

# **RESEARCH ARTICLE**

# Enhancing Source-Sink Partitioning Efficiency and Productivity of Sesame

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### ABSTRACT

Received : 08<sup>th</sup> January, 2019 Revised : 19<sup>th</sup> June, 2019 Accepted : 20<sup>th</sup> June, 2019 A field experiment was conducted to study the effect of nipping and foliar spray of growth regulator on the growth and yield of sesame during Kharif 2016 at Regional Research Station, Vridhachalam. The experiment was laid out in randomized block design with seven treatments encompassing terminal nipping and salicylic acid spray at 30 and 45 DAS, alone and in combination which were replicated thrice. The results of the experiments revealed that the terminal nipping along with a foliar spray of 100 ppm salicylic acid at 30 DAS recorded higher leaf area index (1.54), number of branches per plant (9.7), number of capsules per plant (109.5), and higher sesame seed yield of 930 kg ha<sup>-1</sup>.

Keywords: Sesame, nipping, plant growth regulator, salicylic acid

# INTRODUCTION

Sesame (Sesamum indicum L.) belongs to the family Pedaliaceae, is an ancient important edible oilseed crop cultivated throughout the world. India ranks second in sesame production and first in the area by contributing 23.2 percent and 13.1 percent of the world production and area respectively (Lizabeni Kithan and Rajesh Singh, 2017). In India, sesame is cultivated in an area of 16.66 lakh hectares with a production of 6.75 lakh tonnes and productivity of 405 kg/ha during 2013-14 (Annual Report, 2015). However, the average productivity of sesame in India is far less than the world average. The reduced seed yield of sesame, owing to physiological constraints viz., flower drop, slow dry matter accumulation, and poor source-sink partitioning. Sesame has a yield potential up to 2.0 t ha-1, to be achieved by adopting proper management technologies regulate the crop growth regulation through source-sink partitioning efficiency, which increased the yield potential of sesame.

Salicylic acid is one among the growth regulator, which contribute to the regulation of physiological process in plants. Salicylic acid is involved in the plant metabolism, especially in the xylem and phloem loading of source by regulating the ion channels and buffering the plant temperature (Krasavina and Burmistrova, 2013). Likewise, terminal nipping is one of the practices which are followed in pulses and spice crops to improve the productive branches for the higher yield (Bibek Dhital *et al.*, 2017). Hence, the present experiment was conducted to study the impact of nipping and crop growth regulation by growth regulators on sourcesink manipulation and productivity of sesame.

### MATERIAL AND METHODS

A field experiment was conducted at Regional Research Station, Vridhachalam during Kharif 2016 to study the effect of nipping and growth regulator on the yield of sesame. The soil of the experimental field was sandy loam having with a pH of 6.5 and organic carbon of 0.20 %. Sesame variety VRI 2 was used for the experiment. The experiment consisted of eight treatments viz., T<sub>1</sub>: Control, T<sub>2</sub>: Terminal nipping at 30 DAS, T<sub>3</sub>: Terminal nipping at 45 DAS, T<sub>4</sub>: Foliar spray of 100 ppm salicylic acid (SA) at 45 DAS,  $T_5$ :  $T_2$  + 100 ppm salicylic acid spray at 30 DAS,  $T_2$  :  $T_2$  $+T_4, T_7: T_3 + T_4$ . The experiment was conducted in a randomized block design with three replications. Seeds were sown at a row spacing of 30 cm and later thinned out to maintain the plant to plant spacing of 30 cm. The entire recommended dose of fertilizer (35:23:23 kg NPK/ha) was applied basally. Foliar spray of salicylic acid @ 100 ppm was done at early morning using a knapsack sprayer with a spray fluid of 500 litres per hectare. During the crop season, light irrigations were given and inter-culture operations viz., thinning and weeding were done on 15 and 25 DAS irrespective of treatments. The height of tagged plants from the ground to the tip of the main stem was measured, and the mean values were expressed in cm. The data on growth attributes viz., plant height, number of branches/plant, and LAI were also recorded. The crop matured in 80 days

and was harvested. After harvesting, the capsules present in the tagged plants were counted and the average was calculated to obtain the number of capsules per plant. The number of seed per capsule were counted and recorded. One thousand seeds from each net plot produce were taken and their weigh was estimated and expressed in gram. Cleaned and sun dried grains of net plot area were weighed and sesame seed yield was computed and expressed in kg/ha. The recorded data were analyzed statistically and critical differences were calculated using the standard procedures.

# **RESULTS AND DISCUSSION**

#### **Growth Parameters**

The growth attributes *viz.*, plant height, number of branches per plant and leaf area index was found to be significantly influenced by nipping and foliar spray of salicylic acid spray (Table 1).

	Plant height	Number of	LAI
Treatments	(cm)	branches	
		per plant	
T <sub>1</sub> - Control	163	5.3	1.06
T <sub>2</sub> -Nipping at 30 DAS	117	8.3	1.26
T <sub>3</sub> -Nipping at 45 DAS	139	6.8	1.22
$\rm T_4^-Salicylic$ acid 100 ppm spray at 45 DAS	158	6.1	1.14
$\rm T_{\rm 5}^{-}\rm T_{\rm 2}^{-}$ + Salicylic acid 100 ppm spray at 30 DAS	124	9.7	1.54
$T_{6} - T_{2} + T_{4}$	131	8.7	1.41
$T_7 - T_3 + T_4$	135	8.5	1.37
S.Ed	3.6	0.56	0.03
CD (0.05)	7.9	1.3	0.07

Table 1. Effect of nipping and growth regulator on growth attributes of sesame at harvest stage

Terminal nipping along with a foliar spray of salicylic acid @ 100 ppm at 30 DAS ( $T_5$ ) recorded number of branches plant<sup>1</sup> (9.7) and higher leaf area index (1.54). The important of crop growth rate and leaf area index at early stage and its declination in later stages was also reported by Saren et al., 2004. Terminal nipping arrests the terminal growth

and activates the dormant lateral buds to produce a higher number of branches and leaf area index (Singh *et al.*, 2013). The promoting effect of salicylic acid on the leaf area was attributed to its essential roles inactivating cell division and the biosynthesis of organic foods.

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	Number of	Number	Test weight	Seed yield
Treatments	capsules Plant <sup>1</sup>	of seeds	(g)	(kg ha¹)
		capsule <sup>-1</sup>		
T <sub>1</sub> - Control	83.1	44.5	2.95	525
T <sub>2</sub> -Nipping at 30 DAS	95.6	58.5	3.08	685
T <sub>3</sub> -Nipping at 45 DAS	88.6	54.7	3.06	647
$\rm T_4^{-}Salicylic$ acid 100 ppm spray at 45 DAS	84.9	50.1	3.02	601
$\rm T_5^-T_2^-$ + Salicylic acid 100 ppm spray at 30 DAS	109.5	79.0	3.19	930
$T_{6} - T_{2} + T_{4}$	98.3	73.5	3.14	875
$T_7 - T_3 + T_4$	97.3	66.1	3.09	801
S.Ed	7.5	3.28	0.07	46
CD (0.05)	16.2	7.23	NS	100

### Yield attributes and Yield

The yield attributes *viz.*, the number of capsules per plant and number of seeds per capsule are the most critical parameters for the yield of sesame, which was found to be significantly influenced by terminal nipping and growth regulator spray (Table 2). Terminal nipping along with a foliar spray of 100 ppm salicylic acid at 30 DAS ( $T_5$ ) registered the higher number of capsules per plant (109.5) and seeds per capsules (79) which resulted in highest sesame seed yield (930 kg/ha). However, it is on par with terminal nipping at 30 DAS and foliar spray of 100 ppm salicylic acid at 45 DAS.

As in terminal nipping practice, the apical bud is nipped, and hence the utilization of the photosynthates by the crop for lateral branches could be higher, and this might be the reason for higher yield attributes and sesame seed yield, which was also reported by Singh *et al.*, 2013. Similarly, Dhuary and Ghosh, 2009, stated that arresting the terminal growth through terminal nipping mainly activated the lateral dormant buds and it would have balanced source to sink significantly, which increased the number of capsules per plant and sesame seed yield.

Sarkar and Pal, 2005, opined that terminal nipping is an vital operation which activates the dormant lateral buds to produce a higher number of branches per plant, which could be attributed to an overall improvement in plant vigour leading to initiation of more significant number of branches and ultimately better manifestation of yield attributes in sesame. The clipping practice might have effectively altered the crop architecture, which in turn increased the lateral branches that led to greater ability for development of source and sink features in sesame (Kokilavani et al., 2007).

Table 3. Eff	ect of nipping a	nd growth regulato	r on economics of sesame
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Treatments	Cost of cultivation	Gross return	Net return (Rs./ha)	BCR
	(Rs./ha)	(Rs./ha)		
T <sub>1</sub> - Control	22600	42000	19400	1.86
T <sub>2</sub> -Nipping at 30 DAS	24600	54800	30200	2.23
T <sub>3</sub> -Nipping at 45 DAS	24850	51760	26910	2.08
$\rm T_4\mathchar`-Salicylic acid 100 ppm spray at 45 DAS$	24100	48080	23980	2.00
$\rm T_{_5}\text{-}T_{_2}$ + Salicylic acid 100 ppm spray at 30 DAS	27100	74400	47300	2.75
$T_{6} - T_{2} + T_{4}$	27100	70000	42900	2.58
$T_7 - T_3 + T_4$	27350	64080	36730	2.34

\*Price of sesame – Rs.80/kg

Terminal nipping along with a foliar spray of plant growth regulator salicylic acid @ 100 ppm facilitated for enhancing the number of floral buds and reducing the flower drop resulting in a higher number of capsules per plant and number of seed per capsule. Foliar spray of salicylic acid stimulated flowering in a range of plants, increase flower life, controls ion uptake by roots and stomatal conductivity. Salicylic acid would have induced the flowering by acting as a chelating agent and directly related to the yield and productivity of plants (Vazirimehr and Rigi, 2014). Efficient mobilization of metabolites from source to sink can be the reason for the higher number of seed per capsule and seed yield. The valuable impact of terminal nipping and salicylic acid foliar spray are in agreement with Siddagangamma et al., 2018

# **Economics**

A perusal of the data (Table 3) on economic analysis reveals that terminal nipping and salicylic acid 100 ppm foliar spray at 30 DAS ( $T_5$ ) recorded maximum gross return (Rs.74,400/ha) and net return (Rs. 47,300/ha) giving a B:C ratio of 2.70. Similarly, Sharma *et al.* (2003) observed that the highest gross income, net income, and B:C ratio when nipping was done compared to control in sesame. Singh and Devi (2006) in an experiment to evaluate the profitability of nipping in pea has observed that the highest net return was obtained by nipping as compared to no nipping. Karu *et al.* (2015) observed that higher net returns were recorded under salicylic acid spray compared to water spray

# CONCLUSION

Perceptible effect of terminal nipping and foliar spray of 100 ppm salicylic acid at 30 DAS significantly increased the leaf area index, number of branches per plant, number of capsules per plant and number of seeds per capsule resulting in higher sesame seed yield.

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