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PK Tijare
M.Sc Scholar, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi, Vidyapeeth, Rahuri, Ahmednagar, Ahmednagar, Maharashtra, India

SS Ilhe
Associate Professor, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi, Vidyapeeth, Rahuri, Ahmednagar, Ahmednagar, Maharashtra, India

VR Pusdekar
Assistant Professor, Agronomy Section, Dr. PDKV Akola, Anand Niketan College of Agriculture, Warora, Tah-Warora, Chandrapur, Maharashtra, India

Corresponding Author:
PK Tijare
M.Sc Scholar, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi, Vidyapeeth, Rahuri, Ahmednagar, Ahmednagar, Maharashtra, India

The result of sources of sulphur on growth of different sesame (*Sesamum indicum* L.) cultivars

PK Tijare, SS Ilhe and VR Pusdekar

Abstract
The experimental research was run on the field during summer season of 2019-20 at Post Graduate Institute Research Farm, MPKV, Rahuri, Ahmednagar (MS), to investigate the result of sources of sulphur on growth of different sesame (*Sesamum indicum* L.) cultivars. The FRBD was used to lay out the experiment with three replications. Total combinations of treatments are 12 which comprised of 4 sesamum cultivars (AKT-101, JLT-408, PT-1 & JLT-7) and 3 sources of sulphur (Bensulf, Elemental Sulphur & Single Super Phosphate). In respect of sesame cultivar, AKT-101 cultivar recorded significantly highest count of leaves plant^{-1}, leaf area plant^{-1}, count of branches plant^{-1}, days to 50% flowering and days to maturity but significantly maximum plant height was observed with cv. PT 1 of sesame as compared with all other treatments. Among the sources of sulphur, SSP recorded significantly higher plant height, count of leaves plant^{-1}, leaf area plant^{-1}, count of branches plant^{-1}, days to 50% flowering and days to maturity of sesame compared to all other treatments. Among the sesame cultivar, AKT-101 found significantly superior for growth of sesame and among the sulphur sources, application of SSP proved significantly superior for growth of sesame.

Keywords: Growth, sulphur, sesame, elemental sulphur, single super phosphate

Introduction
Sesamum (*Sesamum indicum* L.) belongs to genus Sesamsum and family Pedaliaceae. Seed of sesame is a source of food and oil. It is rich in oil content, some varieties contains more than 50% oil as compared to soybean which having 20% oil. Because of sesamin, sesamolin, and sesamol, the high level of natural antioxidants, it is one of the most stable vegetable oil. It has long shelf life. The sesame word is introduced from Latin word "sesamum" and also taken from Greek word "sesamon" meaning seed or fruit of the sesame plant. Its flowers are white and purple in colour. It is a tropical annual herb. It has several names such as til, sesame, benniseed, sisim, hawari, and gingelly and also called as "Queen of oilseeds".
Due to variation in temperature and day length the sesamum cultivars are highly sensitive. Use of convenient variety has a great impact on sesamum productivity. Therefore for commercial cultivation recommended varieties need to be season as well as location specific. The seed and oil content of the sesame is increased due to additional sulphur application. Sesame has a high requirement for sulphur which gives significant results with sulphur use (Jadav *et al*., 2010) [3]. Moreover sulphur deficiency is observed due to continuous application of primary major fertilizers (i.e. NPK) which results in depleting the organic matter in soil which is the worst situation for oilseed crops.

Materials and Methods
An experimental research was conducted in the field during Summer season of 2019-20 at Post Graduate Institute Research Farm, MPKV, Rahuri, with 12 treatment combinations comprised of 4 sesamum cultivars (AKT-101, JLT-408, PT-1 & JLT-7) and 3 sources of sulphur (Bensulf, Elemental Sulphur & Single Super Phosphate) i.e., T_1 (AKT-101+Bensulf), T_2 (AKT-101+Elemental Sulfur), T_3 (AKT-101+SSP), T_4 (JLT 408+Bensulf), T_5 (JLT 408+Elemental Sulfur), T_6 (JLT 408+SSP), T_7 (PT 1+Bensulf), T_8 (PT 1+Elemental Sulfur), T_9 (PT 1+SSP), T_{10} (JLT 7+Bensulf), T_{11} (JLT 7+Elemental Sulfur), T_{12} (JLT 7+SSP) in Factorial RBD with replicated thrice.
The field of research plot was uniform in depth up to 60 cm and uniformly leveled having vertisol soil order. The initial soil fertility of developmental plot was low in available nitrogen 186.22 kg ha^{-1}, medium in available phosphorus 27.56 kg ha^{-1} and high in available potassium 478.62 kg ha^{-1}. Dibbling method is used for sowing the seeds. 2-3 seeds were dibbled hill^{-1} at

30 cm x15 cm spacing. The sowing was done on 16/03/2019 and harvested on 18/06/2019. 15 days before sowing the FYM was applied @ 5 t ha^{-1}. The nitrogen was applied @ 50 kg ha^{-1}, out of that 25.00 kg nitrogen ha^{-1} was applied at sowing time and remaining 25.00 kg N ha^{-1} was applied 30 DAS. The sulphur dose was applied fully from various sulphur sources i.e., Bensulf, elemental sulphur and SSP at 25 kg S ha^{-1}. As per treatment combinations it is incorporated in the respective plots 15 days before sowing.

On the five plants of sesamum, the various biometric observations were recorded which were randomly selected from each net plot. Near the selected plants, pegs were fixed by tying with tags for easy demarcation. For recording observations at all the periodical intervals these tagged plants were used at 30, 60, 90, 120 DAS and at harvest.

Result and Discussion

Growth attributes

Among the cultivar the significantly maximum height of the plant was observed with cv. PT 1 over rest of the cultivars. Whereas the significantly minimum plant height was registered by cv. AKT 101. This might be due to genetical characters of cv. PT 1. These findings were in accordance with Korhale (2010) [6]. Among the various sulphur sources the maximum plant height was recorded by using SSP. Similarly significantly minimum plant height was recorded by elemental sulphur. The similar findings were shown by Chattopaddhyay and Ghosh (2012) [1] and Ramakrishna (2017) [10].

Cultivar AKT 101 found significantly maximum number of leaves $plant^{-1}$ whereas cv. JLT 7 shows significantly least count of leaves $plant^{-1}$. The same results were confirmed by Nirval *et al*., (1995) [8]. With reference to sulphur sources, the maximum number of leaves $plant^{-1}$ was observed with SSP respectively. Similarly significantly least count of leaves $plant^{-1}$ was recorded by elemental sulphur. Similar results were recorded by Ramakrishna (2013) [9].

The significantly maximum leaf area $plant^{-1}$ was observed with cv. AKT 101. Whereas the minimum leaf area $plant^{-1}$ except 30 DAS was observed with cv. JLT 7 which is significant. This might be due to more number of leaves, varietal performance to growing period and profuse growth of the plants. The same results were found by Gade *et al*., (2017) [2], they revealed that the AKT-101 recorded significantly higher growth parameters viz., plant height, number of functional leaves $plant^{-1}$, leaf area $plant^{-1}$, number of branches $plant^{-1}$ and dry matter $plant^{-1}$. Among the different sulphur sources, the maximum leaf area $plant^{-1}$ was recorded with SSP. whereas significantly minimum leaf area $plant^{-1}$ was recorded with elemental sulphur. Similar results were in accordance with Krishnaiah (2009) [7].

The significantly higher count of branches $plant^{-1}$ was recorded by cv. AKT 101 and it was at par with PT 1 at 60 DAS and at harvest of crop. This might be due to performance of variety during summer season. Whereas, the significantly minimum count of branches $plant^{-1}$ was recorded with cv. JLT 7. The same results were investigated by Jiotode *et al*., (2013) [4] and Gade *et al*., (2017) [2]. Among the different sulphur sources the higher count of branches $plant^{-1}$ was observed with SSP. However it was at par with bensulf at 30 and 90 DAS. Whereas significantly less number of branches $plant^{-1}$ was recorded with elemental suphur. Same results were found by Krishnaiah (2009) [7] and Chattopaddhyay and Ghosh (2012) [1].

The significantly least count of days required to 50 percent flowering was recorded by cv. AKT 101 (50.56 days) i.e., early flowering cultivar followed by PT 1 (51.10 days) and significantly least count of days required to maturity was observed by cv. AKT 101 (92.89 days) i.e., early maturing cultivar, followed by PT 1 (94.70 days) and it was at par with JLT 408 (51.89 days) for 50 percent flowering. Whereas the significantly maximum count of days required to 50 percent flowering was recorded by cv. JLT 7 (55.44 days) i.e., late flowering cultivar, similar results are also supported by Kanabur (1998) [5]. The maximum count of days required to maturity was recorded by cv. JLT 7 (99.67 days) i.e., late maturing cultivar. These observations were similar with Singh *et al*., (1994) [11]. The numerically minimum count of days required to 50 percent flowering was recorded with elemental sulphur (53.17 days) i.e., early flowering followed by bensulf (53.92 days) and the significantly least count of days required to maturity was recorded with application of elemental sulphur (96.67 days) i.e., early maturity and it was at par with bensulf (96.83 days). Whereas the maximum count of days required to 50 percent flowering was recorded with SSP (54.50 days) i.e., late flowering and maximum count of days required to maturity was recorded with SSP application (98.17 days) i.e., late maturity.

Table 1: Height of plant, No. of leaves $plant^{-1}$, Leaf area $plant^{-1}$ and No. of branches $plant^{-1}$ of sesamum as influenced by different treatment

Treatment	Height of plant (cm) at harvest	No. of leaves $plant^{-1}$ at harvest	Leaf area $plant^{-1}$ (dm^2) at harvest	No. of branches $plant^{-1}$ at harvest
A : Cultivars				
C1 : AKT 101	101.86	77.51	10.05	5.26
C2 : JLT 408	104.85	68.19	9.08	4.67
C3 : PT 1	106.88	72.53	8.69	5.02
C4 : JLT 7	106.59	65.45	8.16	3.79
S.E.m. (±)	0.36	1.13	0.27	0.10
C.D. (P= 0.05)	1.04	3.26	0.79	0.28
B : Source of Sulphur				
S1 : Bensulf	105.73	70.30	9.15	5.03
S2 : Elemental Sulphur	105.43	70.03	8.63	5.00
S3 : SSP	106.98	72.43	9.21	5.43
S.E.m. (±)	0.31	0.98	0.24	0.08
C.D. (P= 0.05)	0.90	N.S.	N.S.	0.24
GM	104.05	70.92	9.00	5.15

Table 2: The different treatments of sesamum was influenced by Days to 50% flowering and days to maturity

Treatment	Days to 50% flowering	Days to maturity
A : Cultivars		
C1 : AKT 101	50.56	92.89
C2 : JLT 408	51.89	96.89
C3 : PT 1	51.10	94.70
C4 : JLT 7	55.44	99.67
S.E.m. (±)	0.48	0.35
C.D. (P= 0.05)	1.40	0.99
B : Source of Sulphur		
S1 : Bensulf	53.92	96.83
S2 : Elemental Sulphur	53.17	96.67
S3 : SSP	54.50	98.17
S.E.m. (±)	0.42	0.30
C.D. (P= 0.05)	N.S.	0.86
GM	53.86	97.22

Conclusion

Out of the various four varieties (cultivars) of sesamum, cv. AKT 101 produced significantly higher growth contributing characters resulting in highest count of leaves plant^{-1}, leaf area plant^{-1}, count of branches plant^{-1}, days to 50% flowering and days to maturity as compared to cv. PT 1, JLT 408 and JLT 7. Therefore, it would be recommended to adopt cv. AKT 101 for cultivation of sesamum in summer under Rahuri condition.

The different sulphur sources and its application observed a significant result on growths of summer sesamum. The SSP (Single super phosphate) favourably influenced growth contributing characters resulted in higher plant height, count of leaves plant^{-1}, leaf area plant^{-1}, count of branches plant^{-1}, days to 50% flowering and days to maturity which was significantly superior over bensulf and elemental sulphur. The application of SSP produced more branches there by more leaf area for more interception of radiation and efficient photosynthesis resulted in higher sesamum seed yield.

Based on one season trial data, cultivation of summer sesamum cv. AKT 101 along with application of SSP (Single super phosphate) as a sulphur source were found suitable for achieving maximum growth contributing characters of sesamum.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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