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Influence of Plant Nutrient Management Practices on Nutrient Uptake by the Mustard Seeds (*Brassica juncea)*

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Abstract

Fifteen treatments consisting of 100, 75 and 50 % of the recommended dose of fertilizers (RDF) either alone or with addition of farmyard manure (FYM 10 t/ ha, sulphur @ 40 kg S/ha, zinc @25 kg $ZnSO_4$/ha, boron@1kg/ B/ha) were tested. The maximum dry matter accumulation in seed (21.11 g/plant) was recorded in treatment T5 which was significantly higher than rest of the treatments. Total sulphur uptake was significantly influenced by the successive adoption of supplementary nutrients. Total zinc uptake was significantly more in those plot received from T3 to T5, T8 to T 10 and T13 to T15 treatments than the application of respective recommended fertility applied alone. The overall present investigation shows that the treatment combination T5 (100 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha+ Boron@1kg/ B/ha) gave best results for nutrient uptake by mustard seeds. It may therefore be concluded that the application of NPK fertilizers alone is not capable of exploiting the fullest potential of the mustard crop, for which addition of supplementary ingredients namely farm yard manure (FYM), sulphur, zinc and boron is essential.

Key words: *Mustard, integrated plant nutrient management, nutrient uptake*

Introduction

Indian soils are becoming deficient in N, P, K along with S, Zn, and B due to intensive cultivation and use of high analysis fertilizers. Plant nutrition is a key input to increase the productivity of mustard crop[5]. Among the major nutrients, nitrogen which is insufficient in most of the Indian soils plays an important role in Brassica crops. Nitrogen is considered to be the most important nutrient for the crop to activate the metabolic activity and transformation of energy, chlorophyll and protein synthesis. Nitrogen also affects uptake of other essential nutrients and it helps in the better partitioning of photosynthates to reproductive parts which increase the seed: stover ratio[4]. The present investigation was, therefore carried out with the objectives to investigate the uptake of different nutrients i.e. nitrogen, phosphorus, potassium, sulphur, zinc and boron in seed of mustard under different integrated plant nutrient management practices[7].

Materials and Methods

The experiment was conducted at Regional Agriculture Testing and Demonstration Station, Bilwa, Bareilly district of Uttar Pradesh. Field experiment of mustard variety Kranti was conducted in randomized block design with three replications. The treatments comprising of 15 different integrated plant nutrient management practices. The gross plot size was 4.2m x 3.5 m and net plot size 3.0 m x 2.5 mm x 5.0 m. Row to row and plant to plant spacing was 30 and 15cm, respectively. A total umber of rows per plot were 14 and number of rows harvested per plot were 10.

The experiment consisted of fifteen treatments of viz., T1- Control, T2 -100 % RDF + FYM 10 t/ha, T3 – 100 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha, T4 – 100 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha, T5- 100 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha+ Boron@1kg/ B/ha, T6 -

75% of Recommended fertility, T7-75% of Recommended fertility++ FYM 10 t/ha, T8-75 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha, T9-75 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha, T10-75 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha+ Boron@1kg/ B/ha, T11-50% of Recommended fertility, T12-50% of Recommended fertility++ FYM 10 t/ha, T13-50 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha, T14-50 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha and T15- 50 % RDF + FYM 10 t/ ha + sulphur @ 40 kg S/ha+ zinc @25 kg $ZnSO_4$/ha+ Boron@1kg/ B/ha.

The sources of nitrogen, phosphorus and potassium were urea, diammonium phosphate and muriate of potash. The sources of sulphur and zinc were gypsum and zinc sulphate while borax was used as a source of boron. Full doses of FYM, phosphorus, potassium, sulphur, zinc, boron and half dose of nitrogen were applied at the time of sowing. Rest half dose of nitrogen was top dressed in two splits, one after first irrigation and second at square leaf stage.

Seeds of five plants were collected separately from the second and third rows from west. The total dry matter accumulation in seeds were recorded and reported in g/plant after drying the seeds samples in hot air oven at 70±5°C till constant weight. The uptake of nutrients (nitrogen, phosphorus, potassium, sulphur, zinc and boron) by seeds of *Brassica juncea* was obtained by multiplying nutrient content with respective dry matter production of seeds in one hectare. The experiment data obtained during the course of study were subjected to statistical analysis[6].

Results and Discussion

Mean total dry matter accumulation was 15.73 g/plant. The maximum dry matter accumulation in seed (21.11 g/plant) was recorded in treatment T5 which was significantly higher than rest of the treatments (Table 1). The lowest dry matter accumulation (10.42 g/plant) was recorded in T11 where 50% recommended fertility was applied followed by the treatment in which 75% recommended fertility was applied.

Table 1 Total dry matter accumulation in seed (g/plant) as influenced by integrated plant nutrient management in *Brassica juncea*

Symbol	Treatment combination	Total dry matter accumulation in seed (g/plant)
T1	Recommended fertility (RF)	14.69
T2	T1+FYM 10 t/ha	15.34
T3	T2+ Sulphur @ 40 kg S/ha	20.18
T4	T3+Zinc @25 kg $ZnSO_4$/ha	20.46
T5	T4+Boron@1kg/ B/ha	21.11
T6	75% of Recommended fertility	12.55
T7	T6+ FYM 10 t/ha	15.44
T8	T7+ Sulphur @ 40 kg S/ha	16.09
T9	T8+ Zinc @25 kg $ZnSO_4$/ha	16.55
T10	T9+ Boron@1kg/ B/ha	17.20
T11	50% of Recommended fertility	10.42
T12	T11+ FYM 10 t/ha	11.53
T13	T12+ Sulphur @ 40 kg S/ha	14.14
T14	T13+ Zinc @25 kg $ZnSO_4$/ha	14.69
T15	T14+ Boron@1kg/ B/ha	15.62
	SEM±	0.19
	CD at 5%	0.55

Successive addition of supplementary ingredient increased the total dry matter accumulation in seeds and attained maximum at T5, T10 and T15, respectively over their respective fertility levels. The total dry matter recorded in seeds had significant difference due to supplementation of nutrients had different levels of recommended fertility as compared to no supplementary nutrients.

The addition of all the supplementary ingredients simultaneously to 100, 75 and 50 percent of recommended fertilizer levels increased the total dry matter production in seed over respective fertilizer levels. However, significantly highest dry matter accumulation in seed (21.11 g/plant) was recorded when all the supplementary ingredients (T5) were added to 100 percent fertilizer level.

The data on nitrogen, phosphorus, potassium, sulphur, zinc and boron uptake by seeds of mustard are presented in Table 2 and 3. Treatment effects were found significant for all the nutrients. Total nutrient uptake was maximum, when all the supplementary nutrient were applied with 100% recommended fertility (T5) and declined with the successive decrease in recommended fertility and supplementary nutrients. Total nitrogen uptake was significantly higher at T5, T10 and T15 than alone application of respective recommended fertility. Total phosphorus uptake had significant difference with the application of T5, T10 and T15 treatments from alone application of respective recommended fertility. Total potassium uptake was significantly higher at the application of T5, T10 and T15 treatments as compared to alone application of respective recommended fertility.

Total sulphur uptake was significantly influenced by the successive adoption of supplementary nutrients. Total zinc uptake was significantly more in those plot received from T3 to T5, T8 to T 10 and T13 to T15 treatments than the application of respective recommended fertility applied alone. Similar trend was observed in total boron uptake.

Studies found a positive effect of sulphur along with FYM on yield, quality and nutrients content and their uptake in Indian mustard by several investigators like earlier studies also showed that successive increase in S-levels on mustard led to increased S uptake[1,3].

Nitrogen, phosphorus, potassium, sulphur, zinc and boron content and uptake by the seed of *Brassica juncea* were significantly influenced due to different integrated plant nutrient management practices. The successive increase in fertilizer levels and successive addition of supplementary ingredients (FYM @10 t/ha, sulphur @ 40 kg/ha, zinc @ 25 $ZnSO_4$/ha, boron @ 1kg B/ha) to different fertilizer levels (100, 75 and 50 percent of recommended fertilizer level) increased the nutrient content over respective fertilizer levels. However the highest nutrient uptake was recorded when all the supplementary ingredients were applied to 100 percent recommended fertilizer level. This might be due to (i) increased supply of nutrients directly through organic and inorganic sources of crop, (ii) indirectly through checking the losses of nutrients from the soil solution, and (iii) increasing the nutrient use efficiency. These resulted in better growth more branches, higher yield as well as more nutrient concentration[2].

Boron application induced marked increase in the uptake of P and S. This increased in P and S uptake could be credited to variation in the availability of these nutrients in the soil and partly due to priming effect of one nutrient on the other. The increase in the seed yield of *Brassica juncea* due to sulphur application may be attributed to the increase in the different growth and yield parameters. Thus mustard plant requires sulphur to use nitrogen efficiently because both nutrients are required for protein synthesis

Table 2 Nitrogen, phosphorus and potassium uptake (kg/ha) in the seeds *Brassica juncea* as influenced by plant nutrient management practices

Symbol	Treatments	Nitrogen	Phosphorus	Potassium
T1	Recommended fertility (RF)	104.46	20.89	26.77
T2	T1+FYM 10 t/ha	134.99	22.83	28.29
T3	T2+ Sulphur @ 40 kg S/ha	179.38	30.49	38.11
T4	T3+Zinc @25 kg $ZnSO_4$/ha	182.32	31.83	39.10
T5	T4+Boron@1kg/ B/ha	192.33	32.84	42.22
T6	75% of Recommended fertility	100.96	18.68	22.31
T7	T6+ FYM 10 t/ha	128.67	22.99	28.48
T8	T7+ Sulphur @ 40 kg S/ha	137.66	23.96	30.39
T9	T8+ Zinc @25 kg $ZnSO_4$/ha	143.43	26.48	31.63
T10	T9+ Boron@1kg/ B/ha	150.98	27.52	34.01
T11	50% of Recommended fertility	79.89	15.05	18.75
T12	T11+ FYM 10 t/ha	92.24	17.17	21.01
T13	T12+ Sulphur @ 40 kg S/ha	118.15	21.37	26.08
T14	T13+ Zinc @25 kg $ZnSO_4$/ha	124.70	22.85	28.07
T15	T14+ Boron@1kg/ B/ha	132.94	24.64	29.85
	SEM±	0.16	0.02	0.03
	CD at 5%	0.48	0.07	0.08

Table 3 Sulphur (kg/ha), zinc (kg/ha) and boron (g/ha) uptake by the seed of *Brassica juncea* as influenced by plant nutrient management practices

Symbol	Treatments	Sulphur	Zinc	Boron
T1	Recommended fertility (RF)	15.02	143.49	109.25
T2	T1+FYM 10 t/ha	17.04	154.95	120.21
T3	T2+ Sulphur @ 40 kg S/ha	27.80	208.32	167.10
T4	T3+Zinc @25 kg $ZnSO_4$/ha	29.10	227.11	170.33
T5	T4+Boron@1kg/ B/ha	30.02	234.32	183.24
T6	75% of Recommended fertility	16.45	11.72	95.28
T7	T6+ FYM 10 t/ha	15.44	144.99	122.02
T8	T7+ Sulphur @ 40 kg S/ha	16.45	157.52	127.52
T9	T8+ Zinc @25 kg $ZnSO_4$/ha	17.65	163.50	135.94
T10	T9+ Boron@1kg/ B/ha	21.02	180.23	145.10
T11	50% of Recommended fertility	9.26	94.84	77.49
T12	T11+ FYM 10 t/ha	11.53	110.06	88.31
T13	T12+ Sulphur @ 40 kg S/ha	16.34	140.63	108.30
T14	T13+ Zinc @25 kg $ZnSO_4$/ha	16.97	150.01	112.84
T15	T14+ Boron@1kg/ B/ha	18.40	160.90	126.57
	SEM±	0.02	0.05	0.03
	CD at 5%	0.06	0.15	0.09

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