The Pharma Innovation Journal 2023; 12(10): 2294-2298

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 2294-2298

www.thepharmajournal.com
Received: 17-07-2023
Accepted: 21-08-2023

Harshit Gautam
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Atul Kumar Singh
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Anurag Shukla
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Vaishali Singh
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Corresponding Author:
Harshit Gautam
Department of Soil Science and Agricultural Chemistry, AKS University, Satna, Madhya Pradesh, India

Influence of integrated nutrient management on yield and nutrient uptake of mustard (*Brassica juncea* L.)

Harshit Gautam, Atul Kumar Singh, Anurag Shukla and Vaishali Singh

Abstract
The experiment was conducted in the *Rabi* season of 2022-2023 to ascertain the effect of integrated nutrient management on yield and uptake of mustard. The experiment was employed in Randomized Block Design with three replications. There were a total of twelve treatments *viz*., control (T_1), 100% RDF (80:60:40 kg NPK/ha) (T_2), 100% RDF + biofertilizers (*Azotobacter* + PSB) @ 7.5 kg/ha (T_3), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg (T_4), 100% RDF + FYM @ 2 t/ha + $ZnSO_4$ @ 10 kg/ha (T_5), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + *Azotobacter* (Seed treatment) (T_6), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + *Azotobacter* (Seed treatment) (T_7), 75% RDF (T_8), 75% RDF + biofertilizers (*Azotobacter* + PSB) @ 7.5 kg/ha (T_9), 75% RDF + FYM @ 2 t/ha + S @ 25 mg/kg (T_{10}), 75% RDF + VC @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha (T_{11}) and 75% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha (T_{12}). The results revealed that integrated nutrient management enhanced the yield attributes, yield and uptake of N, P, K, S, and Zn. Application of T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + Seed treatment with *Azotobacter*) resulted in a higher number of siliquae per plant, number of seeds per siliqua, 1000 seed weight and seed yield of mustard. Furthermore, treatment T_6 also led to higher uptake of N, P, K, S and Zn by seed and straw of mustard.

Keywords: INM, mustard, uptake, yield

Introduction
Mustard is one of the most popular oilseeds, and it plays an essential role in human and animal mineral nutrition and caloric nutrition. Rapeseed and mustard are the second most important oilseed crops after groundnut, accounting for almost 33% of total oilseed production in the country. In India, mustard occupied 5.04 million ha with a production of 3.0 million tons and productivity of 1000 kg ha^{-1} (Anonymous, 2018) [1]. Both the seed and the oil are used as condiments in pickling and to flavour curries and vegetables. The oil content ranges from 37 to 42%, and it is considered a key component of the Indian diet; also, its oil is utilized as the primary cooking medium, particularly in northern India. After the United States, China, and Brazil, India is the world's fourth-largest edible oil economy and the world's second-largest importer after China.

Chemical fertilizers must be used in conjunction with organic manure to improve soil health (Prasad *et al*., 2017) [9]. In addition to restoring soil fertility, the nutrients delivered by INM to crops help them sustain optimal yield throughout time (Pal and Pathak, 2016) [8]. Rapeseed-mustard production must be boosted by making the best use of organic and inorganic nutrition sources. Farmyard manure (FYM), vermicompost (VC), and biofertilizers such as *Azotobacter* have been demonstrated to improve the physical, chemical, and biological characteristics of the soil when used in conjunction with fertilizers. The simultaneous application of organic and inorganic fertilizers ensures the availability of all critical plant nutrients while also improving the soil's chemical and biological properties and increasing crop output (Thakur *et al*., 2009; Meena *et al*., 2015) [10, 12]. The potential of mustard in quality and yield can be harnessed efficiently by integrated nutrient management which involves balanced and efficient use of organic and inorganic supplies of nutrients (Dubey and Shukla, 2020) [6].

Material and Methods
During the 2022-23 *rabi* season, a field experiment was carried out in the Research farm, Department of Soil Science and Agricultural Chemistry, AKS University, Satna (M.P.). The field was levelled and irrigated by a tubewell. The experimental field's soil texture was sandy clay loam, with 0.10 percent organic carbon, EC (0.22 dSm^{-1}), 229.9 kg/ha available N, 8.94

kg/ha available P, 179.8 kg/ha available K, 23.5 kg/ha available S, 0.542 ppm available Zn and pH 7.8. The experiment followed a randomized block design with three replications. The treatments consisting of twelve treatments *viz*., control (T_1), 100% RDF (80:60:40 kg NPK/ha) (T_2), 100% RDF + biofertilizers (*Azotobacter* + PSB) @ 7.5 kg/ha (T_3), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg (T_4), 100% RDF + FYM @ 2 t/ha + $ZnSO_4$ @ 10 kg/ha (T_5), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + *Azotobacter* (Seed treatment) (T_6), 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + *Azotobacter* (Seed treatment) (T_7), 75% RDF (T_8), 75% RDF + biofertilizers (*Azotobacter* + PSB) @ 7.5 kg/ha (T_9), 75% RDF + FYM @ 2 t/ha + S @ 25 mg/kg (T_{10}), 75% RDF + VC @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha (T_{11}) and 75% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha (T_{12}) were applied to the mustard variety Pusa Vijay. FYM/vermicompost was applied in the field according to protocols and properly mixed one week before mustard seed sowing. Prior to sowing, a full dose of phosphorus and potassium and a half dose of nitrogen were applied as a basal dose via urea and SSP. At 30 and 45 DAS, the remaining half dose of nitrogen was top-dressed with urea in two equal splits. Potassium was administered through MOP in accordance with the protocols. On October 22, 2022, the crop was sown in rows 60 cm apart and plants 10 cm apart at a seed rate of 6 kg ha^{-1}. Fisher's analysis of variance method was used to statistically analyze experimental data relating to yield qualities and yield recorded in different observations (Fisher, 1950) [7].

Result and Discussion

It was noticed that the yield attributes and yield of mustard were significantly influenced by the incorporation of different treatments of INM. The data shown in (Table 1) revealed that the maximum number of siliquae $plant^{-1}$ (518.00) was observed from treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*), however, it was statistically similar to treatment T_7, T_5, and T_3. Maximum number of seeds $siliquae^{-1}$ (13.27) was observed from treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*) and T_{11} (75% RDF + VC @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha). However, statistically, it was comparable to all the treatments except treatment T_1 and T_2. A significantly more 1000 seed weight (8.10 g) was registered under the treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*) which was at par with treatment T_7, T_5, T_4, T_3 and T_2. The highest seed yield (18.30 q/ha) was obtained under the treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*), however, it was at par with the treatments T_7, T_5, T_{10} and T_{11}. The higher values for aforesaid parameters under T_6 might be due to the presence of more nutrients which might have improved the growth parameters. Increased growth parameters might have resulted in better yield attributes and yield due to more photosynthetic area. The seed size must have increased owing to the synthesis of additional carbohydrates. These results are in conformity with the findings of Brar *et al*. (2016) [4], Bijarnia *et al*. (2017) [2], Bisht *et al*. (2018) [3], Murali *et al*. (2018) [13], Reddy and Singh (2018) [14].

The data in Table 1 implies that treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*) registered the highest uptake of N by both seed (65.63 kg/ha) and straw (60.59 kg/ha) which were significantly superior over other treatments but statistically similar to treatments T_7, T_4 and T_5. In case of uptake of P by seed, Treatment T_3 (14.50 kg/ha) was superior while in case of uptake by straw, Treatment T_6 (17.09 kg/ha) was obtained to be effective. The uptake of K by seed (15.93 kg/ha) and by straw (111.95 kg/ha) was highest in treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*) which was at par with treatments T_5 and T_7. Similarly, treatment T_6 (100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter*) also registered higher uptake of S by seed (21.24 kg/ha) and by straw (13.23 kg/ha). However, it was comparable with treatments T_3, T_4, T_5 and T_7. The highest uptake of Zn by seed (0.13 kg/ha) and by straw (0.14 kg/ha) was obtained under treatment T_6 as compared to other treatments. The lowest uptake of N, P, K, S and Zn was registered under control plots. The increased uptake of these nutrients was due to the presence of higher amount of nutrients. Dubey and Shukla (2020) [6] found that there is an increase in the uptake of nutrients by an integrated application of chemical fertilizers with FYM and bio-fertilizers. Similar results were given by Singh and Pal (2011) [15], Chand (2007) [5], Ujjwal *et al*. (2018) [16] and Tripathi *et al*. (2010) [11].

Table 1: Yield attributes, yield and uptake of N, P, K, S and Zn by seed and straw of mustard as influenced by integrated nutrient management.

Treatments	Number of siliquae/plant	Number of seeds/siliqua	1000 seed weight (g)	Seed yield (q/ha)	Uptake by seed (kg/ha)					Uptake by straw (kg/ha)				
					N	P	K	S	Zn	N	P	K	S	Zn
T_1	376.10	8.47	7.07	9.87	36.55	6.75	7.44	11.70	0.08	30.01	8.11	72.53	6.67	0.08
T_2	433.00	8.80	7.73	14.08	50.18	13.73	11.11	17.19	0.10	45.55	12.01	90.46	10.33	0.11
T_3	452.10	11.27	7.80	13.50	52.68	14.50	11.89	17.98	0.11	42.84	12.56	96.04	10.36	0.11
T_4	404.60	11.60	7.87	14.70	59.51	11.86	12.15	18.09	0.11	52.68	12.88	98.76	10.55	0.12
T_5	509.10	11.27	7.90	17.62	58.14	12.11	12.51	18.69	0.12	52.65	14.76	99.33	11.76	0.12
T_6	518.00	13.27	8.10	18.30	65.63	13.62	15.93	21.24	0.13	60.59	17.09	111.95	13.23	0.14
T_7	510.10	12.13	8.03	17.94	64.07	12.36	13.89	20.20	0.12	50.06	15.56	100.69	12.39	0.13
T_8	391.30	13.00	7.17	13.69	45.21	6.78	9.02	13.89	0.09	44.65	9.65	82.02	10.04	0.09
T_9	415.70	12.80	7.23	14.51	44.90	9.25	10.98	15.22	0.10	44.66	9.32	81.99	9.56	0.09
T_{10}	420.10	13.30	7.30	15.66	47.88	8.65	11.00	16.22	0.09	40.78	9.58	82.75	9.86	0.11
T_{11}	425.70	13.27	7.50	15.24	50.03	10.54	9.14	18.34	0.11	41.25	9.95	88.07	11.84	0.11
T_{12}	423.60	13.80	7.43	16.51	51.96	9.55	12.21	16.86	0.10	44.85	9.99	82.13	11.54	0.11
S.Em±	28.40	0.75	0.13	0.99	3.31	1.34	1.21	1.22	0.01	4.01	1.36	6.01	1.07	0.01
C.D. (p=0.05)	83.20	2.19	0.37	2.92	9.70	3.92	3.56	3.59	0.02	11.75	3.99	17.63	3.14	0.02

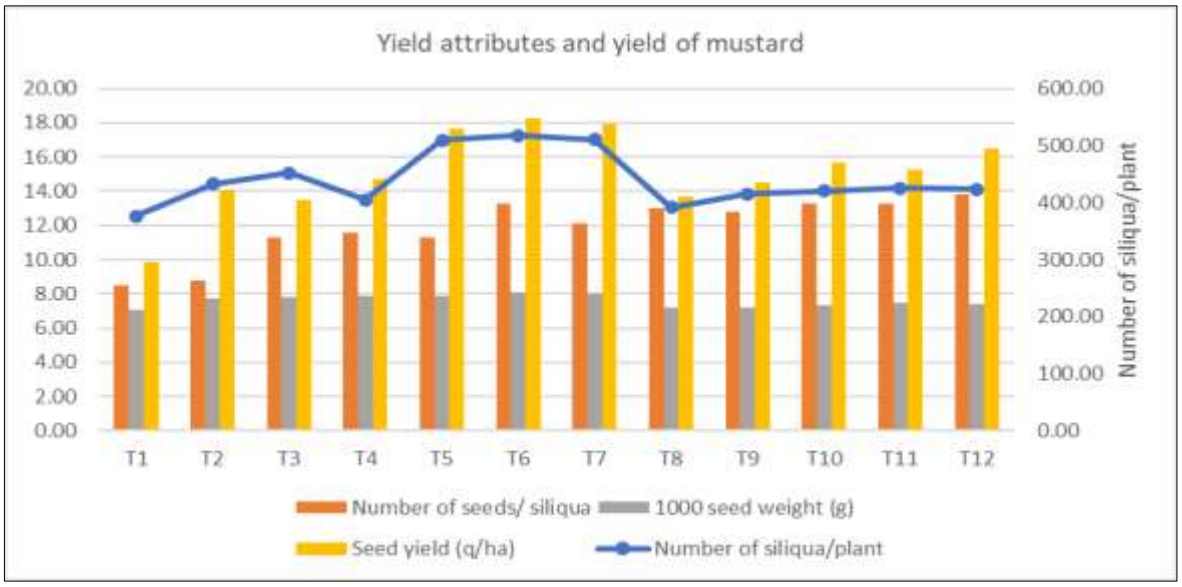

Fig 1: Yield attributes and yield of mustard as influenced by integrated nutrient management.

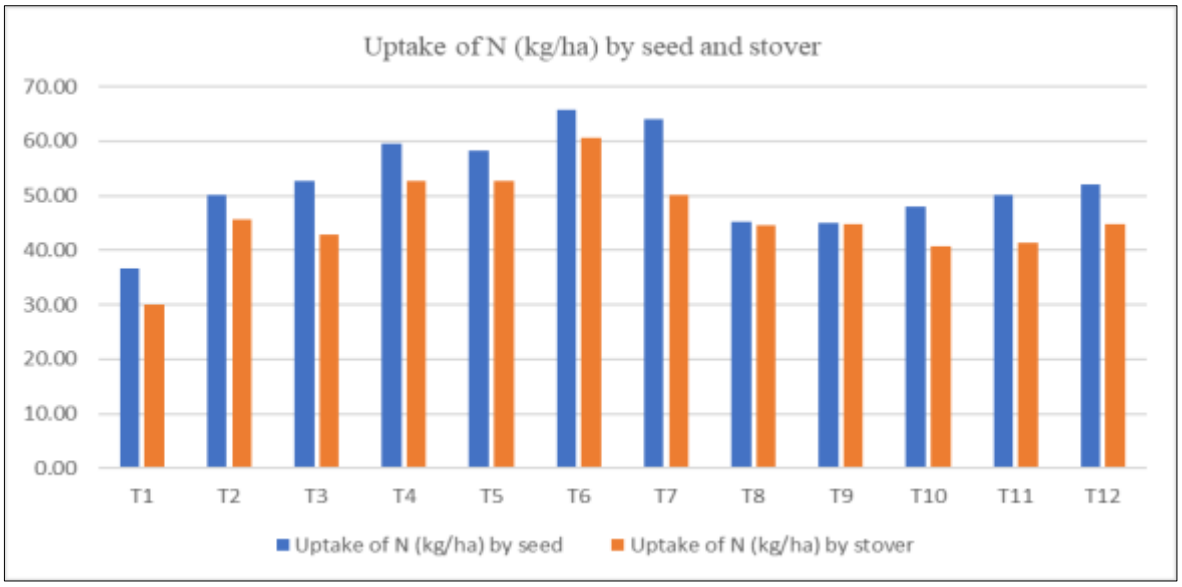

Fig 2: Uptake of N (kg/ha) by seed and stover of mustard as influenced by integrated nutrient management.

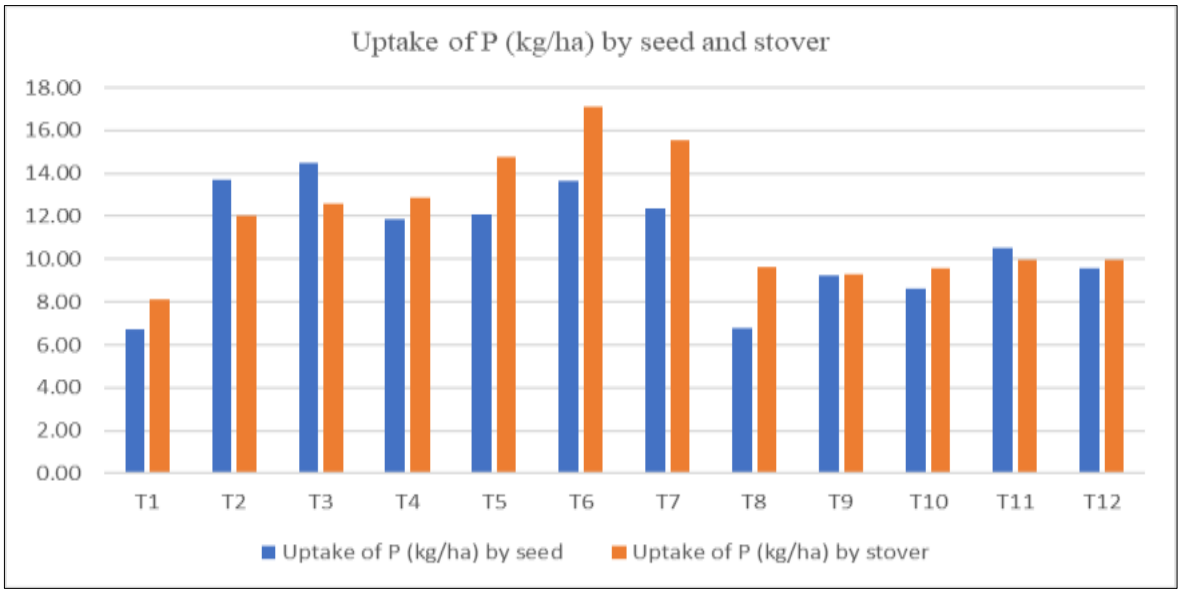

Fig 3: Uptake of P (kg/ha) by seed and stover of mustard as influenced by integrated nutrient management.

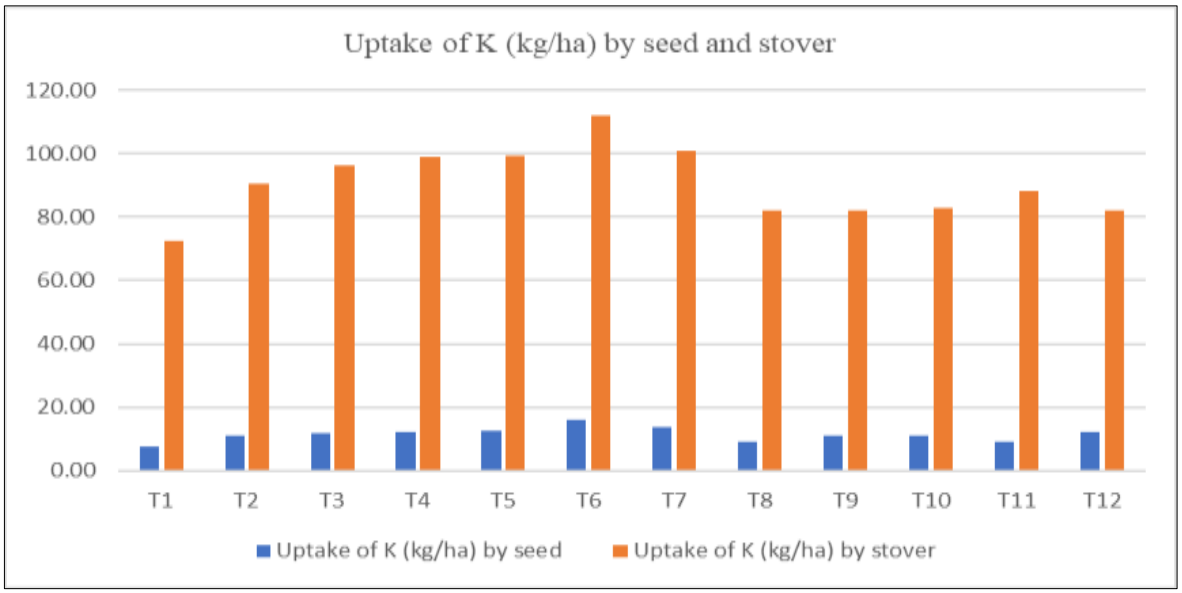

Fig 4: Uptake of K (kg/ha) by seed and stover of mustard as influenced by integrated nutrient management.

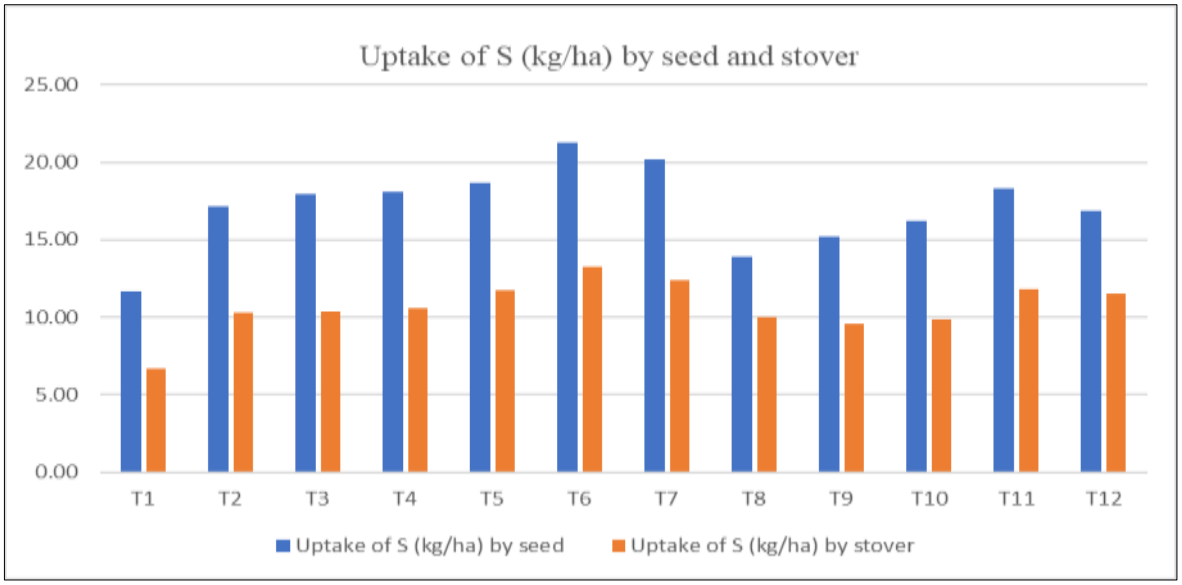

Fig 5: Uptake of S (kg/ha) by seed and stover of mustard as influenced by integrated nutrient management.

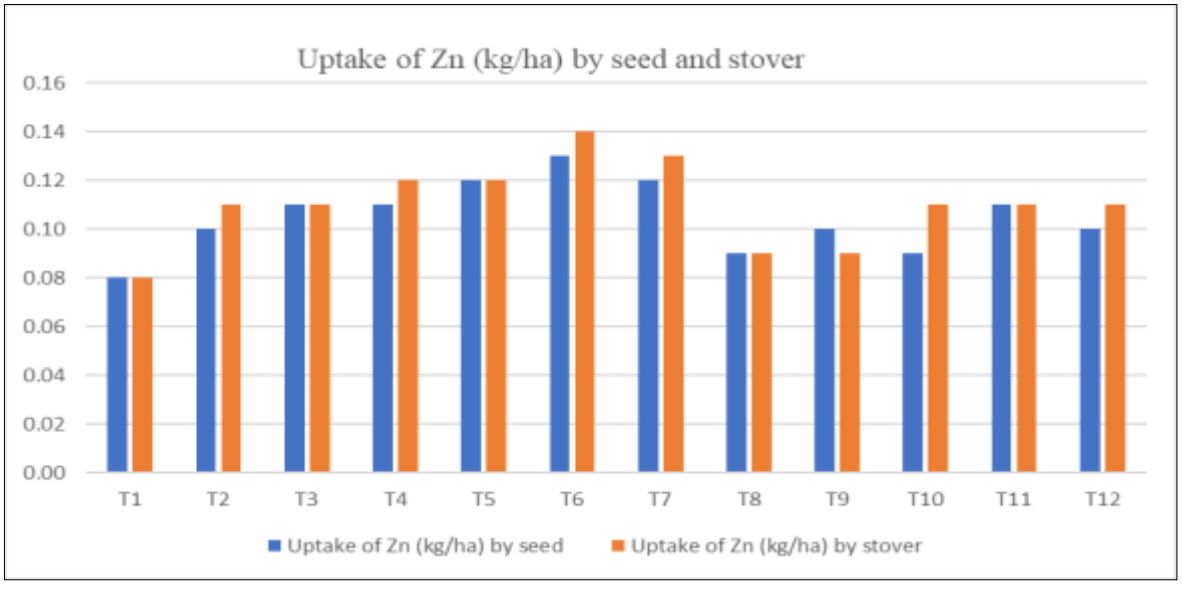

Fig 6: Uptake of Zn (kg/ha) by seed and stover of mustard as influenced by integrated nutrient management.

Conclusion

Based on the experiment, it is concluded that application of 100% RDF + FYM @ 2 t/ha + S @ 25 mg/kg + $ZnSO_4$ @ 10 kg/ha + seed treatment with *Azotobacter* was highly beneficial in order to obtain better yield attributes and overall yield. The uptake of N, P, K, S, and Zn was also higher under this treatment. Hence, it is advisable to employ the INM (Integrated Nutrient Management) method, which involves the combined utilization of diverse organic and inorganic nutrient sources of fertilizers as well as biofertilizers in order to achieve enhanced outcomes in terms of yield and quality across many metrics in mustard cultivation.

References

1. Anonymous. Indian Society of Oilseed Research (ISOR). Annual Report; c2018, 1.
2. Bijarnia AL, Yadav RS, Rathore PS, Singh SP, Saharan B, Choudhary R. Effect of integrated nutrient management and weed control measures on growth and yield attributes of mustard (*Brassica juncea* L.). Journal of Pharmacognosy and Phytochemistry. 2017;6(4):483-488.
3. Bisht S, Saxena AK, Singh S. Effect of integrated nutrient management on growth and yield of mustard (*Brassica juncea* L.) cultivar T-9 under Dehradun region (Uttarakhand). International Journal of Chemical Studies. 2018;6(4):1856-1859.
4. Brar AS, Sidhu PS, Dhillon GS. Response of brown sarson (*Brassica campestris* var. brown Sarson) to integrated nutrient management in mid hill conditions of Himachal Pradesh. International Journal Agriculture Science. 2016;12(2):319-325.
5. Chand S. Effect of integrated nutrient management on yield and nutrient use efficiency in mustard (*Brassica juncea* L.). SAARC Journal of Agriculture. 2007;5(2):93-100.
6. Dubey S, Shukla G. Analysis of Integrated Nutrient Management as a performance enhancer in Mustard. International Journal of Agricultural Invention. 2020;5(2):300-305.
7. Fisher RA. Statistical Methods for Research Workers, Oliver and Boyd, Edinburg, London; c1950. p. 57-63.
8. Pal RL, Pathak J. The effect of integrated nutrient management on yield and economics of mustard. I.J.S.N. 2016;2:255-261.
9. Prasad J, Karmakar S, Kumar R, Mishra B. Influence of integrated nutrient management on yield and soil properties in maize in an alfisol of Jharkhand. Journal of the Indian Society of Soil Science. 2017;58(2):200-204.
10. Thakur NP, Kachroo D, Kour M, Kumar P, Sharma R, Khajuria V. Long-term effect of integrated nutrient management on crop productivity and fertility of clay loam (Inseptisol) soil in continuous rotation of rice-wheat cropping system under sub-tropical ecosystem of Jammu region. Paper presented in 75th Annual convention of ISSS held at IISS, Bhopal during Nov; c2009. p. 14-17.
11. Tripathi MK, Chaturvedi S, Shukla DK, Mahapatra BS. Yield performance and quality in Indian mustard (*Brassica juncea*) as affected by integrated nutrient management. Indian Journal of Agronomy. 2010;55:138-142.
12. Meena BP, Kumar A, Lal B, Sinha NK, Tiwari PK, Dotaniya ML, *et al*. Soil microbial, chemical properties and crop productivity as affected by organic manure application in popcorn (*Zea mays* L. var. everta). Afri. J. Microbio. Res. 2015;9(21):1402-1418.
13. Murali M, Umrao R, Kumar H. Effect of different levels of organic manure on the growth and yield of mustard (*Brassica juncea* L.). under Jatropha (*Jatropha circus* L.) based agroforestry system. Journal of Pharmacognosy and Phytochemistry. 2018;7(4):955-958.
14. Reddy GNK, Singh R. Effect of integrated nitrogen management on the growth and yield of mustard (*Brassica juncea* L.). Journal of Pharmacognosy and Phytochemistry. 2018;7(3):617-619.
15. Singh SP, Pal MS. Effect of integrated nutrient management on productivity, quality, nutrient uptake and economics of mustard (*Brassica juncea*), Indian Journal of Agronomy. 2011;56:381-387.
16. Ujjwal V, Singh MK, Dev P, Chaudhary M, Kumar A, Tomar S. Effect of different levels of GA3 and NAA on vegetative growth and flowering parameters of tomato (*Solanum lycopersicum* L.), Journal of Pharmacognosy and Phytochemistry. 2018;SP(1):146-148.