www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 2366-2369

www.thepharmajournal.com
Received: 28-12-2021
Accepted: 27-02-2022

Gali Haritha
M.Sc. Scholar, Department of Agronomy, NAI, SHUATS, Prayagraj, Uttar Pradesh, India

Dr. Rajesh Singh
Assistant Professor, Department of Agronomy, NAI, SHUATS, Prayagraj, Uttar Pradesh, India

Thakur Indu
Ph.D., Research Scholar, Department of Agronomy, NAI, SHUATS, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Gali Haritha
M.Sc. Scholar, Department of Agronomy, NAI, SHUATS, Prayagraj, Uttar Pradesh, India

Studies on growth and yield of sesame (*Sesamum indicum* L.) as influenced by spacing and foliar application of zinc

Gali Haritha, Dr. Rajesh Singh and Thakur Indu

Abstract
A field experiment was conducted during *kharif season* of 2021, at crop research farm of Department of Agronomy at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj in North Eastern plains of Eastern Uttar Pradesh with the objective to study the effect of spacing and foliar application of zinc on growth, yield and economics of Sesame (*Sesamum indicum* L.) Var. G - 1 under Randomized block design comprising of 9 treatments of which treatments (T1-T9) with different combination of spacing along with zinc which are replicated thrice. The experimental results revealed that 40 cm X 10 cm + ZnSo4 – 0.75% recorded recorded Maximum plant height (125.73 cm), Highest plant dry weight (15.57 gm), number of capsules/plant (54.60), number of seeds/capsule (60.50) and seed yield (1.20 t/ha).

Keywords: Zinc, growth, sesame, spacing, yield

Introduction

Sesame (*Sesamum indicum* L.), also commonly known as sesame, til, simsim, benised, gingelly, Gergelim, etc., It is an ancient oilseed crop that belongs to the Pedaliaceae family. Sesame is known as the "Queen of Oil Seed Crops" because to its high quality. It is a prominent oilseed crop in the world due to its ease of extraction, stability, and drought resistance. During the Harrapan and Antolian eras, sesame was planted and domesticated in the Indian subcontinent (Bedigian and Vander 2003) [1]. Sesame is grown over 365 thousand hectares in Uttar Pradesh, with production and productivity of 157 metric tonne and 430 kg/ha, respectively.

Sesame is a versatile crop with high-quality edible oil that has a wide range of applications. Sesame contains 46 to 55 percent oil, 20 to 25 percent protein, 20 to 25 percent carbohydrate, and 5 to 6 percent ash (Salunkhe *et al.*, 1992) [2]. Vitamins, amino acids, and polyunsaturated fatty acids are also present. In south India, sesame oil is a popular cooking oil. In the soap industry, lower grades of oil are employed. An edible cake high in methionine, cystein, arginine, and tryptophan, the oil cake It is mostly used as a cow feed for milch animals. It's a vital element that can make up to 5% of a well-formulated chicken feed. It can be used as manure as well. Cake has a nitrogen content of 6.0-6.2 percent, a P2O5 content of 2.0-2.2 percent, and a K2O content of 1.0-1.2 percent.

Maintaining an optimal plant population is critical for fully exploiting sesame's yield potential. For sunlight to reach each layer of leaves, proper spacing is required. This will increase the rate of photosynthesis and, as a result, the amount of dry matter produced. Sesame is a photorespiration-affected C3 plant. By following optimal plant geometry, photorespiration can be reduced, resulting in a higher crop yield. In the context of modern technology, spacing refers to plant population, which is mostly determined by the soil fertility and moisture level of the field. The planting geometry aids in the alteration of canopy architecture, which affects light interception and CO2 assimilation, as well as production (Brar *et al.*, 1998) [2].

Zinc being one of the essential micronutrients, plays significant role in various enzymatic and physiological activities of plant body. Zinc also has a role to play in some metabolic processes of plants, such as protein synthesis and membrane integrity (Cakmak and Marschner, 1998) [3]. It promotes synthesis of growth hormone, seed maturation, starch and chlorophyll synthesis and also regulates water absorption. Foliar application of zinc to crops is an effective way to increase the grain concentration of zinc.

Materials and Methods

A field experiment was conducted during *kharif* season of 2021, at Crop research farm of Department of Agronomy at Sam Higginbottom University of Agriculture, Technology, and Sciences, Prayagraj which is located at 25o 24' 42" N latitude, 81o 50' 56" E longitude and 98 m altitude above the mean sea level (MSL). To assess the effect of spacing and zinc on growth and yield of Sesame (*Sesamum indicum* L.). The experiment was laid out in Randomized Block Design comprising of 9 treatments which are replicated thrice. Each treatment net plot size is 3m × 3m. The treatment are categorized as with recommended dose of Nitrogen through Urea, Phosphorus through DAP, Potash through Muriate of Potash and Zinc is applied in the form of Zinc sulphate when applied in combinations as follows, (T1) 25 cm X 15 cm + ZnSo4 – 0.25%, (T2) 25 cm X 15 cm + ZnSo4 – 0.50%, (T3) 25 cm X 15 cm + ZnSo4 – 0.75%, (T4) 35 cm X 15 cm + ZnSo4 – 0.25%, (T5) 35 cm X 15 cm + ZnSo4 – 0.50%, (T6) 35 cm X 15 cm + ZnSo4 – 0.75%, (T7) 40 cm X 10 cm + ZnSo4 – 0.25%, (T8) 40 cm X 10 cm + ZnSo4 – 0.50%, (T9) 40 cm X 10 cm + ZnSo4 – 0.75%. The sesame crop was harvested treatment wise at harvesting maturity stage. Growth parameters *viz.* plant height (cm), dry matter accumulation g/plant were recorded manually on five randomly selected representative plants from each plot of each replication separately and after harvesting, seeds were separated from each net plot and were dried under sun for three days. Later winnowed, cleaned and seed yield per ha was computed and expressed in tonnes per hectare. After complete drying under sun for 10 days stover yield from each net plot was recorded and expressed in tonnes per hectare. The data was computed and analysed by following statistical method of Gomez and Gomez (1984) [6]. The benefit: cost ratio was worked out after price value of seed with stover and total cost included in crop cultivation.

Results and Discussions

Effect on growth parameters

Plant height (cm)

It is evident from Table 1. That plant height measured increased with advancement in crop growth. At harvest the treatment T9 (40 cm X 10 cm + ZnSo4 – 0.75%) recorded maximum height of (125.73 cm). At harvesting stage maximum plant height was measured in T9 (40 cm X 10 cm + ZnSo4 – 0.75%) and treatments T8 (40 cm X 10 cm + ZnSo4 – 0.50%) is found statistically at par to T9 (40 cm X 10 cm + ZnSo4 – 0.75%). Plant height of sesame was influenced by spacing and foliar application of zinc 40cm x 10 cm spacing shows the higher plant height, number of branches per plant, number of capsules/plant and highest test weight in the sesame. The observed improvement in plant height due to zinc might be due to biosynthesis of IAA growth hormones, cell enlargement, cell division and multiplication which ultimately led to better plant height of sesame and boosted plant growth. Similar findings were also reported by Sharma and Jain (2003) [13] in mustard, Choudhary *et al.* (2010) [4] in sunflower and Murthy *et al.* (2011) [9] in sesame.

Dry matter accumulation

The treatment T9 (40 cm X 10 cm + ZnSo4 – 0.75%) recorded maximum dry matter accumulation of (15.57 g) at the harvesting stage and T8 (40cm X 10cm + ZnSo4–0.50%) treatments is found statistically at par to maximum dry matter accumulation. The dry weight of sesame increased significantly due to spacing and foliar application of zinc. Spacing of 40cm x 10cm spacing shows the highest number of branches/plant. It might be due to better utilization of minerals, nutrients, water, solar radiation etc. The observed increase in dry weight due to zinc might be due to biosynthesis of IAA growth hormones, cell enlargement, cell divison and multiplication which ultimately led to better leaf growth of sesame and boosted plant growth an early and plentiful availability of zinc leading to better nutritional environment in root zone for growth and development. Similar findings were also reported by Sharma and Jain (2003) [13] in mustard, Choudhary *et al.* (2010) [4] in sunflower and Murthy *et al.* (2011) [9] in sesame.

Table 1: Effect of Spacing and Foliar application of Zinc on growth parameters of Sesame

S. No	Treatment Combinations	Plant height (cm)	Dry matter accumulation (g/plant)
1	25 cm X 15 cm + ZnSo4 – 0.25%	117.83	13.47
2	25 cm X 15 cm + ZnSo4 – 0.50%	118.27	13.60
3	25 cm X 15 cm + ZnSo4 – 0.75%	118.37	13.97
4	35 cm X 15 cm + ZnSo4 – 0.25%	119.13	14.23
5	35 cm X 15 cm + ZnSo4 – 0.50%	119.73	14.43
6	35 cm X 15 cm + ZnSo4 – 0.75%	123.20	14.93
7	40 cm X 10 cm + ZnSo4 – 0.25%	122.50	14.67
8	40 cm X 10 cm + ZnSo4 – 0.50%	124.60	15.33
9	40 cm X 10 cm + ZnSo4 – 0.75%	125.73	15.57
	F test	S	S
	S.Em (±)	0.64	0.09
	CD (P -0.05)	1.92	0.26

Table 2: Effect of Spacing and Foliar application of Zinc on yield and yield attributing characters of Sesame

S. No	Treatment Combinations	No. of capsules/ plant	No. of seeds/ capsule	Seed Yield (t/ ha)	Stover Yield (t/ ha)
1	25 cm X 15 cm + ZnSo4 – 0.25%	42.60	53.60	1.04	2.44
2	25 cm X 15 cm + ZnSo4 – 0.50%	44.40	54.53	1.06	2.47
3	25 cm X 15 cm + ZnSo4 – 0.75%	47.67	54.93	1.09	2.49
4	35 cm X 15 cm + ZnSo4 – 0.25%	45.60	56.43	1.11	2.50
5	35 cm X 15 cm + ZnSo4 – 0.50%	48.07	56.83	1.12	2.52
6	35 cm X 15 cm + ZnSo4 – 0.75%	51.47	57.30	1.17	2.54
7	40 cm X 10 cm + ZnSo4 – 0.25%	49.53	58.60	1.14	2.51
8	40 cm X 10 cm + ZnSo4 – 0.50%	53.87	59.37	1.19	2.56
9	40 cm X 10 cm + ZnSo4 – 0.75%	54.60	60.50	1.20	2.57
	F test	S	S	S	S
	S.Em (±)	0.60	0.66	0.01	0.01
	CD (P- 0.05)	1.77	1.95	0.03	0.03

Yield and yield attributes

Number of Capsules/plant

Significant effect was observed by the statistical analysis of number of capsules/plant. Treatment 40 cm X 10 cm + ZnSo4 – 0.75% recorded significant and highest number of capsules/plant (54.60). However, treatment 40 cm X 10 cm + ZnSo4 – 0.50% was found to be statistically onpar with 40 cm X 10 cm + ZnSo4 – 0.75%. The yield attributing characters such as number of capsules/plant was significantly higher with wider spacing. It may be due to less competition exerted for light, moisture and nutrients. Sufficient interception of sunlight promotes efficient photosynthesis activities and ultimately greater accumulation of photosynthates under wider spacing. Narrow spacing with dense plant population resulted in the lower values of yield attributes. The increase in number of capsules/plant due to zinc might be due to adequate supply of zinc during early growth is considered important in promoting vegetative growth by influencing cell division and elongation in meristematic cell, thereby increasing the sink in terms in of number of capsules/plant. Similar results were also reported by Kumar *et al.* (2011) [11], Yadav *et al.* (2007) [16], Shekh *et al.* (2014) [14] and Patel (2012) [11].

Number of Seeds/capsule

Significant effect was observed by the statistical analysis of number of seeds per capsule. Treatment 40 cm X 10 cm + ZnSo4 – 0.75% recorded significant and highest number of seeds/capsule (60.50). However, 40 cm X 10 cm + ZnSo4 – 0.50% recorded statistical parity with 40 cm X 10 cm + ZnSo4 – 0.75%. The yield attributing characters such as number of seeds/capsule were significantly higher with wider spacing. It may be due to less competition exerted for light, moisture and nutrients. Sufficient interception of sunlight promotes efficient photosynthesis activities and ultimately greater accumulation of photosynthates under wider spacing. Narrow spacing with dense plant population resulted in the lowervalues of yield attributes. The increase in number of seeds/capsule due to zinc might be due to adequate supply of zinc during early growth is considered important in promoting vegetative growth by influencing cell division and elongation in meristematic cell, thereby increasing the sink in terms in of number of seeds/capsule. Similar results were also reported by Kumar *et al.* (2011) [11], Yadav *et al.* (2007) [16], Shekh *et al.* (2014) [14] and Patel (2012) [11].

Grain yield

Grain yield was significantly influenced with different combinations of Spacing and Foliar application of zinc with Nitrogen, Phosphorus and Potassium The highest grain yield was obtained with the treatment 40 cm X 10 cm + ZnSo4 – 0.75% (1.20 t), however 35 cm X 15 cm +ZnSo4 – 0.75% and 40 cm X 10 cm + ZnSo4 – 0.50% were found to be statistically on par with 40 cm X 10 cm + ZnSo4 – 0.75%. The grain yield of sesame increased significantly with increase in spacing and zinc. The grain yield of sesame increased significantly with increase in spacing and the level of applied foliar zinc up to 0.75%. Increase in spacing resulted due to better utilization of available resources *viz.* mineral, nutrients, water, solar radiation etc. and the optimum plant population due to higher yield of crop. The positive effect of zinc on seed yield might have been due to its requirement in carbohydrate synthesis, the pronounced role in photosynthesis and cell elongation. The increase in yield attributes and yield due to the application of Zn might be due to fact that Zn influences on the water economy and crop growth through its effect on water uptake, root growth, maintenance of turgor, transpiration and stomatal behavior, overcomes the adverse effect of water stress and improving the drought tolerance. Similar results were also reported by Kumar *et al.* (2011) [11], Paraye *et al.* (2009) [10], Deosarkar *et al.* (2001) [5] in soybean. Higher seed yield and stover yield due to spacing 40cm x 10cm spacing mightbe due to availability of larger feeding area for better utilisation of natural resources like space, sunlight, water, nutrients etc. This is in agreement with the findings of Shinde *et al.* (2011) [15].

Stover yield

Highest stover yield (2.57 t/ha) was recorded 40 cm X 10 cm + ZnSo4 – 0.75%, However, 35 cm X 15 cm + ZnSo4 – 0.75% and 40 cm X 10 cm + ZnSo4 – 0.50% were found to be statistically on par with 40 cm X 10 cm + ZnSo4 – 0.75%. The stover yield of sesame increased significantly with increase in spacing and the level of applied foliar zinc. The stover yield of sesame increased significantly with increase in spacing and the level of applied foliar zinc up to 0.75%. Increase in spacing resulted due to better utilization of available resources *viz.* mineral, nutrients, water, solar radiation etc. and the optimum plant population due to higher yield of crop. The positive effect of zinc on stover yield might have been due to its requirement in carbohydrate synthesis, the pronounced role in photosynthesis and cell elongation. The increase in yield attributes and yield due to the application of Zn might be due to fact that Zn influences on the water economy and crop growth through its effect on water uptake, root growth, maintenance of turgor, transpiration and stomatal behavior, overcomes the adverse effect of water stress and improving the drought tolerance. Similar results were also reported by Kumar *et al.* (2011) [11], Paraye *et al.* (2009) [10], Deosarkar *et al.* (2001) [5] in soybean.

Conclusion

Treatment (T9) 40 cm X 10 cm + ZnSo4 – 0.75% recorded maximum in all growth parameters and yield attributes, and also recorded highest grain yield (1.20 t/ha). These findings of the present study is based on research done in one season it may be repeated further for confirmation and recommendation.

Acknowledgements

I express my gratitude to my advisor Dr. RAJESH SINGH for constant support, guidance and for his valuable suggestions for improving the quality of this work. I am indebted to Dr. Umesha C. who has been a constant source of inspiration and all the faculty members of Department of Agronomy, SHUATS, Prayagraj, Uttar Pradesh (U.P), India for providing necessary facilities, for their cooperation, encouragement and support.

References

1. Bedigian D, Vander Maesen LJG. Slimy leaves and oily seeds; Distribution and Use of Sesamum spp. And *Ceratotheca sesamoides* (Pedaliaceae) in Africa. International Workshop, Nairobi, Prota Foundation Wageningen, the Netherlands, 2003, 271-274.
2. Brar ZS, Bal DS, John AS. Influences of sowing dates, nitrogen and planting geometry on the performance of Gobhi Saron (*Brassica napus spp.* Olifera var. Annua). Indian J Agron. 1998;43(1):133-137.
3. Cakmak I, Marschner H. Increase in membrane permeability and exudation of roots of zinc deficient plants. Journal of Plant physiology. 1998;132:356-361.
4. Choudhary AR, Prabhakara S, Nagarathna TK. Growth and yield of sunflower (*Helianthus annuus* L.) as influenced by micronutrients application in Alfisols. Karnataka Journal of Agricultural Sciences. 2010;23:495-496.
5. Deosarkar DB, Patinge SP, Bhosale AM, Deshmukh SB. Effect of micronutrient on seed yield of soybean. Annals of Plant Physiology. 2001;15:163-166.
6. Gomez KA, Gomez AA. Statistical Procedures for Agricultural Research. Edition 2.Wiely Inter Science Publications and John Willy and Sons, New York, 1984.

7. Kumar S, Tewari SK, Singh SS. Effect of sources and levels of sulphur and spacing on the growth, yield and quality of spring sunflower (*Helianthus annuus*). Indian Journal of Agronomy. 2011;56(3):242–246.
8. Mahesh H, Sharma D, Babu B. Influence of micronutrient spraying on different stages of castor. Journal of Oilseeds Research. 2003;17:146-148.
9. Murthy IYLN. Zinc response to oilseed crops. Indian Journal of fertilisers. 2011;7(10):104-117.
10. Paraye PM, Kashyap TL, Chaubey AK. Effect of nutrient management practices and rowspacing on growth yield attributes and yield of Indian mustard (*Brassica juncea* L.). Environment and Ecology. 2009;27(2):589–591.
11. Patel HK. Response of summer sesame to different spacing's and levels of nitrogen under north Gujarat condition. Thesis submitted to S.D.A.U., Gujarat, 2012.
12. Salunkhe DK, Chavan JK, Adsule RN, Kadam SS. World oilseeds: chemistry, technology, and utilization. New York: Van Nostrand. Reinhold, 1992.
13. Sharma PP, Jain NK. Effect of foliar sprays of agrochemicals on growth and yield of Indian mustard (*Brassica juncea* L.). Indian Journal of Agricultural Sciences. 2003;73:381-383.
14. Shekh MA, Mathukia RK, Sagarka BK. Sowing Time and Spacing for summer Sesame (*Sesamum indicum* L.) Agriculture; Towards a New Paradigm of Sustainability, 2014, 111-115.
15. Shinde SD, Raskar BS, Tamboili BD. Effect of spacing and sulphur levels on productivity of sesame (*Sesamum indicum* L.) under summer condition. Journal of Maharashtra Agriculture University. 2011;36(1):28-31.
16. Yadav RA, Mishra A, Singh D. Response of sesame cultivars under various plant spacing and seed rates. Plant Archives. 2007;7(1):287-288.