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Effect of Spacing and Manganese on Growth and Yield of Sesame (*Sesamum Indicum* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A research trail was conducted during Z*aid* season (2022) at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P.). To study the effect of spacing and manganese on the growth and yield of sesame. The Treatments consist of 3 levels of spacing (30 ×10 cm, 40×10 cm, 50 ×10 cm)and three levels of manganese (1.5,3.0,4.5kg/ha) are included respectively. The experiment was laid out in Randomized Block Design with 10 treatments and replicated thrice. The results showed that spacing of 50×10cm+ $Mnso_4$ 4.5kg/ha (Treatment-9) Plant height (87.66 cm), Number of branches/plant (6.27), plant dry weight (15.74 g/plant), number of capsules per plant (52.47), number of seeds per capsules (74.50), test weight (3.37 g), seed yield (1.19 t/ha), straw yield (2.67 t/ha) and Biological yield (3.6t/ha).

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1. INTRODUCTION

Sesame *(Sesamum indicum L.)* is the most important oil crop and it belongs to the family Pedaliaceae sesame a self pollinated crop, better known as "Queen of oil seed crop". Indian climate is most suitable for the cultivation of oil seed crops by high caliber of its incredible quality [1] India is the major producer of sesame and ranks area (1.78Mha) and production (0.81Mt/ha) first. Among all the oil seed crops, sesame has the highest oil, protein contents and carbohydrates (Raja et al., 2007) "Sesame crop thrives best on moderately fertile, well - drained soils Ph range. Sesame oil has 85% unsaturated fatty acid". (Nirav parimal et al.,). Gujarat is largest producer of sesame followed by west bengal, Maharashtra, Rajasthan, Tamilnadu, and karnataka. Spacing is the most important component in intensive farming sesame seeds provides excellent food, nutrition, edible oil [2]. Proper spacing should be maintained for increasing yield and it also provides satisfactory absorption of nutrients, sufficient light interaction and also spacing avoids intra-species competition. From all cultural practices, row spacing is the most important component [3,4]. Optimum plant spacing enables the sesame plant to grow properly both in its aerial and underground parts by utilizing maximum radiant energy to boost crop production [5]. "Application of Manganese improves plant growth and development and sustains metabolic role with different plant cell compartments and it is essential to photosynthesis reactions, an enzyme activation. And also it has much importance in N metabolism and Co_2 assimilation and regulates nitrate reductase" [6,7]. (Tisdale, et al.,) By applying manganese seed yield can be increased (Krishasamy et al *.,* 1994) manganese deficiency leads to an accumulation of No-N in plant tissue and is essential for splitting water molecules during photosynthesis [8]. Manganese is a very important essential micro nutrient for improving growth and development [9-11]. Keeping these points in view the present experiment was conducted to assess the effect of spacing and manganese nutrients on crop physiology.

2. MATERIALS AND METHODS

The experiment was conducted during the *Zaid* season of 2022. The experiment was conducted in a Randomized Block Design consisting of 10 treatment combinations with three replications and was laid out with the different treatments allocated randomly in each replication. The soil of the experimental field was sandy loam in texture, slightly alkaline reaction (pH 7.1) with a low level of organic carbon (0.28%), available N (225 Kg/ha), P (19.50 kg/ha) and a higher level of K (92.00 kg/ha). The treatment combinations are T_1 - 30×10 cm + $Mnso_4$ 1.5 kg/ha, T_2 - 40×10 cm + $Mnso_4$ 1.5 kg/ha, T_3 - 50×10 cm + $Mnso_4$ 1.5 kg/ha, T_4 - 30×10cm + $Mnso_4$ 3.0 kg/ha, T_5 - 40×10 cm+ $Mnso_4$ 3.0kg/ha, T_6 - 50×10 cm+ $Mnso_4$ 3.0kg /ha, T_7 - 30×10 cm + $Mnso_4$ 4.5 kg/ha, T_8 - 40×10 cm+ $Mnso_4$ 4.5 kg/ha, T_9 - 50× 10cm + $Mnso_4$ 4.5 Kg/ha, T_{10} - Control (RDF). "The observations were recorded on different growth parameters at harvest viz. plant height(cm), number of branches per plant, plant dry weight, Number of capsules per plant, number of seeds per capsule, test weight, seed yield, and stover yield" [12].

3. RESULTS AND DISCUSSION

3.1 Growth Attributes

At 75 DAS, maximum plant height (87.66 cm) was recorded in treatment No.9 with the application of 50×10 cm + $Mnso_4$ 4.5 Kg/ha which was significantly superior over all other treatments and treatment with the application of 50×10 cm + $Mnso_4$ 3.0 kg/ha (84.33cm) is statistically at par with treatment application of 50× 10cm + $Mnso_4$ 4.5 kg/ha. At 75DAS, the highest branches per plant were observed in the with 50×10 cm + $Mnso_4$ 4.5 kg/ha (6.27) which was significantly higher over the rest of the treatments and treatment with the application of 50× 10cm + $Mnso_4$ 3.0 kg/ha (6.10) which were statistically at par with application of with 50×10cm + $Mnso_4$ 4.5 kg/ha. At 75 DAS, maximum plant dry weight (15.740g) was recorded with the application 50×10 cm+ $Mnso_4$ 4.5 kg/ha which was significantly superior over all other treatments and treatment with the application of 50×10 cm+ $Mnso_4$ 3.0 kg/ha. (15.64 g) is statistically at par with Treatment(T_9) with the application of 50×10 cm+ $Mnso_4$ 4.5 kg/ha [13].

3.2 Yield Attributes

Treatment with the application of 50×10 cm + $Mnso_4$ 4.5 Kg/ha was recorded a maximum number of capsules per plant (52.47) which was

Table 1. Effect of spacing and manganese levels on growth attributes of sesame

Treatments	Plant height (cm) 60 DAS	Number of branches per plant At 60 DAS	Plant dry weight (g/hill) At 60DAS
30×10 cm + $Mnso_4$ 1.5 kg/ha	68.6	4.00	11.46
40×10 cm+ $Mnso_4$ 1.5 kg/ha	69.03	3.80	11.86
50×10 cm+ $Mnso_4$ 1.5 kg/ha	70.63	3.93	12.15
30×10 cm + $Mnso_4$ 3.0 kg/ha	68.76	3.85	11.56
40×10 cm + $Mnso_4$ 3.0 kg/ha	69.23	4.03	11.96
50×10 cm + $Mnso_4$ 3.0 kg/ha	71.4	4.23	12.28
30× 10cm + $Mnso_4$ 4.5 kg/ha	68.9	4.20	11.65
40× 10cm + $Mnso_4$ 4.5 kg/ha	69.33	4.17	12.08
50×10 cm + $Mnso_4$ 4.5 Kg/ha	72.16	4.47	12.37
Control (RDF)	68.0	3.97	11.35
SEm(±)	0.27	0.11	0.04
CD (p=0.05)	0.82	0.34	0.12

Table 2. Effect of spacing and manganese levels on yield attributes and yield of sesame

Treatments	No. of capsules per plant	No. of seeds per capsule	Test weight (g)	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)
30×10 cm + $Mnso_4$ 1.5 kg/ha	47.03	68.87	2.10	1.00	2.54	29.37
40 ×10cm+ $Mnso_4$ 1.5 kg/ha	45.17	69.10	2.63	1.04	2.57	28.80
50×10cm+ $Mnso_4$ 1.5 kg/ha	46.77	72.67	3.07	1.07	2.59	29.23
30×10cm + $Mnso_4$ 3.0 kg/ha	46.47	68.17	2.40	1.10	2.60	29.72
40 ×10cm + $Mnso_4$ 3.0 kg/ha	45.27	72.60	2.77	1.11	2.62	29.75
50×10 cm + $Mnso_4$ 3.0 kg /ha	50.53	74.43	3.20	1.17	2.64	30.70
30×10 cm + $Mnso_4$4. 5 kg/ha	47.60	73.07	2.43	1.13	2.61	30.21
40 ×10cm + $Mnso_4$ 4.5 kg/ha	48.40	72.07	2.90	1.16	2.66	30.36
50×10 cm + $Mnso_4$ 4.5 Kg/ha	52.47	74.50	3.37	1.19	2.67	30.82
Control (RDF)	46.97	65.03	2.07	0.90	2.50	26.47
SEm (±)	1.02	1.75	0.09	0.04	0.01	0.02
CD (5%)	3.05	5.22	0.28	0.14	0.03	0.06

significantly superior over all other and treatment with the application of 50×10 cm +Mnso$_4$ 3.0 Kg/ha (50.53) which was statistically at par with the treatment with the application of 50×10 cm + Mnso$_4$ 4.5 Kg/ha. Treatment with the application of 50×10 cm + Mnso$_4$ 4.5 Kg/ha was recorded a maximum number of seeds per capsules (74.50) which was significantly superior over all other and treatment with the application of 30×10 cm + Mnso$_4$ 4.5 Kg/ha (73.07) and 50×10m + Mnso$_4$ 1.5 Kg/ha (72.67) which was statistically at par with the treatment with the application of 50× 10cm + Mnso$_4$ 4.5 Kg/ha.Treatment with the application of 50× 10cm+ Mnso$_4$ 4.5 Kg/ha was recorded maximum test weight (3.37g) which was significantly superior over all other and treatment with the application of 50×10 cm + Mnso$_4$ 3.0 Kg/ha (3.20) which was statistically at par with the treatment with the application of 50 ×10 cm + Mnso$_4$ 4.5 Kg/ha.Treatment with the application of 50× 10cm + Mnso$_4$ 4.5 Kg/ha was recorded maximum seed yield (1.19 t/ha) which was significantly superior over all other and treatment with the application of 40×10 cm + Mnso$_4$ 4.5 Kg/ha (1.16) which was statistically at par with the treatment with the application of 50×10 cm + Mnso$_4$ 4.5 Kg/ha. Treatment with application of 50×10 cm + Mnso$_4$ 4.5 Kg/ha was recorded a maximum stover yield (2.67t/ha) which was significantly superior over all other and treatment with the application of 50×10 cm + Mnso$_4$ 3.0 Kg/ha (2.66 t/ha) which was statistically at par with the treatment with the application of 50× cm + Mnso$_4$ 4.5 Kg/ha.

Treatment with the application of 50× 10 cm + Mnso$_4$ 4.5 Kg/ha was recorded maximum harvest index (30.82 %) and minimum with the application of 40×10 cm + Mnso$_4$ 4.5 kg/ha (30.36%) [14].

4. CONCLUSION

On the basis of one-season experimentation, it may be said that with the application of 50×10 cm + Mnso$_4$ 4.5 kg/ha was found more productive (1.19 t/ha) and economically viable.

The conclusions are based on data from a single season of research, so additional trials are required to confirm the findings.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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