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Evaluation of Mustard Seeds for their Potential Nutrients

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Abstract To study the influence of fertilization on different nutrients in seed of mustard, 15 treatments consisting of 100, 75 and 50% of the recommended dose of fertilizers (RDF) either alone or with successive addition of farmyard manure (FYM 10 t/ha, sulfur @ 40 kg S/ha, zinc @ 25 kg $ZnSO_4$ / ha, boron @ 1 kg / B/ha) were tested. Successive decrease in fertility (100, 75 and 50% recommended fertility) significantly decreased the most undesired erucic acid content (44.47, 43.64 and 43.05%) and increased palmitic (saturated fatty acid), oleic and linoleic acid. The mean glucosinolate content in seed was 94.61 µmole/g seed. The overall present investigation shows that the maximum nutrients and reduced antinutritional properties were found when recommended doses of sulfur, zinc ; boron along with farm yard manure was applied.

Keywords Mustard, Protein, Glucosinolate, Erucic, Palmitic.

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Introduction

Rapeseed-mustard is an important source of edible oil in Indian diet especially in Eastern and North-Western India. The major fatty acids of rapeseed-mustard oil are oleic, linoleic, linolenic, eicosenoic and erucic acid. Erucic acid in oil of Indian rapeseed-mustard varieties is quite high [1, 2]. *Brassica* oil production has been considered beneficial due to the presence of nutritionally desirable oleic and linoleic acids. High oleic acid oil offers better taste, good cooking medium due to its high thermostability, cholesterol reducing properties and its use in industrial applications due to high oxidative stability (long shelf-life) [3]. However, presence of high content (~ 50% of the total fatty acids) of additional long chain unsaturated fatty acids (LCUFA) viz. eicosenoic acid (C20 : 1) or erucic acid (C22 : 1) in different species of *Brassica* viz., *B. carinata*, *B. juncea*, *B. napus* and *B. nigra*, which are absent in many commercial plant oils, makes them a poor candidate for human consumption due to antinutritional properties [4]. Rapeseed-mustard cultivars grown in India also have high level of glucosinolate content [2]. Glucosinolates, a group of plant thioglucosides, found principally among members of family *Brassicaceae* are responsible for the characteristic pungency of rapeseed-mustard oil.

Therefore, the present study was conducted to evaluate the influence of fertilization on fatty acid composition, protein content, protein yield, glucosinolate, crude fiber, ash and carbohydrate content of mustard (*Brassica juncea* L.) cultivar Kranti.

Table 1. Fatty acid composition (%) in oil of seeds of *Brassica juncea* seed as influenced by integrated plant nutrient management.

Symbol	Treatments	Palmitic 16 : 0	Oleic 18 : 1	Linoleic 18 : 2	Linolenic 18 : 3	Eicosenoic 20 : 1
T_1	Recommended fertility (RF)	3.75	14.25	16.45	12.60	7.93
T_2	T_1 + FYM 10 t/ha	4.40	13.90	15.55	11.62	9.30
T_3	T_2 + Sulfur @ 40 kg S/ha	4.05	14.13	15.45	11.34	8.70
T_4	T_3 + Zinc @ 25 kg $ZnSO_4$ / ha	3.72	13.63	16.00	12.60	10.61
T_5	T_4 + Boron @ 1 kg/ B/ha	4.00	14.20	15.86	12.00	8.80
T_6	75% of Recommended fertility	4.70	15.00	16 70	12.80	7.92
T_7	T_6 + FYM 10 t/ha	3.80	13.40	15.20	10.50	7.40
T_8	T_7 + Sulfur @ 40 kg S/ha	4.02	15.74	16.45	11.90	8.60
T_9	T_8 + Zinc @ 25 kg $ZnSO_4$ /ha	3.70	14.70	16.55	12.12	8.55
T_{10}	T_9 + Boron @ 1 kg/ B/ha	3.80	13.30	15.76	11.93	9.23
T_{11}	50% of Recommended fertility	4.07	15.40	16.25	12.50	9.03
T_{12}	T_{11} + FYM 10 t/ha	4.00	15.15	16.35	11.73	8.95
T_{13}	T_{12} + Sulfur @ 40 kg S/ha	4.30	15.53	16.25	12.06	7.65
T_{14}	T_{13} + Zinc @ 25 kg $ZnSO_4$ / ha	4.15	14.65	17.31	12.30	8.50
T_{15}	T_{14} + Boron @ 1 kg/ B/ha	4.17	14.70	16.10	12.25	9.01
	SEm±	0.03	0.03	0.02	0.04	0.02
	CD at 5%	0.09	0.09	0.06	0.13	0.06

Materials and Methods

To study the impact of fertilization on nutrients of Indian mustard, a field experiment was conducted at Regional Agriculture Testing and Demonstration Station Bilwa, Bareilly district of Uttar Pradesh. The soil of the experimental field belonged to sandy loam. Soil having low to medium fertility status with low organic content, available N, available P and available S were in low range, available K was medium in range, hot water soluble B and DTPA extractable Zn in optimum range and neutral to slightly alkaline in nature.

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 × 3.5m and net plot size 3.0m × 2.5mm × 5.0m. Row to row and plant to plant spacing was 30 and 15cm, respectively. A total number of rows per plot was 14 and number of rows harvested per plot was 10.

The uniform representative seed samples of *Brassica juncea* were taken, dried and processed separately. These samples were used for different chemical studies. Pooled seed samples of whole plant over the replication were used for the analysis of fatty acid composition. Different components of fatty acid viz., palmitic acid, oleic acid, linoleic acid, lonolenic acid, eicosenoic acid and erucic acid were expressed in percent of the oil content in the seed. Defatted seed samples after extraction of oil in Soxhlet apparatus were used for the estimation of glucosinolates content in the seed. The total glucosinolates content was expressed in µmoles/g seed.

The experiment data obtained during the course of study were subjected to statistical analysis by applying the technique of analysis of variance (ANOVA) prescribed for the randomized block design (RBD) to test the significance of the overall differences among treatments by the *F* test and conclusion were drawn at 5% probability level. When the *F* value from analysis of variance tables was found to be significant, the critical difference (CD) was computed to test the significance of the difference between the two treatments.

Results and Discussion

The seed fatty acid composition was significantly influenced by the different integrated plant nutrient

Table 2. Glucosinolate content (µmole / g seed) in the seed of *Brassica juncea* seed as influenced by integrated plant nutrient management.

Symbol	Treatments	Glucosinolate
T_1	Recommended fertility (RF)	85.2
T_2	T_1 + FYM 10 t/ha	87.2
T_3	T_2+Sulfur @ 40 kg S/ha	93.6
T_4	T_3+Zinc @ 25 kg $ZnSO_4$ / ha	85.0
T_5	T_4+Boron @ 1 kg/ B/ha	82.0
T_6	75% of Recommended fertility	92.0
T_7	T_6+FYM 10 t/ha	94.2
T_8	T_7+Sulfur @ 40 kg S/ha	95.7
T_9	T_8+Zinc @ 25 kg $ZnSO_4$ / ha	92.2
T_{10}	T_9+Boron @ 1 kg/ B/ha	88.0
T_{11}	50% of Recommended fertility	113.6
T_{12}	T_{11}+FYM 10 t/ha	108.3
T_{13}	T_{12}+Sulfur @ 40 kg S/ha	114.2
T_{14}	T_{13}+Zinc @ 25 kg $ZnSO_4$ / ha	97.0
T_{15}	T_{14}+Boron @ 1 kg/ B/ha	91.0
	SEm±	0.16
	CD at 5%	0.45

management practices. In general, successive decrease in fertility (100, 75 and 50% RF) significantly decreased the most undesired erucic acid content (44.47, 43.64 and 43.05%) and increased palmitic (saturated fatty acid), oleic and linoleic acid (Table 1). At 75% fertility level eicosenoic and linolenic acid content also decreased (8.34 and 11.85%) in comparison to 100% recommended fertility.

The application of supplementary ingredient significantly influenced the fatty acid composition especially erucic acid. In general, the sulfur application (T_3 to T_5, T_8 to T_{10} and T_3 to T_{15}) increased the erucic acid composition. Treatment T_{11}, T_6, T_{14} and T_7 resulted in comparatively lower erucic acid composition in the oil. The saturated fatty acid (palmitic acid) content decreased with sulfur application. Increase in availability of sulfur attribute to increased conversion of fatty acid metabolites to the end products of fatty acids as supported by earlier reports [5, 6].

Glucosinolate content in seed

The mean glucosinolate content in seed was 94.61 µmole/g seed. The different integrated plant nutrient management practices significantly influenced the seed glucosinolate content. In general, successive increase in fertility levels decreased the seed glucosinolate content. The lowest seed glucosinolate content was observed with treatment T_5 (Table 2). Addition of supplementary nutrient up to the sulfur resulted increase in glucosinolate content and further addition of supplementary nutrient reduced the glucosinolate content in seed. The application of sulfur to respective fertility level increased the seed glucosinolate content over no sulfur application. Application of supplementary ingredient zinc reduced the glucosinolate content. Successive addition of element boron further reduced the seed glucosinolate content. Application of sulfur was reported to increase yield attributes and yield of Indian mustard [7] and glucosinolates content in mustard seed.

Conclusion

From the present study, it was concluded that the seed fatty acid composition was significantly influenced by the different integrated plant nutrient management practices. The overall present investigation shows that the maximum nutrients and reduced antinutritional properties were found when recommended doses of sulfur, zinc ; boron along with farm yard manure was applied.

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