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Effect of Levels and Sources of Sulphur on Growth and Yield Attributes of Sesamum (*Sesamum indicum* L.) under Rainfed Condition of Nagaland

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ABSTRACT

Background: Sulphur is an important component of plant amino acids, proteins, vitamins as well as enzyme structures which influence the productivity, quality of oil seed and its total oil content. The current study was undertaken to evaluate the role of sulphur and its proper fertilization for better growth, yield and quality of sesamum crop.

Methods: The field experiment was laid out in randomized block design (RBD) with three replications and ten treatments *viz*; T_1 (control), T_2 (10 kg gypsum ha^{-1}), T_3 (20 kg gypsum ha^{-1}), T_4 (30 kg gypsum ha^{-1}), T_5 (40 kg gypsum ha^{-1}), T_6 (control), T_7 (10 kg elemental sulphur ha^{-1}), T_8 (20 kg elemental sulphur ha^{-1}), T_9 (30 kg elemental sulphur ha^{-1}) and T_{10} (40 kg elemental sulphur ha^{-1}).

Result: From all the treatments, T_{10} (40 kg elemental sulphur ha^{-1}) recorded the highest plant height (cm), plant dry weight (g plant^{-1}), crop growth rate (g m^{-2} day^{-1}), number of capsule plant^{-1}, length of capsule (cm), number of seed capsule^{-1}, stover yield (kg ha^{-1}), seed yield (kg ha^{-1}) and harvest index (%).

Key words: Growth, Seed yield, Sesamum, Stover yield, Sulphur, Yield attributes.

INTRODUCTION

Sesamum is known by different names such as simsim, sesame, biniseed, gingly, till and gargelim and is also called as the “Queen of Oilseeds”. Sesamum has the highest oil content (46-64%) among the oilseed crops with 25% protein. Sulphur is an important component of plant amino acids, proteins, vitamins as well as enzyme structures which influence the productivity, quality of oil seed and total oil content. Oilseed crops are especially sensitive to sulphur deficiency because their demand for sulphur is quite high and produces seeds with a high yield of protein with relatively large quantities of sulphur containing amino acids (Zhao *et al.*, 1997). Among all the sulphur supplying sources, gypsum and elemental sulphur are most abundantly used in sulphur deficient soils. The response of sesamum to sulphur fertilization for the production of higher yield was up to 40 kg S ha^{-1} (Nagavani *et al.,* 2001 and Kathiresan, 2002). Therefore, this study was undertaken to realize the importance of sulphur and its proper fertilization for better growth, yield and quality of sesamum crop.

MATERIALS AND METHODS

A field experiment was conducted at the experimental farm, Department of Agronomy, SASRD, Nagaland University, during the *Kharif* season of 2019 to study the effect of different levels and sources of sulphur on sesamum. The experiment was laid out in randomized block design (RBD) with three replications and ten treatments *viz*; T_1 (control), T_2 (10 kg gypsum ha^{-1}), T_3 (20 kg gypsum ha^{-1}), T_4 (30 kg gypsum ha^{-1}), T_5 (40 kg gypsum ha^{-1}), T_6 (control), T_7 (10 kg elemental sulphur ha^{-1}), T_8 (20 kg elemental sulphur ha^{-1}), T_9 (30 kg elemental sulphur ha^{-1}) and T_{10} (40 kg elemental sulphur ha^{-1}).

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The soil of the experimental farm was categorized as clayey loam. The recommended dose of N, P and K fertilizer (30 kg ha^{-1} urea, 60 kg ha^{-1} SSP and 30 kg ha^{-1} MOP) was applied as a single basal dose followed by the treatments as per *viz.*, (T_1- S_1L_0), (T_2 -S_1L_1), (T_3- S_1L_2), (T_4- S_1L_3), (T_5- S_1L_4), (T_6- S_2L_0), (T_7- S_2L_1), (T_8- S_2L_2), (T_9- S_2L_3) and (T_{10}- S_2L_4), where, T= Treatment, S_1= Gypsum, S_2= Elemental Sulphur, L_0= 0 kg ha^{-1}, L_1= 10 kg ha^{-1}, L_2= 20 kg ha^{-1}, L_3= 30 kg ha^{-1}, L_4= 40 kg ha^{-1}. The seeds were pre- treated with Bavistin @2g kg^{-1} of seed and sown manually in lines and then covered them with soil to make it favorable for germination. Seed were sown at the rate of 4 kg ha^{-1}.From each plot five plants were selected randomly for recording the observations on growth attributes of the crop. At harvest, yield data of grain and stover of sesamum was recorded.

RESULTS AND DISCUSSION

Growth attributes of sesamum

The crop growth attributes in terms of plant height (cm), leaf area index, plant dry weight (g plant^{-1}) and crop growth rate (g m^{-2} day^{-1}) were significant among different treatments (Table 1). The plant height was highest in T_{10} (40 kg Elemental sulphur ha^{-1}). Plant height was not influenced significantly by sources and levels of sulphur at 30 DAS which might have been due to the young age of the seedlings. At 60 DAS, the highest plant height was recorded by T_{10} (162.00 cm) and the lowest height (138.67 cm) was recorded by T_2. At 90 DAS, T_{10} showed the highest plant height whereas T_1 (control) showed the lowest plant height.

The sources and levels of sulphur were not found to influence significantly on LAI of sesamum. Significantly highest plant dry weight at 30, 60 and 90 DAS was recorded in T_{10}. The lowest plant dry weight at 30, 60 and 90 DAS was recorded in T_6 (control). The application of nutrients in higher amounts and source of sulphur (elemental sulphur) might have resulted in the highest accumulation of total dry matter. The crop growth rate (g m^{-2} day^{-1}) was recorded significantly highest in T_{10} at 60 DAS-harvest (Deshmukh *et al. 2010)*. At 30-60 DAS and 60-90 DAS, T_{10} recorded highest crop growth rate. The lowest CGR value was recorded at T_1 (control) followed by T_6 (control) respectively where no sulphur treatment was applied.

Yield attributes of sesamum

The yield attributes in terms of number of capsules plant^{-1}, number of seeds capsule^{-1}, length of capsule, seed yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index (%) were significant among the treatments (Table 2). T_{10} (89.33)

Table 1: Effect of sources and levels of sulphur on plant height (cm), leaf area index (LAI), plant dry weight (g plant^{-1}) and CGR (g m^{-2} day^{-1}) of sesamum.

Treatments	Plant height			Leaf area index			Plant dry weight			CGR	
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30-60 DAS	60-90 DAS
Sources											
S_1: Gypsum	54.61	149.89	153.88	0.20	0.75	0.77	1.98	9.66	35.24	6.40	21.78
S_2: Elemental Sulphur	53.63	153.73	156.85	0.21	0.77	0.79	2.16	10.80	38.93	7.08	23.54
SEm±	0.45	0.23	0.27	0.003	0.002	0.003	0.03	0.05	0.18	0.03	0.05
CD (p=0.05)	NS	1.38	1.65	NS	0.014	0.019	0.15	0.29	1.10	0.17	0.28
Levels											
L_0: 0 kg ha^{-1}	52.57	148.50	144.67	0.18	0.70	0.71	1.32	6.94	30.46	5.01	18.96
L_1: 10 kg ha^{-1}	52.47	141.17	153.83	0.19	0.72	0.74	1.93	9.07	36.21	5.92	21.28
L_2: 20 kg ha^{-1}	53.43	154.03	156.17	0.21	0.75	0.76	2.08	10.42	37.00	6.73	23.01
L_3: 30 kg ha^{-1}	57.10	156.03	158.33	0.23	0.79	0.83	2.38	12.05	39.57	7.65	24.47
L_4: 40 kg ha^{-1}	55.05	159.33	163.83	0.23	0.84	0.87	2.63	12.68	42.19	8.39	25.57
SEm±	1.14	0.46	0.53	0.003	0.007	0.008	0.03	0.18	0.29	0.09	0.20
CD (p=0.05)	NS	1.37	1.59	0.010	0.021	0.023	0.10	0.53	0.86	0.26	0.60

Note: DAS = Days after sowing.

Table 2: Effect of sources and levels of sulphur on yield and yield attributes of sesamum.

Treatments	Number of capsules plant^{-1}	Length of capsule (cm)	Number of seeds capsule^{-1}	Test weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Sources							
S_1: Gypsum	77.20	2.34	61.07	2.59	438.01	1807.84	18.36
S_2: Elemental Sulphur	80.87	2.52	65.73	2.65	498.47	1949.30	19.64
SEm±	0.52	0.01	0.25	0.03	9.13	17.82	0.14
CD (p=0.05)	3.16	0.04	1.52	NS	55.58	108.43	0.85
Levels							
L_0: 0 kg ha^{-1}	65.33	2.02	58.00	2.41	325.22	1271.71	14.50
L_1: 10 kg ha^{-1}	73.83	2.34	62.00	2.54	435.83	1803.61	18.06
L_2: 20 kg ha^{-1}	82.33	2.48	63.33	2.63	480.47	1972.30	20.18
L_3: 30 kg ha^{-1}	85.67	2.56	65.67	2.71	519.49	2091.50	20.87
L_4: 40 kg ha^{-1}	88.00	2.77	68.00	2.81	580.20	2253.73	21.38
SEm±	0.48	0.01	0.54	0.11	7.03	21.69	0.36
CD (p=0.05)	1.43	0.04	1.63	NS	21.06	65.02	1.09

Note: NS = Non-significant at 5% level of significance.

recorded the highest number of capsule plant^{-1} which was followed by T_9 (87.33) and were statistically at par. However T_1 (control) recorded the lowest number of capsule plant^{-1} (62.00). The data on length of capsule as affected by different treatments showed that the longest capsule was recorded in T_{10} (2.86 cm), while the shortest capsule (1.90) was recorded at T_1 (control). Application of elemental sulphur at increased levels gave a superior result. The highest number of seeds capsule^{-1} was recorded in T_{10} (70.67) while the lowest number of seeds capsule^{-1} was recorded at T_1 (control) [57.33] which were statistically at par with T_6 (control) [58.67]. The variation in the different levels and sources of sulphur application did not give any significant effect on test weight of sesamum. The seed and stover yield reductions were observed more with T_1 (control) over other treatments (315.04 and 1222.44 kg ha^{-1} respectively).

The stover yield and seed yield was found to be highest in T_{10} (40 kg elemental sulphur ha^{-1}) with 2338.5 kg ha^{-1} and 623.36 kg ha^{-1} respectively. The harvest index was found to be maximum in T_{10} (40 kg elemental sulphur ha^{-1}) which was statistically at par with T_9 (30 kg elemental sulphur ha^{-1}) and T_1 (control) with 12.75% recorded the lowest.

CONCLUSION

From the above result, it can be concluded that the treatment T_{10} (40 kg elemental sulphur ha^{-1}) recorded the highest in plant height, plant dry weight (g plant^{-1}), CGR (g m^{-2} day^{-1}), number of capsules plant^{-1}, number of seed capsule^{-1}, length of capsule, seed yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index (%). The present study showed that elemental sulphur is a better source of sulphur as compared to gypsum under rainfed condition of Nagaland and that sesamum yield also increases with increased level of sulphur application upto 40 kg ha^{-1}.

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