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Effect of Different Levels of NPK and Zinc Sulphate on Yield and Oil Content in Mustard (*Brassica juncea* L.) Var. Jai Kisan

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ABSTRACT

An experiment was conducted Rabi season of 2013-14. It was observed that the best yield attributes characters was in treatment T_8-(@NPK_{100} +@ Zinc $Sulphate_{100}$) in respect to different days intervals i.e. 30, 60 and 90 days after sowing (DAS). Number of leaves per plant were 14.06, 19.10 and 20.10 and no. of branches per plant were 6.30, 11.40 and 12.20 found to be significant at 30DAS, 60DAS and 90 DAS but, Plant height was 29.10 cm, 99.53 cm and 107.16 cm found significant at 30 DAS and 60 DAS and interaction effect of NPK and Zinc Sulphate found non-significant at 90 DAS. In the same yield (q ha^{-1}) was 24.82 found to be significant. In the same treatment T_8, Interaction between the Zinc Sulphate and N P K on an average test weight, fresh weight, dry weight and oil content (%) as 4.10 g, 81.06 g, 70.76 g and 45.44 % respectively showed a non-significant effect. Effect of NPK and Zinc Sulphate on fresh weight, dry weight and oil content (%) was significant and effect of NPK on test weight was significant and effect of Zinc Sulphate found non-significant. Adequate plant nutrient supply holds the key for improving the food seed production food security.

Key word: *Yield, Mustard, Nitrogen, Phosphorous, Sulphur*

INTRODUCTION

India is one among the leading oil seed producing countries in the world. Oilseeds form the second largest agricultural commodity after cereals. Mustard is the second important edible oil seed crop after groundnut. It plays an important role in the oil seed economy of the country. Indian mustard (*Brassica juncea* L.) commonly known as raya, rai or lahi is an important oilseed crop among the Brassica group of oilseed in India. It possesses a higher potential of production per unit area than other members of the family cruciferae. Rape seed and mustard crops are being cultivated in 53 countries spreading over the six continents across the globe covering an area of 24.2 million hectare. Indians contribution to world and production is 28.3 and 19.8 percent respectively. In India, Toria is cultivated on 6.86 million hectares in Rabi season[3]. *Brassica juncea* (L.) required cool and moist climate of winter months is the major factor for luxuriant growth and productivity of mustard in these states.

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The plant reaches about 4-5 feet in height and bears golden yellow 1ecause flowers. Its tiny, round seeds measuring about 1mm in diameter is encased inside a fruit pod in a similar fashion like green pea pod. Mustard seeds are known by different names in different places. Sarson rai or raya toria or laha[15] Rapeseed-mustard is an important group of edible oil seed crops and contributes around 26.1% of the total oil seed production. Out of 57856 thousand tonnes of rapeseed–mustard seed produced over 30308 thousand ha in the world, India produce 5833 thousand tonnes from 5750 thousand ha^{-1}. Indian mustard [*Brassica juncea* (L.)] contributes about 85% of the total rapeseed–mustard produced in India[12]. Rapeseed-mustard is rich in minerals like calcium, manganese, copper, iron, selenium, zinc, vitamin A, B, C and proteins. 100g mustard seed contains 508 kcal energy, 28.09g carbohydrates, 26.08g proteins, 26.08 g total fat and 12.2g dietary fiber. The oil and protein of Toria seeds of range from 40 – 48% and 20 – 40% respectively. The Toria seeds and oil are used as a condiment in preparation of pickles and for 723ecause723ng curries and vegetables. The leaves of young plant are used as green vegetable. It is also used for making, medicine, soaps and various lubricants, such as grease. Toria oil contains more of sulphur compounds. In Uttar Pradesh (Toria crop) was grown on an area of 0.64 million hectare with production of 0.53 million tonnes and the productivity of 831 kg ha-[13]. Nitrogen is the most important nutrient, which determines the growth of the Toria crop and increases the amount of protein, methionine dry matter and the yield. Phosphorus and Potash are known to be efficiently utilized in the presence of Nitrogen. It promotes flowering, setting of siliqua and in increase the size of siliqua and yield[17]. Phosphorus is an element for Toria and mustard. Phosphorus is generally deficient in majority of our Indian soils and need much attention for maintenance of soil fertility. When Phosphorus was applied in conjunction with Nitrogen and Potash, there was significant increase in the yield of Toria and mustard[17]. Potassium is one of the seventeen elements which are essential for growth and development of plants. Mustard is an important oil seed crop of arid and semi-arid region. Potassium is required for improving the yield and quality of different crops 723ecause of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between protein and carbohydrates[17]. One of the most important micronutrient is zinc (Zn). Zinc deficient soil can be found throughout the world and are normally associated with low soil organic matter and a soil pH higher than 7.0. Zinc deficiencies are corrected in most cases by applying a granular Zn fertilizer. In this research, the material and method used to achieve the general objectives, which are to evaluate the growth promoting, to reduce zinc deficiency effect and to get high yield of fresh weight of mustard using zinc sulphate[11]. Sulphur plays the key role is most important among the secondary nutrient in the production of oilseed crops. It plays significant role in the development of seed. An oilseed crop requires sulphur comparatively higher than other nutrient. Average over a large amount of data the application of sulphur increased crop yield by 17% in rice 25% in soybean 20% in sunflower and mustard 16% in linseed. Various nutrient and micro nutrient as required for oilseed production but the nutrient which plays a multiple role in providing nutrition to oil seed crops, particularly those belonging to cruciferae family is sulphur. Each unit of fertilizer generates 3-5 units of edible oil, commonly needed by every family. Amount of sulphur absorbed by crops is generally 9-15% (one-tenth to one- seventh) of the nitrogen up take, In Toria sulphur uptake is usually one-third of nitrogen uptake[17].

MATERIAL AND METHODS

A field Experiment was conducted on Crop Research Farm of Department of Soil Science, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture**,** Technology & Sciences (Deemed-to-be-

University) Allahabad, (U.P.) India. The soil of experimental area falls in Inceptisols order and the experimental field is alluvial in nature. The design applied for statistical analysis was carried out with 3^2 factorial randomized block design having three factors with three levels of NPK and three levels of Zinc Sulphate. Doses for three levels of N P K as 0, 50 and 100 % were L_0 (0 kg N/ha +0 kg P/ha+ 0 kg K/ha), L_1 (40 kg N/ha +30 kg P/ha+ 20 kg K/ha) and L_2 (80 kg N/ha +60 kg P/ha+ 40 kg K/ha) respectively and doses for three levels of $ZnSO_4$ 0, 50 and 100% were Z_0 (0.0 kg ha^{-1}), Z_1 (25.0 kg ha^{-1}) and Z_2 (50.0 kg ha^{-1}) respectively. Treatments were $T_0 - (L_0 Z_0)$ [@ 0 % N P K + 0% $ZnSO_4$], $T_1 - (L_0Z_1)$ [@ 0% N P K+ 50% $ZnSO_4$], $T_2 - (L_0 Z_2)$ [@ 0% N P K+ 100% $ZnSO_4$], $T_3 - (L_1Z_0)$ [@ 50% N P K + 0% $ZnSO_4$], T_4- $(L_1 Z_1)$ [@ 50% N P K+ 50% $ZnSO_4$], T_5- $(L_1 Z_2)$ [@50% N P K+100% $ZnSO_4$], $T_6 - (L_2 Z_0)$ [@ 100% N P K+ 0% $ZnSO_4$], $T_7 - (L_2 Z_1)$ [@100% N P K+ 50% $ZnSO_4$], T_8- $(L_2 Z_2)$ [@100% N P K+ 100% $ZnSO_4$]. Having the treatments was replicated thrice. The source of Nitrogen, Phosphorus, Potassium, Zinc and Sulphur as Urea, SSP, MOP, Zinc Sulphate respectively. Basal dose of fertilizer was applied in respective plots according to treatment allocation in furrows opened by about 5cm depth before sowing of seeds in soil at the same time at the depth of 5cm, row to row distance was maintained at 45 cm and plant to plant distance was 15 cm. During the course of experiment, observations were recorded as mean values of the data.

The soil analysis was done in the laboratory of Soil Science and Agriculture Chemistry, SHIATS.-DU, Allahabad with following standard methods:-

Table 1(a): Mechanical analysis of the Pre Sowing Soil.

S. No.	Soil separates	(%)	Method followed
1.	Sand	60.0	**Bouyoucous hydrometer (1927)**
2.	Silt	20.12	
3.	Clay	11.51	
4.	Texture of soil	Sandy loam	

Table 1 (b): Physical and Chemical analysis of Pre-sowing soil.

Particulars	Rating	Method
1.Soil pH, Soil water Suspension	7.80	Digital pH meter[10]
2. EC (dS m^{-1})	0.43	Digital Conductivity meter[19]
3. Bulk density (gcm^{-3})	1.63	Graduated measuring cylinder[7]
4. Particle density (gcm^{-3})	2.62	Graduated measuring cylinder[7]
5. Pore space (%)	49.22	Graduated measuring cylinder[7]
6. Organic carbon (%)	0.49	Walkley and Black[20]
7. Available N ($Kgha^{-1}$)	230.70	Alkaline Permanganate Method[16]
8. Available P ($Kgha^{-1}$)	17.96	Calorimetric Method[14]
9. Available K ($Kgha^{-1}$)	258.00	Flame photometric Method[18]
10. Available Zn (ppm)	0. 58	**Shaw and Dean Method (1952)**
11.Available S (ppm)	11.05	Turbidemetric method **(Chesnin & Yien 1950)**

RESULTS AND DISCUSSIONS

The results given in table 2(a) indicate some of the important parameters of plant height (cm), No. of leaves per plant, No. of branches per plant in mustard crop. The maximum no. of leaves per plant was 14.06, 19.10 and 20.10 and No. of branches per plant were 6.30, 11.40 and 12.20 increased significantly and

progressively with the increasing level of N P K fertilizer and Zinc Sulphate at 30 DAS and 60 DAS and 90 DAS found to be significant but, plant height (cm) was 29.10 cm, 99.83 cm and 107.16 cm found to be significant at 30 DAS and 60 DAS and non- significant at 90 DAS. The result given in table 2(b) indicates Fresh weight (g), Dry weight (g), Test weight (g), Seed yield (q ha^{-1}) and Oil content (%)

The interactive effects of N P K generally influenced the important seed yield, fresh weight, dry weight, test weight on mustard crop. Maximum Fresh weight (g), Dry weight (g), Test weight (g), Seed yield (q ha^{-1}) and Oil content (%) were 81.06 g, 70.76 g, 4.10 g, 24.82 q ha^{-1} and 45.44 % respectively recorded in T_8- L_2Z_2 [@100%NPK+ 100% $ZnSO_4$]. The effect of N P K and Zinc Sulphate on Fresh weight (g), Dry weight (g) and Oil content (%) was found to be significant but interaction between NPK and Zinc Sulphate found non-significant. The maximum yield was 24.82 q ha^{-1} found to be significant. The maximum oil content was 45.44% shows significant effect of NPK and non-significant effect of Zinc Sulphate and interaction between NPK and Zinc Sulphate.

Table 2(a): Effect of different levels of N P K and Zinc Sulphate on Plant Height (cm), No. of Leaves (per plant) and No. of Branches (per plant) of mustard (*Brassica juncea* L.) var. Jai Kisan.

Treatment combination	Plant Height (cm)			No. of Leaves			No. of Branches		
	30DAS	60DAS	90DAS	30DAS	60DAS	90DAS	30DAS	60DAS	90DAS
$T_0=L_0Z_0$	19.20	76.96	81.10	5.60	9.10	9.86	3.96	7.0	7.00
$T_1=L_0Z_1$	22.06	79.86	86.76	6.00	10.06	10.96	4.30	7.76	7.96
$T_2=L_0Z_2$	22.63	82.66	92.00	6.30	10.50	10.96	4.40	7.63	8.50
$T_3=L_1Z_0$	22.73	86.53	96.30	6.43	10.40	11.06	4.50	8.0	8.20
$T_4=L_1Z_1$	23.73	87.86	96.10	7.30	10.53	11.53	4.73	8.20	8.40
$T_5=L_1Z_2$	27.33	93.96	102.63	11.73	15.06	16.20	5.60	9.53	10.43
$T_6=L_2Z_0$	25.30	89.30	96.16	9.40	12.86	13.40	5.10	8.60	8.96
$T_7=L_2Z_1$	25.93	90.50	99.86	11.06	13.10	13.63	5.40	8.16	8.96
$T_8=L_2Z_2$	29.10	99.83	107.16	14.06	19.10	20.10	6.30	11.40	12.20
Mean	24.22	87.49	95.34	8.65	12.30	13.07	4.92	8.47	8.95
F- test (LxZ)	**S**	**S**	**NS**	**S**	**S**	**S**	S	**S**	**S**
S. Em	0.22	0.53	0.99	0.28	0.60	0.66	0.01	0.26	0.29
C. D. at 5%	0.66	1.61	-	0.85	1.81	1.98	0.35	0.80	0.88

Table 2(a): Effect of different levels of N P K and Zinc Sulphate on Dry Weight (g), Test Weight (g), Seed Yield (q ha^{-1}) and Oil content (%) of mustard (*Brassica juncea* L.) var. Jai Kisan.

Treatment combination	Fresh weight (g)	Dry weight (g)	Test weight (g)	Seed yield (q ha^{-1})	Oil content (%)
$T_0=L_0Z_0$	29.26	21.73	3.30	16.38	28.88
$T_1=L_0Z_1$	33.53	25.16	3.66	18.06	34.44
$T_2=L_0Z_2$	44.50	33.83	3.70	19.37	42.00
$T_3=L_1Z_0$	41.20	30.50	3.93	20.68	31.10
$T_4=L_1Z_1$	41.96	30.83	3.73	22.21	34.44
$T_5=L_1Z_2$	59.63	52.10	4.03	23.29	43.22
$T_6=L_2Z_0$	37.73	28.96	3.90	21.88	32.22
$T_7=L_2Z_1$	51.63	42.40	3.96	23.95	41.00
$T_8=L_2Z_2$	81.06	70.76	4.10	24.82	45.44
Mean	**46.72**	**37.36**	**3.81**	**21.14**	**36.97**
F- test (LxZ)	**NS**	**NS**	**NS**	**S**	**NS**
S. Em	6.41	5.38	0.11	0.07	1.55
C. D. at 5%	-	-	-	0.21	-

CONCLUSION

The various levels of NPK and $ZnSO_4$ used from different sources in the experiment The treatment T_8-L_2 Z_{2-} **[**@ NPK 100%+ @ $ZnSo_4$ 100%] found to be the best for yield attributes characters i.e. plant height (cm) was 107.16, number of leaves were 20.10, numbers of branches were 12.2, fresh weight was 81.0 g, Test weight was 4.1 g, Dry weight was 70.7 g and Seed yield was 24.82 q ha^{-1} and Oil (%) was 45.44%, were found more than any other treatment combinations. The result is based on one year experimental data further research may be initiated for the establishment of the above findings.

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