Journal of AgriSearch **4**(3):212-214
An Open Access International Peer Reviewed Quarterly
ISSN : 2348-8808 (Print), 2348-8867 (Online)
http://dx.doi.org/10.21921/jas.v4i03.9026

Influence of Sulphur and Zinc on Biochemical Properties and Severity of Alternaria Blight in Indian Mustard

HK SINGH*, SUNITA SINGH[1], NA KHAN[2], RP SINGH[1] AND MK MAURYA

Department of Plant Pathology, ND University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India

ARTICLE INFO

Received on	:	21.07.2017
Accepted on	:	30.08.2017
Published online	:	05.09.2017

ABSTRACT

Effect of different doses of sulphur and zinc application was studied on Indian mustard [*Brassica juncea* (L.) Czern & Coss.] for protein, methionine, tryptophan, allyl-isothiocynate, mineral status content in oil/cake and Alternaria blight severity (%). The highest protein content was obtained in Varuna variety followed by strain NDR 8501. Application of 40 kg sulphur and 40 kg zinc resulted in highest protein percentage over control in seeds of mustard. Methionine content ranged from 0.743-1.561 g/16g N in Varuna variety whereas it varied from 0.899 to 1.503 g/16 g N in strain NDR 8501. Methionine contents were increased significantly due to the application of sulphur and zinc. Sulphur is an essential constituent of sulphur containing amino acids viz. methionine, cysteine and cystine. Variation in tryptophan content was recorded from 0.545 to 1.079 g/16 g N in Varuna variety whereas it varied from 0.501 to 1.545 g/16 g N strain NDR 8501. The highest rate of application of sulphur and zinc resulted in the highest content of minerals. The highest allyl-isothiocynate content in oil (0.342%) was recorded in variety NDR 8501 followed by Varuna (0.311%) variety. The minimum Alternaria blight severity was recorded in the dose of $S_{40}Zn_{40}$ (34.57, 32.04) in variety Varuna and NDR 8501, respectively.

Key words: Indian mustard, Nutritive value of cake and oil, Sulphur, Zinc, Alternaria blight

INTRODUCTION

Brassicas are members of the Brassicaceae family. They occupy a unique position in world agriculture as the source of vegetables, oilseed, forage and fodder, green manure and condiments (Singh *et al.*, 2017) *Brassica* seed oilis used for edible purpose, as industrial lubricants and as base for polymer synthesis. Oilseed brassica cake is used as a source of protein in animal feeds. Among the oilseed *Brassica* crops, Indian mustard [*Brassica juncea* (L.) Czern & Coss.] is an important source of oil from nutritional point of view (Singh *et al.*, 2013). The nutritional value of oil is governed mainly by the composition of its fatty acids *viz*. Palmitic acid, Stearic acid, Oleic acid, Linoleic acid, Linolenic acid, Eicosenoic acid, Erucic acid along with anti-nutritional factors.

Indian mustard has higher amount of erucic acid and glucosinolates in its oil and meal, respectively. The high amount of glucosinolates in meal and erucic acid in oil may create health problems *viz.* lipidopsis in young animals, fibrosis in older animals, reduce food intake, causes goiter, stroma and cancer. In *Brassica* breeding, considerable emphasis is being laid to develop the varieties with low glucosinolates and low erucic acid. The development of rapid and accurate methods for determination of glucosinolate levels in seed in early 1960's led to the identification of *B. napus* cultivar "Bronowski" from Poland.The first double low spring *B. napus* cultivar "Tower" was released in 1974 and afterwards a number of double zero cultivars were identified in different countries of the world. In India till date, the main emphasis has been to improve the rapeseed-mustard seed yield and oil content. It is necessary that seed oil quality especially the fatty acid composition also be improved wherever possible. Mustard is cultivated in mostly under temperate climates. Sulphur fertilizers have been reported to increase the seed yield and oil content of mustard (Singh *et al.*, 2013).

Sulphur has been reported to influence productivity of oilseed (Singh *et al.*, 1999). Similarly, Biswas *et al.* (1995) reported that application of S fertilizer increase the seed yield of mustard. Sulphur (S) is increasingly being recognized as the fourth major plant nutrient after nitrogen, phosphorous and Potassium. Sulphur and Zinc content and uptake were significantly higher with the application of $ZnCl_2$ as a source of Zinc in soyabean. Yasari (2012) studied the effect of applying Zn to compare the effects that incorporating them in the soil and spraying them on the soybean crop on seed oil and contents and percentages. Application of micro-nutrients like zinc, sulphur, magnesium and boron significantly increased yield. Alternaria blight is one of the major biotic limit factors for realizing quality mustard production (Singh *et al.*, 2013).

Keeping this in view there is a need to screen/develop Indian mustard varieties having low erucic acid and effect of different doses of Zinc (Zn) and Sulphur (S) on protein content, tryptophan, methionine, and allyl-isothiocynate content, mineral status of the cake and Alternaria blight severity in mustard.

[1]Department of Chemistry, Kamla Nehru Institute of Physical and Social Sciences, Sultanpur, Uttar Pradesh, India
[2]Department of Biotechnology, N. D. University of Agriculture and Technology, Kumarganj, Faizabad, Uttar Pradesh, India
*Corresponding Author Email: hksndu@gmail.com

MATERIALS AND METHODS

Brassica juncea cultivar 'Varuna' and 'NDR 8501' was planted at research farm of GPB Farm of the N. D. University of Agriculture and Technology, Kumarganj, Faizabad located at (26^0 47'N, 82^0 12'E). Seeds of *Brassica juncea* cultivar 'Varuna' and 'NDR 8501' were obtained from different coordinating centers of AICRP on Rapeseed-mustard and Department of Genetics and Plant Breeding the N. D. University of Agriculture and Technology, Kumarganj, Faizabad. The experiment was conducted in Randomized Block Design with three replications, having plot size of 4.0 m x 3.0 m with anspacing of 30 cm x 15 cm row to row and plant to plant, respectively. Fertilizers NPK were applied at the rate of 120 N, 60 P, 60 K, kg/ha, respectively. Half dose of nitrogen, full dose of phosphorus and potash were applied as basal, whereas both sulphur and zinc were applied at the rate of 0, 10, 20, 30, 40 kg/ha. Remaining half dose of nitrogen was top dressed at first irrigation.

The protein content of the cake was estimated by the conventional kjeldahl method (AOAC, 1970). The nitrogen content was estimated in the cake and multiplied by the factor 6.25 in order to get the protein percentage in the sample. The tryptophan content was estimated by the method of Spice and Chamber (1949). The calculation was done by standard curve. Methionine content was analysed as described by Horn *et al.*, 1946. The filtrate was used for colorimetric estimation of methionine. The intensity of colour was measured along with the blank on photoelectric colorimeter at 450 nm. The calculation was done on the basis of standard curve prepared for methionine. Total ash content was estimated by the method as described by Hart and Fisher (1971), Allyl-isothiocynate content in cake collected was each samples was estimated as method given by AOAC, 1970. The calculation was carried on the basis of consumption of $AgNO_3$.

RESULTS AND DISCUSSION

The application of sulphur and zinc increased the protein contents in both cultivars (Varuna and NDR 8501) with increasing application of doses. The maximum protein content 30.13% was found in Varuna variety followed by variety NDR 8501 (29.66%). Increasing levels of S and Zn did not showed significant results in all treatments (Table 2). The results are closely conformity with the findings of Babhulkar *et al.* (2000) in safflower. The increase in protein content an addition of zinc has also been reported by Husain and Kumar (2006).

One of the essential constituents of protein, methionine is involved in number of biochemical transmethylation reactions of vital significance in animal and plants (Karlson, 1968).The maximum methionine content (1.561 g/ 16g N) was obtained in Varuna variety followed by variety NDR 8501 (1.503 g/ 16g N). Increasing doses of S and Zn did not showed significant results in all treatments of both cultivars. However, treatment $S_{30}Zn_{30}$& $S_{40}Zn_{40}$ varied significantly in Varuna variety whereas in variety NDR 8501 treatment $S_{10}Zn_{10}$ and $S_{40}Zn_{40}$ showed significant results. An examination of data in Table 1 revealed that increasing S and Zn increased the methionine contents of both cultivars. The similar findings were observed by Havlin *et al.* (1999).

Table 1: Influence of sulphur and zinc application on protein, methionine, and tryptophan content

Treatments	Varuna			NDR 8501		
	Protein(%)	Methionine (g/16gN)	Tryptophan (g/16gN)	Protein (%)	Methionine (g/16gN)	Tryptophan (g/16gN)
S_0Zn_0	26.49	0.743	0.545	25.05	0.899	0.501
$S_{10}Zn_{10}$	26.60	0.753	0.580	25.23	1.078	0.703
$S_{20}Zn_{20}$	27.76	0.883	0.740	26.49	1.199	0.905
$S_{30}Zn_{30}$	28.55	1.235	1.011	27.65	1.289	1.003
$S_{40}Zn_{40}$	30.13	1.561	1.079	29.66	1.503	1.545
CD at 5%	**2.17**	**0.150**	**0.17**	**1.89**	**0.136**	**0.165**

Tryptophan content has got a fundamental role in the biosynthesis of nicotinamide (Vitamin B-6) as well as in other metabolic process (Karlson, 1968). The application of S and Zn significantly increased the tryptophan content in both cultivars with increasing application of doses. Variation in tryptophan content was recorded from 0.545 to 1.079 g/16 g N in Varuna variety whereas it varied from 0.501 to 1.545 g/16 g N strain NDR 8501. Treatment $S_{40}Zn_{40}$ resulted highest content of tryptophan in both cultivar increasing level of S and Zn did not showed significant results in all treatment (Table 2). The similar findings were observed by Khan *et al.* (2016).

The content of allyl-isothiocynate varied from cake to oil samples. In oil it was found minimum followed by cake. The highest allyl-isothiocynate content in oil (0.342%) was recorded in variety NDR 8501 followed by Varuna (0.311%) variety (Table 2). However, these were exhibited a non-significant difference in allyl-isothiocynate content in both cultivar. Increasing doses of sulphur and zinc reduced allyl-Isothiocynate content in oil and cake too. A variety/strain contains minimum allyl-isothiocynate per cent in oil and cake indicates superior mill quality of mustard. The findings obtained in this study are in accordance with those as reported by Khan *et al.* (2016).

Total ash content being the sum total of the minerals present in any food crop maximum as percentage (5.28 %) was found in strain NDR 8501 followed by Varuna variety (4.21 %) The highest rate of application of sulphur and zinc resulted highest content of minerals per cents followed by lower dose over control. This is due to uptake of

Table 2: Influence of sulphur and zinc application on allyl-isothiocynate, mineral status content in oil/cake

Treatments	Allyl-isothiocynate content (%)				Mineral status of the cake	
	Varuna		NDR 8501			
	Cake	Oil	Cake	Oil	Varuna	NDR 8501
S_0Zn_0	0.357	0.311	0.362	0.342	4.143	5.180
$S_{10}Zn_{10}$	0.351	0.290	0.325	0.330	4.150	5.199
$S_{20}Zn_{20}$	0.348	0.247	0.314	0.310	4.158	5.211
$S_{30}Zn_{30}$	0.340	0.213	0.311	0.288	4.175	5.255
$S_{40}Zn_{40}$	0.320	0.205	0.295	0.250	4.211	5.277
CD at 5%	**NS**	**NS**	**NS**	**NS**	0.050	0.080

mineral available in the soil profile and its metabolism in kernels. This finding pertaining to total ash content revealed that there was a non-significant difference in the samples (Table 2).

In case of Alternaria blight increasing doses of S and Zn significantly decreased the Alternaria blight severity. The minimum Alternaria blight severity was recorded in dose of $S_{40}Zn_{40}$ (34.57, 32.04) in Variety Varuna and NDR 8501, respectively (Table 3). Similar results were also recorded by Meena *et al.* (2011).

Table 3: Influence of sulphur and zinc application on Alternaria blight severity (%)

Treatments	Alternaria blight severity (%)	
	Varuna	NDR 8501
S_0Zn_0	44.63	40.57
$S_{10}Zn_{10}$	40.57	38.35
$S_{20}Zn_{20}$	38.63	35.46
$S_{30}Zn_{30}$	36.01	33.36
$S_{40}Zn_{40}$	34.57	32.04
CD at 5%	**1.02**	**1.20**

CONCLUSION

It is concluded that effect of graded doses of sulphur and zinc application has significant effects on the protein, methionine, tryptophan, allyl-isothiocynate and mineral content in oil as well as cake in Indian mustard.

Further application of sulphur and zinc has altered the severity of Alternaria blight. Application of 40 kg sulphur and 40 kg zinc can produce highest protein percentage over control in mustard seeds. Application of sulphur and zinc has positive influence on minerals contents. In case of genotypes, their response to applied nutrients with respect to protein, methionine, tryptophan, allyl-isothiocynate and mineral was also varied.

Alternaria blight incidence was less due to application of tested plant nutrients i.e. S and Zn. Minimum attack of *Alternaria* blight (less severity) was recorded in the dose of $S_{40}Zn_{40}$. Though the response varied according to their genetic make and it was inless in NDR8501 as compare to Varuna.

ACKNOWLEDGEMENT

The authors are grateful to Director, DRMR, Sewar, Bharatpur (Rajasthan) for providing necessary facilities during investigations.

REFERENCES

AOAC. 1970. Association of official Agricultural Chemist. Official Methods of Analysis, 11th edition. Washington DCP.Pp 438.

Babhulkar PS, Kar D, Badole WP, Balpande SS. 2000. Effect of sulphur and zinc on yield quality and nutrient uptake by safflower in vertisol.*J. Indian Soc. Soil Sci.* **48**: 541-543.

Biswas DR, Ali SA and Khera MS. 1995. Response of Ghobhisarson (*Brassica napus* L. ASN-706) to nitrogen and sulphur. *J. Indian Soc. Soil Sci.* **43**: 220-225.

Hart FL and Fisher HJ. 1971. Modern food analysis Springerverlag, New York.

Havlin LJ, Beaton DJ, Tisdale LS and Nelson LW. 1999. Soil fertility and fertilizers. Prentice Hall of India, New Delhi, 6thEdn.pp 227-346.

Horn JM, Jones DB and Blum AE. 1946. Calorimetric determination of methionine in protein and foods. *J. Biol. Chem.* 116-313.

Husain MF and Kumar R. 2006. Influence of sowing dates and application of zinc on the performance of mustard in south-west semi-arid zone of Uttar Pradesh. *International J. Agril. Sci.***2**(2): 601-604.

Karlson P.1968. In introduction to modern biochemistry. Ed. III translated by Doering, CHA Academic Press, New York, 174-175.

Khan NA, Husain R, Vikram N, Ali A, Gyanendra K and Shivani. 2016. Effect of Zn and S on the biochemical characteristics of Indian mustard (*Brassica juncea (L.)* Czern and Coss).*Green Farming* **7**(3): 623-627.

Meena PD, Chattopadhyay C, Kumar A, Awasthi RP, Singh R, Kaur S, Thomas L, Goyal P and Chand P. 2011. Comparative study on the effect of chemicals on Alternaria blight in Indian mustard – A multi-location study in India.*J. Environ. Biol.* **32:** 375-379.

Singh AK, Singh AK, Choudhary AK, Kumari Aand Kumar R. 2017. Towards oilseeds sufficiency in India: Present status and way forward. *Journal of AgriSearch* **4** (2):80-84

Singh B, Singh J, Kumar A, Yadav YP and Singh S. 1999. Response of Brassica to sulphur for yield. *Ind. J. Agric. Sci.* **69**: 427-431.

Singh HK, Srivastava Shilpi, Singh RB and Singh Anil Kumar. 2013. Management of alternaria blight of rapeseed-mustard. *J of Plant Disease Sci*. **8** (2):131-136.

Singh R, Singh AK and Kumar P. 2014. Performance of Indian mustard (*brassica juncia* L.) in response to integrated nutrient management. *Journal of AgriSearch* **1** (1): 9-12.

Spice JR and Chambers DC.1949. Chemical determination of tryptophan in proteins. *Analyt. Chem.* 21: 1249-1252.

Yasari E. 2012. Micro-nutrients impact on soybean (*Glycine max* (Merrill) qualitative and quantitative traits. *International J. Biol.* **4**(2): 112-118.

Citation:

Singh S, Singh HK, Khan NA, Singh RP and Maurya MK. 2017. Influence of sulphur and zinc on biochemical properties and severity of alternaria blight in Indian Mustard. *Journal of AgriSearch* **4** (3): 212-214