Key words: -*Nitrogen, Growth, Yield, Zinc, Rabi, Economics.*

INTRODUCTION

Indian mustard is predominantly cultivated in the states of Rajasthan, Uttar Pradesh, Haryana, Madhya Pradesh and Gujarat. Rajasthan ranks first in area and production of rapeseed and mustard with 2.50 million ha. area and 3.71 million tonnes production. Mustard oil is used as condiment in pickles, flavoring curries and vegetables, preparation of hair oils, medicines, soap making and in the tanning industry for softening of leather. The mustard cake is used mostly for cattle feed and manure. Nitrogen is vital for crops because it is a major constituent of chlorophyll, the compound by which plants use sunlight energy to produce sugars from water and carbon dioxide that is photosynthesis. It is correspondingly a major factor of amino acids, the building blocks of proteins. Lacking proteins, plants wither and die. The main nutrients are required for plant growth are nitrogen (N), phosphorus (P), and potassium (K) and the use of nitrogen fertilizer outcomes in improved crop production costs and atmospheric pollution. Numerous plant particles such as amino acids, chlorophyll, nucleic acids, ATP and phytohormones, that contains nitrogen as a basic part, are required to complete the biological processes, involving carbon and nitrogen metabolisms, photosynthesis and protein production. Nitrogen application is more important than the other major important fertilizers/nutrients for successful crop production. Zinc is a divalent action exhibiting important role in health & disease as evidenced by the role of Zn in the functional

capacity more than 200 metallic enzymes including Carbonic anhydrase, Carboxypeptidases, Alcohol dehydrogenases, Alkaline phosphatases, and RNA Polymerases etc.. It is also required to maintain the structure of nucleic acid protein, cell membrane and also exerts vital role in various physiological functions viz., Cell growth, division, maturation and reproduction, Dark adaptation, night vision, Wound healing, host immunity, Taste acuity, Maintenance of pregnancy, fetal growth etc. **(Alam *et al.*, 2010; Alloway, 2008).** The main functions of zinc is tendency to make up tetragonal complexes with nitrogen, oxygen and sulfur thus zinc have a catalytic, building and activating role in the enzymes (**Alloway, 2008**). Zinc is essential element for crop production and optimal size of fruit, also it required in the carbonic enzyme which present in all photosynthetic tissues and required for chlorophyll biosynthesis **(Ali *et al.*, 2008; Graham *et al.*, 2000).**

MATERIALS AND METHODS

The experiment was conducted during *Rabi* season of 2021-2022. The experiment was conducted in Randomized Block Design consisting of nine treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) with low level of organic carbon (0.28%), available N (225 Kg/ha.), P (19.50 kg/ha.) and higher level of K (92.00 kg/ha.). The treatment combinations are T_1 Nitrogen 60 kg/ha. + Zinc 5 kg/ha., T_2 Nitrogen 60 kg/ha. + Zinc 10 kg/ha., T_3 Nitrogen 60 kg/ha. + Zinc 15 kg/ha., T_4 Nitrogen 80 kg/ha. + Zinc 5 kg/ha., T_5 Nitrogen 80 kg/ha. + Zinc 10 kg/ha., T_6 Nitrogen 80 kg/ha. + Zinc 15 kg/ha., T_7 Nitrogen 100 kg/ha. + Zinc 5 kg/ha., T_8 Nitrogen 100 kg/ha. + Zinc 10 kg/ha., T_9 Nitrogen 100 kg/ha. + Zinc 15 kg/ha. The observations were recorded on different growth parameters at harvest viz. plant height(cm), number of branches per plant, plant dry weight, Number of siliquae per plant, number of seeds per siliqua, test weight, grain yield and stover yield.

RESULT AND DISCUSSION

A. Yield Attributes

Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum number of siliquae per plant (398.90) which was significantly superior over all other and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (375.40) which was statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum number of seeds per siliqua (24.40) which was significantly superior over all other treatment and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (22.30) which was statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum length of siliqua (5.20) which was significantly superior over all other treatment and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (5.10) which was statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum test weight (3.53 g) which was significantly superior over all other and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (3.29 g) which was

statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum seed yield (1.89 t/ha.) which was significantly superior over all other and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (1.79 t/ha.) and Nitrogen 80 kg/ha. + Zinc 15 kg/ha. (1.75 t/ha.) which was statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was recorded maximum stover yield (3.11 t/ha.) which was significantly superior over all other and treatment with application of Nitrogen 100 kg/ha. + Zinc 10 kg/ha. (3.06 t/ha.) which was statistically at par with the treatment with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. Treatment with application of Nitrogen 80 kg/ha. + Zinc 10 kg/ha. was recorded maximum harvest index (38.63 %) and minimum with application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. (36.83 t/ha.). There was no significance difference between different treatment combinations. (Mayur *et al.*, 2004).

Table.1 Effect of Nitrogen and Zinc levels on Yield Attributes and Yield of Mustard.

Treatments	No. of Siliquae per plant	No. of Seeds per Siliqua	Length of Siliqua	Test Weight (g)	Seed Yield (t/ha.)	Stover Yield (t/ha.)	Harvest Index (%)
Nitrogen 60 kg/ha. + Zinc 5 kg/ha.	289.80	17.90	4.40	2.52	1.41	2.39	36.98
Nitrogen 60 kg/ha. + Zinc 10 kg/ha.	312.70	18.70	4.70	2.69	1.51	2.43	38.25
Nitrogen 60 kg/ha. + Zinc 15 kg/ha.	330.20	19.40	4.80	2.74	1.59	2.64	37.62
Nitrogen 80 kg/ha. + Zinc 5 kg/ha.	320.20	18.90	4.70	2.68	1.54	2.57	37.49
Nitrogen 80 kg/ha. + Zinc 10 kg/ha.	348.50	20.20	4.80	2.91	1.71	2.75	38.63
Nitrogen 80 kg/ha. + Zinc 15 kg/ha.	365.00	21.70	4.90	3.04	1.75	2.87	37.93
Nitrogen 100 kg/ha. + Zinc 5 kg/ha.	341.00	19.70	4.80	2.88	1.66	2.70	38.16
Nitrogen 100 kg/ha + Zinc 10 kg/ha.	375.40	22.30	5.10	3.29	1.79	3.06	37.06
Nitrogen 100 kg/ha. + Zinc 15 kg/ha.	398.90	24.40	5.20	3.53	1.89	3.11	36.83
SEm (±)	7.85	0.71	0.08	0.12	0.05	0.05	1.08
CD (5%)	23.54	2.13	0.25	0.35	0.15	0.17	-----

B. Economics

Cost of cultivation (33385.92 INR/ha.) was found to be highest in Nitrogen 100 kg/ha. + Zinc 15 kg/ha. and the minimum cost of cultivation (31171.52 INR/ha.) was found to be in Nitrogen 60 kg/ha. + Zinc 5 kg/ha. as compared to other treatments. Gross returns (103650.00 INR/ha.) were found to be highest in Nitrogen 100 kg/ha. + Zinc 15 kg/ha. and the minimum gross returns (78450.00 INR/ha.) was found to be Nitrogen 60 kg/ha. + Zinc 5 kg/ha. as compared to other treatments. Net returns (70264.08 INR/ha.) were found to be highest in Nitrogen 100 kg/ha. + Zinc 15 kg/ha. and the minimum net returns (47278.48 INR/ha.) was found to be Nitrogen 60 kg/ha. + Zinc 5 kg/ha. as compared to other treatments. Benefit Cost ratio (2.10) was found to be highest in Nitrogen 100 kg/ha. + Zinc 15 kg/ha. and the minimum benefit cost ratio (1.51) was found to be in Nitrogen 60 kg/ha. + Zinc 5 kg/ha. as compared to other treatments.

Table.2 Effect of Nitrogen and Zinc levels on Yield and Economics of Mustard.

Treatments	Total Cost of Cultivation (INR/ha.)	Gross Returns (INR/ha.)	Net Returns (INR/ha.)	B:C ratio
Nitrogen 60 kg/ha. + Zinc 5 kg/ha.	31171.52	78450.00	47278.48	1.51
Nitrogen 60 kg/ha. + Zinc 10 kg/ha.	32171.52	81800.00	49628.48	1.54
Nitrogen 60 kg/ha. + Zinc 15 kg/ha.	33171.52	87400.00	54228.48	1.63
Nitrogen 80 kg/ha. + Zinc 5 kg/ha.	31278.72	84750.00	53471.28	1.70
Nitrogen 80 kg/ha. + Zinc 10 kg/ha.	32278.72	92850.00	60571.28	1.82
Nitrogen 80 kg/ha. + Zinc 15 kg/ha.	33278.72	95750.00	62471.28	1.87
Nitrogen 100 kg/ha. + Zinc 5 kg/ha.	31385.92	90400.00	59014.08	1.88
Nitrogen 100 kg/ha + Zinc 10 kg/ha.	32385.92	99700.00	67314.08	2.07
Nitrogen 100 kg/ha. + Zinc 15 kg/ha.	33385.92	103650.00	70264.08	2.10

CONCLUSION

On the basis of one season experimentation application of Nitrogen 100 kg/ha. + Zinc 15 kg/ha. was found more productive (1.89 t/ha.) as well as economically viable (INR 70264.08/ha.) also.

The conclusions drawn are based on one season research only which requires further confirmation and recommendation.

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