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Study on effect of nitrogen and zinc application to the sesame *(Sesamum indicum)* under rainfed condition

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Abstract
Sesame is an importantance oil crops which has good position to increase economic earning of grower. The Study on effect of nitrogen and zinc application to the sesame *(sesamum indicum)* at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh), it could be concluded that among different levels of nitrogen 1% urea 2 spray ha^{-1} combination with zinc 1ppm 1 spray ha^{-1} resulted into significantly higher grain yield (6.06 q/ha) of sesame var. JTS-8 as compared to application of nitrogen 1% urea 2 spray ha^{-1} and zinc 1ppm 1 spray ha^{-1}.

Keywords: Sesame crop, varieties, nitrogen and zinc levels

Introduction
Sesamum is quality food, nutrition, edible oil, biomedicine and health care, all in one. Sesamum has remarkable antioxidant due to the presence of lignin and tocopherol. The seed of sesame are highly rich in quality proteins and essential amino acids, especially methionine is considered rejuvenate anti-aging for human body. Sesamum seeds are rich source of fatty acids (linoleic, oleic, palmitic and stearic acids), vitamins (E, A, B1, B2), niacin and minerals including calcium and phosphorus. Sesame is called as 'the queen of oils' because of extra ordinary cosmetic and skin care qualities. Sesame seeds are rich in oil (44–58%), proteins (18–25%), and carbohydrates (13.5%); oil fraction contains about 90% unsaturated fatty acids, including oleic acid and linoleic acid. As protein fraction, sesame seeds are rich in arginine and leucine with about 140 $mg \cdot g^{-1}$ and 75 $mg \cdot g^{-1}$, respectively.
The zinc (Zn) content of soils, according to rather extensive surveys, is generally in the range of 10-300 ppm. Certainly Zn, because of its concentration, can be considered as a trace element in soil. It occurs most frequently in the lithosphere as the mineral Zn (sphalerite). Zn appears to be scattered throughout the mineral fraction of soils. It is probably held in crystal lattices, by isomorphous substitution and as occluded ions. Since it is a trace element, it is usually surrounded, by many other solid phases. Zn can also be held, by exchange sites, and adsorbed to solid surfaces. Crops differ in their sensitivity to zinc deficiency. Zn deficiencies are frequently found on soils, with restricted root zones. The movement of Zn to plant roots is dependent on the intensity factors (concentration) and on the capacity factors (ability to replenish). Increasing the pH decreases the solubility of zinc in soils, and thereby reduces the concentration, the concentration gradient, and, hence, the uptake and availability of Zn to plants. Zn plays an important role in auxin formation and in other enzyme systems. Presently, Zn is recognized as an essential component in several dehydrogenases, proteinases, and peptidases. It is one of the most important micronutrient in plants. It has an important role in enzyme combination, translocation procedure, nucleic acid structure, and protein synthesis and auxin metabolism. Zinc (Zn) is important micronutrients in sesame production. Reduced growth hormone production in Zn deficient plants causes shortening of internodes and short leaves resulting in malformation of fruit with little or no yield (Havlin, 2005).

Material and Method
Investigations was carried out during the year 2018-19 on sesame Variety JTS-8 at the Rajola Farm of the Faculty of Agricultural Sciences, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot – Satna (Madhya Pradesh) during the *kharif season*. The experiment was laid out in a Randomized Block Design with three replication were Nine Treatments including a control. Sprays were given during treatment 1% urea 1 spray & 1ppm 1spary of Zinc and 1% urea 2 spray&1 ppm 2spary. Growth Parameters were taken Plant height, Number of branches, Number of leaves per plant, number of capsules per plant, number of seeds per capsules and Yield.

Result and Discussion

The observation on the different parameters i.e. growth parameters, and yield attributes and yield were recorded at different stages of crop. The data pertaining to plant height (cm) at 30, 60, 90 DAS and at maturity as influenced by different levels of nitrogen and zinc are presented in Table 1. and depicted in Fig 1. The analysis of variance of plant height (cm) at 30, 60, 90 DAS. Irrespective of different treatments, it is evident from the data (Table 1.) that plant height increased with the advancement in the age of the plant and reached the maximum at maturity. The perusal of data indicated that different level of nitrogen and zinc were significantly influenced the plant height at 30, 60, 90 DAS at maturity. Among different levels of nitrogen and zinc, plant height (26.5 cm, 92.1cm, 93.9 cm,) at 30, 60, 90 DAS and at maturity, respectively were recorded significantly greater with nitrogen 1% urea spary ha-1 followed by @ 1 ppm zinc ha-1 (26.5 cm, 92.1 cm, 93.9 cm, respectively) and the lowest plant height (21.5cm, 74.2 cm, 76 cm) at 30, 60, 90 DAS and at maturity, respectively were recorded.

Table 1: Effect of nitrogen and zinc application on plant height of sesame at successive stages.

S. No.	Treatment	Plant height (cm)			Number of branches per plant			Number of leaves per plant		
		30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
1	T_{1}($N_0 Z_0$)	21.5	74.2	76	3.5	4.8	6.0	17.9	30.6	33
2	T_{2}($N_1 Z_0$)	24.8	83.4	85	4	5.6	6.8	19.8	33.6	36.2
3	T_{3}($N_2 Z_0$)	26.2	79.6	80.6	3.6	5.2	7.6	20.1	32	34.4
4	T_{4}($N_0 Z_1$)	25.2	85.6	86.6	4.9	6.5	7.4	24.6	36	38.5
5	T_{5}($N_1 Z_1$)	24.6	85.2	82.6	3.9	5.2	6.2	18.7	31.5	34.1
6	T_{6}($N_2 Z_1$)	26.5	92.1	93.9	5.4	6.8	7.8	24.2	36.9	39.6
7	T_{7}($N_0 Z_2$)	24.8	77.2	78.7	4	5.2	6.2	19.2	31.3	33.9
8	T_{8}($N_1 Z_2$)	24.5	80.8	87.2	4.9	5.8	7	23.2	35.3	37.8
9	T_{9}($N_2 Z_2$)	25.6	90.6	92.4	3.7	6.5	7.4	20.6	34.8	37
Maximum		26.5	92.1	93.9	5.4	6.8	7.8	24.6	36.9	39.6
Minimum		21.5	74.2	76	3.5	4.8	6.0	17.9	30.6	33
Average		24.0	83.15	84.95	4.45	5.8	6.9	21.25	33.75	36.3
SE+-		0.980	3.857	3.803	0.417	0.475	0.593	1.426	1.474	1.387
CD5%		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
NXZn		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

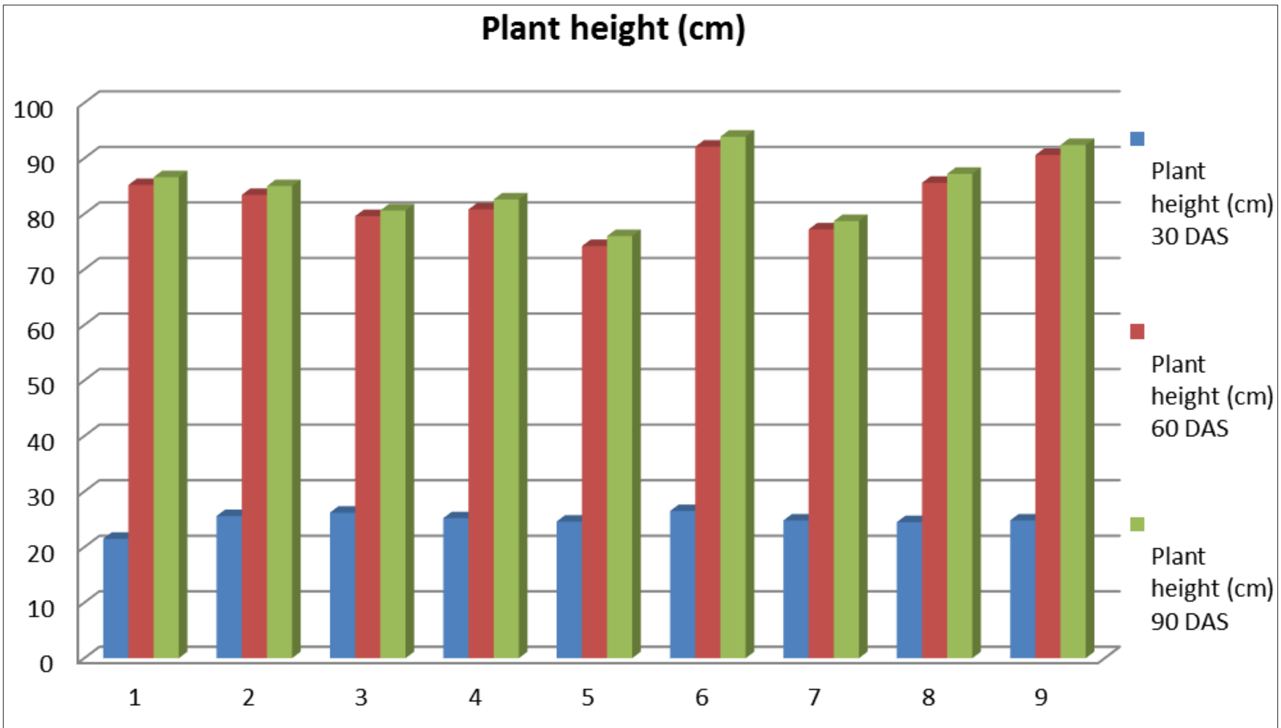

Fig 1(i): Effect of nitrogen and zinc application on plant height of sesame at successive stages.

Number of branches per plant

The number of branches of sesame was not significantly affected by treatment at 30 DAS. While, at 60 DAS and 90 DAS, number of branches was also not significantly affected by different treatments. The data of number branches showed in table 4.2@ three levels i.e. 30, 60 and 90 DAS using different inorganic combination. the maximum number of branches observed T_6 (5.4) and minimum T_1 (3.5) at 30 DAS while, 60 DAS maximum number of branches T_6 (6.8) and minimum T_1 (4.8). At 90 DAS, highest number of branches observed T_6 (7.8) and minimum T_1 (6.0).

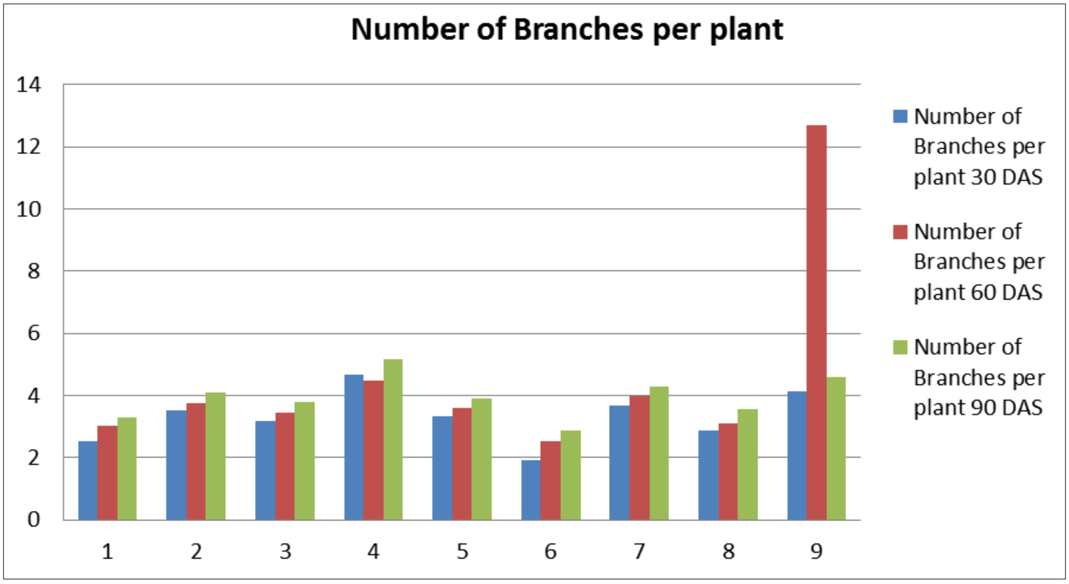

Fig 1(ii) Effect of nitrogen and zinc application on number of branches of sesame at successive stages.

Number of leaves per plant

The number of leaves per plant was recorded at successive stages of crop growth and the data were analyzed statistically. The number of leaves of sesame was not significantly affected by treatment at 30 DAS. While, at 60 DAS and 90 DAS, number of leaves was also not significantly affected by different treatments. The data of number leaves showed in table 4.3@ three levels i.e. 30, 60 and 90 DAS using different inorganic combination. the maximum number of leaves observed T_6 (24.6) and minimum T_1 (17.9) at 30 DAS while, 60 DAS maximum number of leaves T_6 (36.9) and minimum T_1 (30.6). At 90 DAS, highest number of leaves observed T_6 (39.6) and minimum T_1 (33).

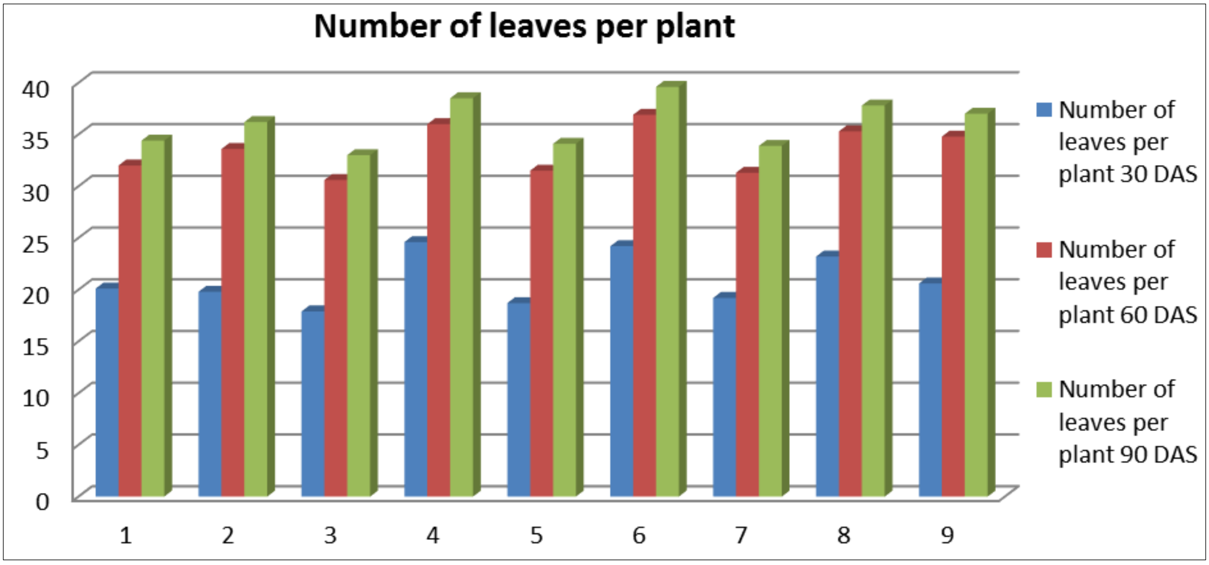

Fig 1(iii): Effect of nitrogen and zinc application on number of leaves of sesame at successive stages.

Yield attributes and yield

The number of capsule accumulation per plant significantly influenced due to various inorganic treatments. Treatments of N_2Zn_1 produced maximum number of capsule (cm) T_6 (20.13) minimum number of capsule was registered in N_0Zn_0 T_1 (11.2).

That number of seed per plant of sesame crop was significantly influenced with inorganic treatments. Treatments of N_2Zn_1 produced maximum number of seed per plant T_6 (63.4) remained statically at par. Minimum number of seed per plant was registered in N_0Zn_0 T_1 (57.4).

The data in Table 2 clearly indicated that the number of plant per plot of sesame was significantly influenced by different levels of nitrogen and zinc. Among different levels of nitrogen and zinc produced significantly more number of plant per plot of sesame T_6 (280) followed by N_2Zn_1. The lowest number of plant per plot of sesame N_0Zn_0 T_1 (270.6) was recorded with nitrogen and Zinc.

The data pertaining to 1000-seed weight (g) as influenced by different levels of nitrogen and zinc are given in Table 2. The analysis of variance of 1000-seed weight (g) and reveals that the 1000-seed weight (g) was significantly influenced by different levels of nitrogen and zinc. Among different levels of nitrogen and zinc recorded significantly higher 1000-seed weight T_1 (3.43g) and the lowest value of 1000-seed weight T_1 (3.26g) was recorded with N_0Zn_0.

Grain yield (q ha^{-1})

The data pertaining to grain yield (q ha-1) as influenced by different levels of nitrogen and zinc given in Table 2 and depicted in Fig. 2 and clearly reveals that the grain yield (q ha-1) was significantly affected by different levels of nitrogen and Zinc. Among different levels of nitrogen and zinc produced significantly higher grain yield T_6 (6.06 q ha-1) followed by N_2Zn_1 and the lowest grain yield T_1 (5.06 q ha-1) was recorded with N_0Zn_0. The interactional effects of different levels of nitrogen and zinc on grain yield (q ha-1) were found non-significant.

Straw yield (q/ha^{-1})

The data pertaining to straw yield (q ha-1) as influenced by different levels of nitrogen and zinc given in Table 2 and depicted in Fig. 2 the data in Table 2 clearly reveals that the straw yield (q ha-1) was significantly affected by different levels of nitrogen and zinc. Among different levels of nitrogen and zinc produced significantly higher straw yield T_6 (5.22 q ha-1) followed by N_2Zn_1 and the lowest straw yield T_1 (4.35 q ha-1) was recorded with N_0Zn_0.

The interactional effects of different levels of nitrogen and zinc on straw yield (q ha-1) were found non-significant. Among different levels of nitrogen and zinc produced significantly higher straw yield T_6 (5.22 q ha-1) followed by N_2Zn_1 and the lowest straw yield T_1 (4.35 q ha-1) was recorded with N_0Zn_0. The interactional effects of different levels of nitrogen and zinc on straw yield (q ha-1) were found non-significant.

Table 2: Effect of different levels Nitrogen and Zinc on yield attributes of Indian sesame var. JTS-8.

S. No.	Treatment	yield attributes of Indian sesame					
		Number of capsules per plant	**Number of seed per capsule**	**Number of plant per plot**	**1000 seed weight g/plot**	**Grain yield (q/ha)**	**Straw yield (q/ha)**
1	T_1	11.6	57.4	270.6	3.26	5.06	4.35
2	T_2	20.4	60.8	275.3	3.37	5.73	5.22
3	T_3	11.2	62.6	276	3.37	5.68	5.06
4	T_4	17.2	61	278.3	3.28	5.39	4.62
5	T_5	16.7	58.4	270.6	3.38	5.44	4.82
6	T_6	20.13	63.4	280	3.43	6.06	5.22
7	T_7	13.7	60.6	273.3	3.42	5.86	4.95
8	T_8	18.6	62	277.6	3.37	5.44	4.90
9	T_9	17.6	61.8	276	3.33	5.75	4.98
Maximum		20.13	63.4	280	3.43	6.06	5.22
Minimum		11.2	57.4	270.6	3.26	5.06	4.35
Average		15.67	60.4	275.3	3.34	5.56	4.78
SE+-		2.616	0.989	1.629	0.026	0.090	0.165
CD5%		N/A	N/A	N/A	N/A	0.273	N/A
NXZn		N/A	N/A	N/A	N/A	0.473	N/A

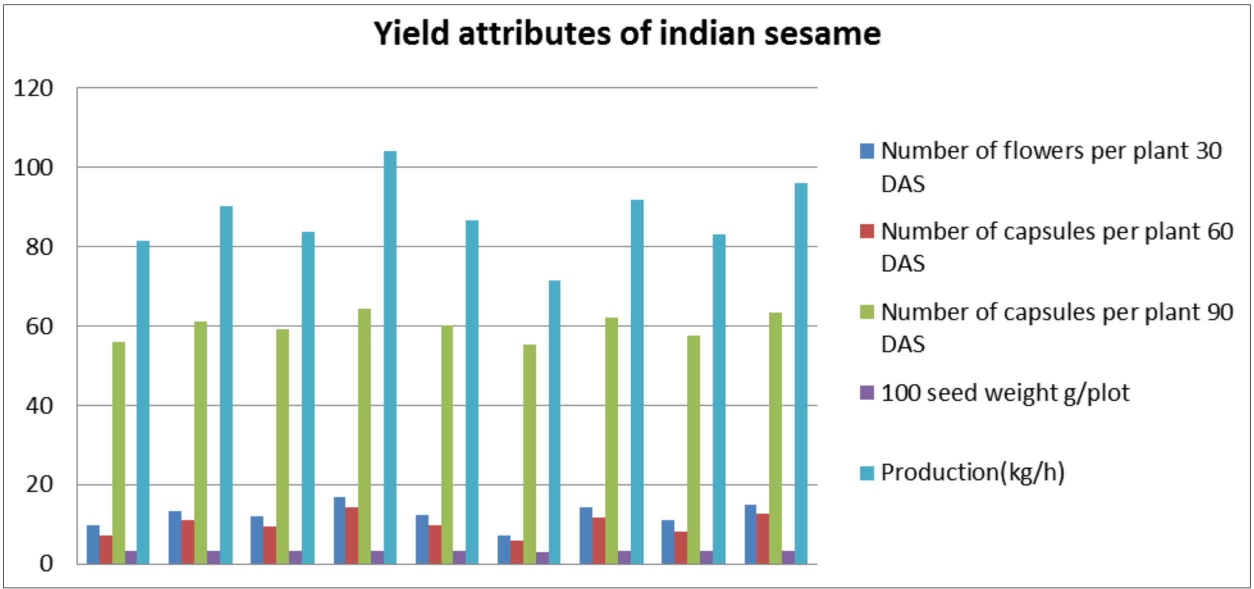

Fig 2: Effect of different levels of nitrogen and zinc on yield attributes of Indian sesame var. JTS-8.

Conclusion

From the results of one-year field investigation during kharif 2018-19, it could be concluded that among different levels of nitrogen 1% urea 2 spray ha^{-1} combination with zinc 1ppm 1 spray ha-1 resulted into significantly higher grain yield (6.06 q/ha) of sesame var. JTS-8 as compared to application of nitrogen 1% urea 2 spray ha^{-1} and zinc 1ppm 1 spray ha-1.

Looking to the results of the present study, it is suggested that the experiment should be repeated further one or two years with increased levels of nitrogen and zinc for higher productivity of prevailing varieties of sesame under rainfed condition of agro-climatic condition of chitrakoot of Bundelkhand region.

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