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Impact of Plant Growth Regulators on Sesame (*Sesamum indicum* L.) Yield and its Attributes

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A B S T R A C T

The experiment was conducted at Agronomy Instructional Farm, S. D. Agricultural University, Sardarkrushinagar during *Kharif* 2020 to examined the effect of different foliar spray of plant growth regulators viz., GA_3 (100 and 200 ppm), NAA (50 and 100 ppm), CCC (500 and 1000 ppm) and SA (500 and 1000 ppm) on seed yield and its related attributes of sesame variety (Gujarat Til 3).The research was laid out in randomized block design, with ten treatments in three replication under rainfed condition. GA_3 200 ppm significantly increased seed yield and its attributes of sesame the number of capsule per plant, number of seeds per capsule, biological yield, harvest index and oil content.

Introduction

Sesame (*Sesamum indicum* L.) is an ancient oil yielding crop and popularly known as "Queen of Oilseeds". Sesame belongs to family pedaliaceae (Nayar, 1984). The genus *Sesamum* has 37 species, out of which *Sesamum indicum* L. is the dominant cultivated species, grown widely in tropical and subtropical areas for its edible uses viz. oil, proteins, vitamins, and amino acids etc. It originated from Africa and most its species distributed in Africa, India and the Far East Asia (Kobayashi *et al.,* 1991).

Sesame is typically an erect branched annual 0.5-2 m in height with a well-developed root system. It is multi-flowered, and its fruit is a capsule containing a number of small oleaginous seeds.

Sesame seeds are very small in size and around four millimetre long two millimetre wide and one millimetre thick. They are pearl

shaped, ovate, small, slightly flattened and somewhat thinner at the eye of the seed (hilum). The varieties and strains differ considerably in size, form, growth, flower colour, seed size, seed colour and composition. Plant hormones are organic substance produced naturally by plant to regulate their growth and development at very low concentration.

It is produced by plant itself but production of plant growth hormones is affected by different biotic and abiotic factor, which cause constraint in growth and development of plant. So, approaches of application of synthetic plant growth regulators to meat out the demand of plant hormones in crops observed good results.

Recently plant growth regulators are considered as new generation of agrochemicals which are not only known to modify plant architecture, but also enhance source-sink relationship as well as stimulate the translocation of photo-assimilates. Which help in better retention of flowers, pod and seed development.

Materials and Methods

A field experiment was carried out at Agronomy Instructional Farm, S. D. Agricultural University, Sardarkrushinagar during *Kharif* 2020. Geographically, Sardarkrushinagar is situated at 24° 19' North latitude and 72° 19' East longitudes with an elevation of 154.52 meter above the mean sea level and situated in the North Gujarat.

Climate of this region is sub-tropical type and comes under semi-arid region, in general, the monsoon is warm and moderately humid, winter is cold and dry, while summer is hot and dry. Maximum mean temperature ranged between 30.2 to 38.5°C, while mean minimum temperature ranged between 15.8 to 27.4°C during the period of experimentation in *Kharif* 2020. The mean relative humidity recorded at morning and evening 61 to 90 and 37 to 93 per cent, respectively. Seeds of GT-3 variety of sesame (*Sesamum indicum* L.) obtained from the Castor-Mustard Research Station, S.D.A.U., Sardarkrushinagar and plant growth regulators (PGRs) purchased from open market.

Land selected for the experiment was sandy loam soil which brought to fine for sowing by applied two to three ploughing. The fertilizer @ 50 kg N and 25 kg P_2O_5/ha were applied as a basal dose at the time of sowing. The operations like gap filling, thinning, weeding, hoeing and plant protection measures were carried out regularly to ensure satisfactory crop growth.

A set of ten treatments of experiment was evaluated by using randomized block design (RBD) with three replication. Each treatments sown in four rows of 3.00 meter length with spacing 45 cm between row to row and 15 cm between plant to plant.

The experiment comprised of total 10 treatments viz. Control, Water spray, GA_3 100 ppm, GA_3 200 ppm, NAA 50 ppm, NAA 100 ppm, CCC 500 ppm, CCC 1000 ppm, SA 500 ppm and SA 1000 ppm foliar application at 30 and 50 days after sowing, evaluated by using randomized block design (RBD) with three replication.

Observations

Yield and yield related attributes *i.e.* number of capsule per plant, number of seed per capsule, number of chaffy seed per capsule, number of healthy seed per capsule, 1000 seed weight, seed yield per plant, seed yield per hectare, biological yield per plant, biological yield per hectare, harvest index and oil content.

Results and Discussion

Yield and yield attributes

Number of capsule per plant

Evaluated the table 1 revealed that highest value of capsules per plant recorded with GA_3 200 ppm followed by NAA 50 ppm as compared to rest of all other treatments whereas other than these treatments rest of all treatments showed non-significant difference to each other, these results conceded with the finding of Sarkar *et al.,* (2002) in soybean and Behera *et al.,* (2017) in sesame.

Number of seed per capsule

Data indicated that the maximum numbers of seed per capsule were recorded with foliar application of GA_3 200 ppm followed by GA_3 100 ppm, NAA 50 ppm, NAA 100 ppm, CCC 500 ppm and SA 1000 ppm, over to rest of other treatments. However remaining treatments were found at par with each other.

These results were evident by the finding of Sarkar *et al.,* (2002) in soybean, Akter *et al.,* (2007) in mustard, Kalyankar *et al.,* (2008) in soybean and Behera *et al.,* (2017) in sesame.

Number of chaffy seed per capsule

Carefully perusal of data showed that minimum number of chaffy seeds per capsule recorded with NAA 50 ppm followed by GA_3 200 ppm as compared to rest of all other treatments, whereas maximum number of chaffy seed per capsule recorded with control.

More numbers of chaffy seeds per capsules showed in control and water spray as compared to other treatments it might be due to variation in translocation of assimilates toward seed, similar results were also obtained by Behera *et al.,* (2017) in sesame.

Number of healthy seed per capsule

Data belongs to healthy seeds per capsule indicated that maximum number of healthy seeds per capsule were recorded with foliar application of GA_3 200 ppm followed by NAA 50 ppm, NAA 100 ppm, SA 1000 ppm, CCC 1000 ppm, GA_3 100 ppm and SA 500 ppm over to control and foliar spray of water.

Higher number of healthy seed per capsule produced by GA_3 200 ppm because after anthesis GA_3 can enhance the stigma vigor and correspondingly improved seed vigor. The results were concur with the finding of Kalyankar *et al.,* (2008) in soybean, Behera *et al.,* (2017) in sesame and Wang *et al.,* (2019) in rice.

1000 seed weight (g)

Examine the data of 1000 seed weight showed that highest value observed with foliar spray of CCC 500 ppm followed by CCC 1000 ppm over to rest of all other treatments. However minimum value of 1000 seed weight recorded with control, which was at par with remaining all treatments except SA 1000 ppm.

It is also concluded that increase in 1000 seed weight by CCC might be due to accelerated translocation of photo assimilate toward seed. Similar results were also obtained by Sontakey *et al.,* (1991) in sesame, Sarkar *et al.,* (2006) in sesame and Secondo and Reddy (2018) in sunflower.

Seed yield

Seed yield data indicated that the maximum seed yield recorded with foliar application of GA_3 200ppm followed by NAA 50 ppm as compared to all other treatments. Whereas other treatments were observed at par with each other except NAA 100 ppm and GA_3 100 ppm.

Table.1 Effect of PGR on number of capsule per plant, number of seed per capsule, number of chaffy seed per capsule and 1000 seed weight, seed yield, biological yield, harvest index and oil content of sesame

Treatments	No. of capsule per plant	No. of seed per capsule	No. of chaffy seed per capsule	No. of healthy seed per capsule	1000 seed weight (g)	Yield per Hectare (kg)	Biological Yield per Hectare (kg)	Harvest index (%)	Oil Content (%)
Control	30.02	38.90	8.01	30.59	2.91	568.37	2185.5	25.48	46.09
Water	30.70	39.78	7.55	32.56	2.95	575.61	2199.0	25.86	46.23
GA_3 100ppm	32.43	43.47	6.63	36.55	3.11	650.24	2455.1	26.73	49.58
GA_3 200ppm	36.97	44.99	4.44	40.31	3.14	740.03	2636.0	28.35	49.64
NAA 50ppm	34.05	44.01	4.35	39.38	3.09	682.72	2548.7	27.11	48.21
NAA 100ppm	32.73	43.68	5.49	38.64	3.10	666.60	2503.1	26.63	48.19
CCC 500ppm	32.23	43.43	5.35	38.56	3.69	628.32	2369.0	26.67	48.62
CCC 1000ppm	30.93	42.71	6.40	36.71	3.42	598.74	2266.7	26.31	48.46
SA 500ppm	30.81	41.30	6.23	36.35	3.16	587.65	2225.6	26.25	47.10
SA 1000ppm	31.79	43.20	5.86	37.46	3.20	611.23	2304.4	26.47	47.51
Mean	**32.26**	**42.54**	**6.03**	**36.71**	**3.18**	**630.95**	**2369.3**	**26.58**	**47.96**
SEm±	**1.22**	**1.24**	**0.30**	**1.73**	**0.09**	**24.31**	**97.26**	**0.79**	**0.79**
C.D at 5 %	**3.63**	**3.68**	**0.90**	**5.14**	**0.28**	**72.22**	**288.98**	**2.34**	**2.34**
C.V %	**6.57**	**5.04**	**8.71**	**8.16**	**5.04**	**6.67**	**7.11**	**5.08**	**2.84**

Increased in seed yield can be attributed to the increased characters like plant height, number of branch, number of capsule per plant, number of healthy seed per capsule, number of leaves, leaf area, chlorophyll content and dry matter production, and partitioning of assimilaters toward seeds.

Present studies were also supported by Sarkar *et al.,* (2002) in soybean, Akter *et al.,* (2007) in mustard, Kalyankar *et al.,* (2008) in soybean and Behera *et al.,* (2017) in sesame.

Biological yield

Examine of the data showed that the higher value of biological yield obtained with foliar application of GA_3 200 ppm followed by NAA 50 ppm, NAA 100 ppm, GA_3 100 ppm and CCC 500 ppm as compared to rest of all treatments.

Foliar spray of GA_3 200 ppm is increased plant dry matter which directly associated to increased biological yield. Similar results were obtained by Sontakey *et al.,* (1991) in sesame, Sarkar *et al.,* (2002) in soybean and Behera *et al.,* (2017) in sesame.

Harvest index

Data related to harvest index indicated that the superior value of harvest index recorded with GA_3 200 ppm followed by NAA 50 ppm, GA_3 100 ppm, CCC 500 ppm, NAA 100 ppm, SA 1000 ppm, CCC 1000 ppm and SA 500 ppm over to control and water spray.

Harvest index is ratio of economic yield to biological yield so foliar application of GA_3 200 ppm recorded highest value of seed yield due to that increase the value of harvest index.

Similar results were also reported by Sontakey *et al.,* (1991) in sesame and Vekaria *et al.,* (2017) in sesame.

Oil content in per cent (%)

Data related to oil content indicated that the higher per cent of oil content registered with foliar application of GA_3 200ppm followed by GA_3 100 ppm, CCC 500 ppm, CCC 1000 ppm, NAA 50 ppm, NAA 100 ppm and SA 1000 ppm over to control, water spray and SA 500 ppm our results were evident by the finding of Sontakey *et al.,* (1991) in sesame, Vekaria *et al.,* Khan and Khan (2016) in soybean and Thuc *et al.,* (2021) in sesame.

Among all the characters studied related to seed yield production and their distribution in component parts of plant and it was observed that the GA_3 200 ppm treatment was found superior followed by NAA 50 ppm under rainfed conditions. Therefore on the basis of these observations, foliar application of GA_3 200 ppm was most promising treatment due to highest seed yield under rainfed condition.

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