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GROWTH, YIELD AND QUALITY OF SUMMER SESAME AS INFLUENCED BY THE FERTILIZER AND SULPHUR LEVELS

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ABSTRACT

An experiment was conducted at Agriculture College, Nagpur during *summer* season of 2011-2012. The experiment was laid out in split plot design with three fertilizer levels as main plot treatments viz., 100% RDF, 125% RDF, 150% RDF and five sulphur levels as subplot treatments viz., 0 kg S ha^{-1}, 10 kg S ha^{-1}, 20 kg S ha^{-1}, 30 kg S ha^{-1} and 40 kg S ha^{-1}. There were fifteen treatment combinations replicated three times. The soil was clayey in texture with pH 7.76 indicating slightly alkaline in reaction.Treatment 150% RDF recorded maximum and significantly higher plant height, number of branches plant^{-1}, dry matter accumulation plant^{-1}, number of capsules plant^{-1} (80.7), number of grains capsule^{-1} and seed yield plant^{-1}. Test weight was not influenced significantly. Seed yield (kg ha^{-1}) were also significantly more due to 150% RDF over 100% RDF but 125% RDF was at par with it. Oil content (%) and oil yield (kg ha^{-1}) were also significantly more due to 150% RDF over 100% RDF but 125% RDF was at par with it.

The plant height, number of branches plant^{-1} was not significantly influenced by sulphur application. Dry matter accumulation recorded highest due to 40 kg S ha^{-1} application and was at par with 30 kg S ha^{-1} and 20 kg S ha^{-1}. Application of 40 kg S ha^{-1} recorded maximum and significantly higher number of capsules plant^{-1}, number of grains capsule^{-1} and seed yield plant^{-1}. Test weight was not influenced significantly. Seed yield (kg ha^{-1}) was recorded maximum in 40 kg S ha^{-1} (471 kg ha^{-1}) and was at par with 30 kg S ha^{-1} (465 kg ha^{-1}). Oil content (%) and oil yield (kg ha^{-1}) were also significantly more due to application of 40 kg S ha^{-1} over control and 10 kg S ha^{-1}. But application of 20 kg S ha^{-1} and 30 kg S ha^{-1} were found at par with 40 kg S ha^{-1}.

Interaction effects of fertilizer levels with sulphur were found to be not significant in respect of all growth characters, yield attributes and yield of sesame.

(Key words ; Fertilizer, growth attributes, oil content, sulphur)

INTRODUCTION

Sesame (*Sesamum indicum* L.) is an important oilseed crop in the tropics as major source of high quality, unique edible oil and thus occupies premier place in farming system. India ranks first in area (29%), production (26%) and export (40%) of sesame in the world. Adoption of improved varieties and suitable crop management practices are important factors for improving crop productivity. Intensive crop cultivation requires the use of chemical fertilizers, which are not only very short in supply, but they are expensive in developing country like India. The farmers usually apply nitrogen and phosphorus in limited quantity but not potassium and sulphur. The availability of sulphur is not able to fulfill the crop requirements which reflect in poor performance of the crop. In view of the importance of fertilizer application along with sulphur in sesame cultivation, the experiment was planned with the objectives to study the effect of fertilizer and sulphur levels on growth, yield and quality of sesame.

MATERIALS AND METHODS

A field experiment was conducted at Agronomy Farm, College of Agriculture, Nagpur during *summer* season of 2011-2012. The experiment was laid out in split plot design with three fertilizer levels viz.,100% RDF (25:25:0 kg NPK ha^{-1}), 125% RDF (31.25: 31.25:0 kg NPK ha^{-1}) and 150% RDF (37.5: 37.5:0 kg NPK ha^{-1}) as main plot treatments and five sulphur levels 0 (Control), 10, 20, 30, 40 kg S ha^{-1} as subplot treatments with 15 treatment combinations replicated three times. The soil of experimental plot was low in available nitrogen (263.60 kg ha^{-1}), low in available phosphorus (20.32 kg ha^{-1}) and organic carbon (0.52 %), very high in available potassium (414.42 kg ha^{-1}) as regards to fertility status and neutral in reaction (pH 7.76). The soil of the experiment field was clayey in texture. In general, available sulphur below 10 mg kg^{-1} is said to be deficient and between 10 – 20 mg kg^{-1} said to be medium and above 20 mg kg^{-1} it is sufficient. The soil of experimental plot was deficient in available sulphur (6.02 mg kg^{-1}). During the growing season of crop the maximum temperature varied from 27.0°C to 42.1°C and minimum temperature ranged from 11.5°C to 27.7 °C. The relative humidity at morning varied from 21 to 39% where as it was 10 to 41% in evening during the period of crop season.

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The crop variety AKT–101 was used with spacing of 30 cm × 10 cm. Gross plot size was 3.60 m × 4.80 m and net plot size was 2.40 m × 3.60 m. The observations were taken in respect of plant height, number of branches plant^{-1} and total dry matter accumulation plant^{-1} (g). At the time of harvesting number of capsules plant^{-1}, number of seeds capsule^{-1}, seed yield plant^{-1} (g), test weight plant^{-1} (g), seed yield (kg ha^{-1}), stover yield (kg ha^{-1}), oil content (%) and oil yield (kg ha^{-1}) were also recorded. The harvest index was also calculated. In order to represent the plot, five plants of sesame from each net plot in every net plot were selected randomly for various biometric observations on growth and post harvest studies. The selected five plants were labeled and all biometric observations were recorded properly on them. For the observation on dry matter accumulation plant^{-1}, two representative plants from each net plot were selected and used for the observation. Oil content in seed was estimated with nuclear magnetic resonance (NMR) spectrometer and the oil yield ha^{-1} was worked out by multiplying with oil content.

RESULTS AND DISCUSSION

Effect on growth attributes :

The data pertaining to various growth attributes studied viz., mean plant height at harvest, mean number of branches plant^{-1} and mean dry matter plant^{-1} as influenced by various treatments are presented in table 1.

Effect of fertilizer levels :

The plant height at harvest was maximum and significantly more due to application of 150% RDF (37.5:37.5:0 NPK kg ha^{-1}) over 125% RDF and 100% RDF. Higher levels of nutrients might be involved in increasing number and size of cell, which ultimately increased plant height. Similar results were also obtained by Kathiresan and Dharmalingam (1999) who reported the highest plant height due to 150% RDF which was significantly higher than its lower level.

Application of 150% RDF recorded maximum number of branches plant^{-1} and was significantly superior over 125% RDF and 100% RDF. Increase in number of branches plant^{-1} was observed with the increase in fertilizer levels, which might be due to more availability of nutrients. Similar results were obtained by Purushotham *et al*. (2009) who reported that, application of 40 kg N ha^{-1} is beneficial in getting higher number of branches in sesame.

Application of 150% RDF significantly increased the total dry matter accumulation plant^{-1} over 125% RDF and 100% RDF. The increase in dry matter production might be due to more photosynthesis which might be due to more nutrient availability. The data in our present research was also supported by Kathiresan and Dharmalingam (1999) who also reported the highest dry matter production of sesame due to 150% RDF which was significantly higher than its lower level.

Effect of sulphur levels :

Application of 40 kg S ha^{-1} produced maximum number of branches and more plant height but these parameters were not significantly influenced by sulphur levels. This might be due to the fact that sulphur do not have role in producing branches.

Maximum dry matter accumulation was recorded in treatment 40 kg S ha^{-1} which was significantly superior over other treatments but 20 kg S ha^{-1} and 30 kg S ha^{-1} were found at par with this treatment. This might be due to application of sulphur improved the physiological parameters viz., crop growth rate, biomass production contributing towards stronger reproductive phase resulting into more dry matter production. The results are in line with the findings of Daury and Mandal (2005) who reported the maximum plant height in sesame due to the application of 40 kg sulphur ha^{-1}.

Interaction effect :

The interaction effect due to fertilizer and sulphur on plant height, mean number of branches plant^{-1} and mean dry matter plant^{-1} were found to be non significant.

Yield attributes :

The data pertaining to various yield attributes studied viz., number of capsules plant^{-1}, number of seeds capsule^{-1}, test weight (g) and seed yield plant^{-1} as influenced by various treatments are presented in table 1.

Effect of fertilizer levels :

Fertilizer levels influenced the number of capsules plant^{-1} significantly. Maximum number of capsules plant^{-1} were recorded in 150% RDF which was significantly superior over 100% RDF and 125% RDF. Maximum number of grains capsule^{-1} was recorded in 150% RDF which was significantly superior over 100% RDF and 125% RDF. The findings are close accordance with Singh *et al.* (2006) who also recorded more number of seeds capsule^{-1} due to 150% RDF. Test weight was not significantly influenced by fertilizer levels. Test weight was maximum in 150% RDF which was followed by 125% RDF and 100% RDF. Seed yield plant^{-1} was maximum in 150%RDF which was significantly superior over 100%RDF and at par with 125%RDF. Similar observations were recorded by Purushotham *et al.* (2009) who also observed that application of 150% RDF increased the yield in seasmum.

Effect of sulphur levels :

The 40 kg S ha^{-1} application recorded significantly higher number of capsules plant^{-1} (78.83) than control and 10 kg S ha^{-1} but was at par with 30 kg S ha^{-1} and 20 kg S ha^{-1}. The treatment 40 kg S ha^{-1} recorded maximum and significantly higher number of grains capsule^{-1} (49.62) over all other levels. Same treatment recorded higher test weight (3.04 g) but results were non significant. Seed yield (g plant^{-1}) was maximum due to 40 kg S ha^{-1} followed by 30 Kg S ha^{-1} and 20 kg S ha^{-1}. Increase in yield attributing characters and yield could be attributed to the overall improvement in growth and vigor with S application. Subrahmaniyam *et al.* (1999) also found that application of sulphur applied at the rate of 35 kg ha^{-1} with FYM at the rate of 5 t ha^{-1} recorded the maximum and significantly increased number of capsules plant^{-1} and seed yield in summer sesame. Nagavani *et al. (*2001) reported that S at 40 kg ha^{-1} had a profound influence on yield components viz., number of capsules plant^{-1}, number of seeds capsule^{-1}, test weight, seed and oil yield of sesame which support the present findings.

Interaction effect:

Interaction effects were found non-significant.

Seed yield, Stover yield (kg ha^{-1}) and harvest index (%) :

Data regarding mean seed and stover yield (kg ha^{-1}) and harvest index (%) as influenced by different treatments are presented in table 1.

Effect of fertilizer levels :

Seed yield (kg ha^{-1}) was significantly influenced by fertilizer levels. Seed yield (kg ha^{-1}) was maximum in 150%RDF and was significantly superior over 100%RDF and was at par with 125% RDF. Similar results were found by Purushotham *et al.* (2009) who found that application of 40 kg N in the form of urea was beneficial in getting higher yield in sesame. While Throve *et al.* (2011) reported that, the grain yield was increased significantly with every successive increase in the level of fertility and was the highest with 37.5 kg N ha^{-1} + 18.5 P_2O_5 ha^{-1} which was 39.3 per cent higher than control in sesame. Also Narkhede *et al.* (2001) revealed that, application of NPK (40:30:20 kg ha^{-1}) in combination with farmyard manure produced significantly higher grain yield of sesame. Stover yield (kg ha^{-1}) was significantly influenced by fertilizer level. Stover yield (kg ha^{-1}) was maximum in 150% RDF which was significantly superior over 100% RDF and at par with 125% RDF. Purushotham *et al.* (2009) also reported significantly more stover yield due to 150% RDF. Treatment 100% RDF gave highest harvest index (26.3%) followed by 125% RDF and 150% RDF.

Effect of sulphur levels :

Seed yield (kg ha^{-1}) was maximum in 40 kg S ha^{-1} which was significantly superior over other treatments but found at par with 30 kg S ha^{-1} and 20 kg S ha^{-1}. Supply of sulphur might have also promoted floral initiation, resulting in higher number of capsules plant^{-1}, number of seeds plant^{-1} and ultimately enhanced seed yield. The increase in seed yield may be attributed to stimulatory effect of applied sulphur on the synthesis of protein, which in turn might have accelerated photosynthesis, improved most of the yield contributing components which ultimately might have resulted in significantly higher seed yield. Subrahmaniyam *et al.* (1999) also found that application of sulphur applied at the rate of 35 kg ha^{-1} with FYM at the rate of 5 t ha^{-1} recorded the maximum and significantly increased seed yield in

Table 1. Growth, yield attributes , oil content and yield of sesame as influenced by the fertilizer and sulphur levels

Treatments	Growth attributes at harvest			Yield attributes				Yield		Harvest index (%)	Oil (%)	Oil yield (kg ha^{-1})
	Plant height (cm)	Number of branches plant^{-1}	Dry matter plant^{-1} (g)	No. of capsules plant^{-1}	No. of seeds capsule^{-1}	Test weight (g)	Seed yield plant^{-1}	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})			
Fertilizer levels												
F_1 - 100% RDF	109.1	4.16	23.3	60.96	39.26	2.81	3.66	430	1204	26.31	48.64	209.57
F_2 - 125% RDF	112.9	4.68	24.34	75.26	46.31	2.95	4.14	447	1313	25.43	48.78	218.55
F_3 - 150% RDF	119.5	5.03	26.17	80.70	51.92	2.99	4.53	463	1382	25.11	48.90	228.77
SE (m) ±	1.17	0.12	0.32	1.07	0.51	0.07	0.30	4.02	28.74	-	-	2.59
C D (P=0.05)	3.29	0.31	0.89	2.98	1.44	--	0.86	16.74	82.52	-	-	7.194
Sulphur levels												
S_0 - 0 kg S ha^{-1}	115.0	4.48	22. 5	62.63	40.66	2.75	3.73	415	1270	24.62	48.46	201.17
S_1 - 10 kg S ha^{-1}	116.0	4.56	23.24	66.81	43.75	2.84	3.98	431	1281	25.17	48.59	209.59
S_2 - 20 kg S ha^{-1}	117.8	4.60	24.16	75.86	47.09	2.95	4.12	453	1299	25.98	48.75	221.19
S_3 - 30 kg S ha^{-1}	118.0	4.65	26.71	77.40	48.08	2.99	4.28	465	1316	26.10	48.89	227.51
S_4 - 40 kg S ha^{-1}	118.2	4.83	26.41	78.83	49.62	3.05	4.43	471	1333	26.11	49.19	232.03
SE (m) ±	1.77	0.13	0.40	0.81	0.48	0.14	0.24	5.97	20.62	-	-	2.92
C D (P=0.05)	--	--	0.83	1.69	1.01	--	0.50	17.41	61.88	-	-	8.54
Interactions												
SE (m) ±	3.07	0.23	0.71	1.00	0.60	0.24	0.42	10.33	8.83	-	-	5.067
C D (P=0.05)	--	--	--	--	--	--	--	--	--	-	-	--

summer sesame. Similarly Duary and Mandal (2005) observed significant increase in seed yield of sesame due to 40 kg sulphur ha^{-1}. Stover yield (kg ha^{-1}) was maximum in 40 kg S ha^{-1} which was significantly superior over 10 kg S ha^{-1} but found at par with 30 kg S ha^{-1} and 20 kg S ha^{-1}. Application of S 40 kg ha^{-1} recorded highest harvest index (26.1) which was at par with 30 kg S ha^{-1}.

Interaction effect :

Interaction effects were not significant.

Quality studies(Oil content and oil yield) :

Data pertaining to the oil content and oil yield of summer sesame as influenced by different treatments are presented in table 1.

Effect of fertilizer levels :

Oil percentage and oil yield were significantly influenced by fertilizer levels. Maximum oil percentage and oil yield were obtained in 150% RDF which was significantly superior over 100% RDF and at par with 125% RDF. The increased seed yield was mainly responsible for increased oil yield. Kathiresan and Dharmalingam (1999) also reported significantly more oil yield with 150% RDF over 100% RDF in summer sesamum.

Effect of sulphur levels :

Sulphur levels influenced oil content whereas oil yield was significantly differed due to different treatments. Maximum oil yield (kg ha^{-1}) was recorded due to 40 kg ha^{-1} which was at par with 30 kg ha^{-1} and 20 kg ha^{-1} and significantly superior over treatment 10 kg ha^{-1} and control. Sulphur can be identified as a key element for increasing oil yield. The increase in oil content with sulphur application might be because of role of sulphur in oil synthesis as sulphur is constituent of amino acid that play a vital role in oil synthesis. Nagavani *et al. (*2001) also found that application of sulphur up to 40 kg ha^{-1} significantly increased the oil content of sesamum. Maragatham *et al*. (2006) reported that, application of 40 kg S ha^{-1} in sesame, increased seed oil content from 47.63 (control) to 49.83%.

Interaction effect:

Interaction effects between fertilizer levels and sulphur levels were found to be non-significant.

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