The Pharma Innovation Journal 2023; 12(12): 1874-1877

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 1874-1877

www.thepharmajournal.com
Received: 03-11-2023
Accepted: 09-12-2023

NK Lakhnotra
M.Sc. (Agri.), Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat, India

BB Ramani
Associate Research Scientist, Directorate of Research, Junagadh Agricultural University, Junagadh, Gujarat, India

RR Mushar
Ph.D. Scholar, Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat, India

JR Karamata
M.Sc. (Agri.), Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat, India

Corresponding Author:
NK Lakhnotra
M.Sc. (Agri.), Department of Agronomy, Junagadh Agricultural University, Junagadh, Gujarat, India

Effect of plant growth regulators on nutrient content, uptake and quality of summer sesame [*Sesamum indicum* (L.)]

NK Lakhnotra, BB Ramani, RR Mushar and JR Karamata

Abstract
A field experiment was conducted on medium black calcareous soil at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat) during the summer season of 2019 to study the effect of plant growth regulators on nutrient content, uptake and quality of summer sesame in randomized block design with three replications, comprised with 10 treatments of three plant growth regulators spray at single stage as well as double stage. Foliar application of plant growth regulators improvement in nutrient content (N, P and K) and their uptake by seed and stover of sesame were noticed with foliar application of 100 ppm IAA at flowering and capsule formation stage followed by 100 ppm IAA at flowering stage as compared to control. This foliar spray of 100 ppm IAA at both stages gave higher values of quality parameters like chlorophyll content and oil content over rest of the treatments including Control.

Keywords: Plant growth regulators, summer sesame, GA_3, IAA, NAA, nutrient content and uptake, chlorophyll content and oil content (%)

Introduction
In India, one of the earliest oil seed crops to be grown is sesame (*Sesamum indicum* L.). The outstanding quality of this crop has earned it the title of "Queen of oil seed crop." In semiarid areas, sesame is a crop that can withstand severe droughts. Its high level of drought tolerance and capacity to adapt to a variety of agroclimatic conditions make it superior to other oilseed crops. It is extensively grown in arid regions of Africa and the Mediterranean, as well as in nations like Turkey, Bangladesh, China, and India. It can thrive in areas where most crops cannot, earning it the moniker "survivor crop." In several languages, it is referred to as gingelly, til, benni, ajanjoli, ellu, goma, and simsim. With 6355 K cal/kg dietary energy in seeds and an oil content of 46–64%, sesame comes in first Sesame seeds are also an excellent source of minerals (5-7%), sugar (14-16%), and protein (20-28%). With 85% unsaturated fatty acid, this oil is very stable, lowers cholesterol, and guards against coronary heart disease. As a prized oil seed, sesame seems to have many industrial uses. Sesame is a member of the Pedaliaceae family and comes from South West Africa. Its botanical name is *Sesamum indicum* L. A further increase in production could be achieved by adopting improved agronomic practices like proper nutrient management, application of biofertilizers, micronutrients and plant growth regulators. Plant growth hormones are organic substances formed naturally in the higher plants, controlling growth or other physiological functions at a site remote from its place of production, and active in little amounts. Plant growth substances have key function in different physiological processes related to growth and development of crops. It is clear that changes in the level of endogenous hormones due to biotic and abiotic stress alter the crop growth and any sort of manipulation including exogenous application of growth substances would help for yield enhancement or at least nourishment of the crop. Exogenous application of PGR's has been reported to increase the growth and yield of various crops (Bharud *et al*., 1988) [4]. It is well known that all the PGR control the physiological functions of plant. Some workers highlighted that spraying of PGR's on crop plants improves growth, yield and quality attributes (Gott and Thomas, 1986; Deore and Bharud, 1990; Paspatis, 1995; and Geetha *et al*., 2000) [11, 4, 13, 9]. Genetic and environmental factors influence the oil content and fatty acid compositions in sesame (Carlsson *et al*., 2008) [5]. To achieve this strategy, the field experiment was conducted at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat).

Materials and Methods

The field experiment entitled "Response of summer sesame (*Sesamum indicum* L) to plant growth regulators in relation to growth and yield parameters, yield and economics" was conducted during summer season of the year 2019. The soil of the experimental plot was clayey in texture and slightly alkaline in reaction with pH 7.9 and EC 0.33dS/m. The soil was low in available nitrogen (278 kg/ha), high in available phosphorus (38 kg/ha) and medium in available potash (252 kg/ha). The field experiment was comprised with 10 treatments including Control (T_1) and three plant growth regulators spray at single stage as well as double stage *viz.*, T_2: GA_3 - 50 ppm at flowering stage, T_3: GA_3 - 50 ppm at capsule formation stage, T_4: GA_3 - 50 ppm at flowering and capsule formation stage, T_5: IAA - 100 ppm at flowering stage, T_6: IAA - 100 ppm at capsule formation stage, $T_{7:}$ IAA - 100 ppm at flowering and capsule formation stage, T_8: NAA - 50 ppm at flowering stage, T_9: NAA - 50 ppm at capsule formation stage, T_{10}: NAA -50 ppm at flowering and capsule formation stage which were tried under randomized block design with three replications. Summer Sesame variety Gujarat Junagadh Til-5 was used for sowing with seed rate of 5 kg/ha on 20th February during 2019. Seeds were dropped manually in opened furrows at depth 2-3 cm with inter row spacing 30 cm and gently covered with the soil. The fertilizer dose 50-25-0kg N-P_2O_5-K_2O/ha in form of urea and diammonium phosphate was applied to the crop just before sowing. Thinning operation were undertaken 15 days after sowing to maintain intra-row spacing of 10 cm. Spraying of plant growth regulators was done at flowering and capsule formation stage.

Results and Discussion

Effect on quality parameters

Effect on chlorophyll content

Application of plant growth regulator IAA 100 ppm at flowering and capsule formation stage (T_7) recorded maximum value of chlorophyll content (Table 1) in leaves after 1st and 2nd spray of plant growth regulators which remained at par with treatments, IAA 100 ppm at flowering stage (T_5), IAA 100 ppm at capsule formation stage (T_6), GA_3 50 ppm at flowering and capsule formation stage (T_4), GA_3 50 ppm at capsule formation stage (T_3) and GA_3 50 ppm at flowering stage (T_2). While, Lower chlorophyll content was found under Control (T_1). The present findings are in close agreement with those reported by Behera *et al*. (2017) [3] in sesame, Sao and Sahu (2013) [15] in groundnut. Application of NAA being at par with Control (T_1) found poor impact.

Effect on oil content (%)

All the treatments of plant growth regulators recorded significantly higher oil content (%) over Control (T_1) (Table 1). This is might due to increased accumulation of hexose sugars at the time of synthesis of triglcylglycerol. These results are support with the findings of Patil (2019) [14] in groundnut, soybean and sunflower, Sao and Sahu (2013) [6] in groundnut, Baz *et al*. (1984) [2], Tagade *et al*. (1998) [17] and Travaglia *et al*. (2009) [18] in soybean, Farooqui *et al*. (2005) [7] in palmarosa and Baydar (2000) [1] in safflower.

Effect on nutrient content and uptake

Effect on nutrient content

The content of N, P and K in seed and stover (Table 2) were significantly influenced by plant growth regulators. Significantly the higher values of these parameters were recorded under treatment IAA 100 ppm at flowering and capsule formation stage (T_7), however it remained at par with treatments, IAA 100 ppm at flowering stage (T_5), IAA 100 ppm at capsule formation stage (T_6) and GA_3 50 ppm at flowering and capsule formation stage (T_4) with respect to N, P and K content in seed and stover. While, significantly lower values of nutrient content in seed and stover were observed in Control (T_1). Plant growth regulators application might have helped in improvement of metabolic processes of plants and better growth and development, leading to greater absorption of nutrients from rhizosphere. This might have promoted growth of root as well as their functional activity resulting in higher extraction of nutrients form soil environment to aerial parts. Thus, influence of plant growth regulators on photosynthesis and their translocation to different plant part which ultimately increased the content of nutrient in seed and stover. The similar results were also reported by Fawzy *et al*. (2011) [8] in groundnut, Idrees *et al.* (2010) [12] in coriander.

Effect on nutrient uptake

Uptake of N, P and K by seed and stover (Table 3) were increased significantly due to application of IAA 100 ppm at flowering and capsule formation stage (T_7). While significantly lower nutrient uptake were recorded in Control (T_1). The quantum of nutrient uptake by the crop is dependent on extent of biomass production and concentration of nutrient at cellular level. Since, concentration of nutrients are improved by application of plant growth regulators (Table 2) is primarily responsive for the quantum of nutrient uptake. The similar results were also reported by Singh (1991) [16] in groundnut.

Table 1: Effect of different treatments on chlorophyll content and oil content (%) of summer sesame (*Sesamum indicum* L).

Treatments	Chlorophyll content after 1st spray	Chlorophyll content after 2nd spray	Oil content (%)
T_1	38.84	42.06	43.79
T_2	44.90	51.50	46.78
T_3	45.92	52.95	46.79
T_4	47.84	54.73	47.19
T_5	49.42	57.50	47.42
T_6	48.92	56.00	47.49
T_7	50.84	58.61	47.61
T_8	42.75	50.89	46.19
T_9	43.02	51.09	46.44
T_{10}	43.70	51.13	46.74
S.Em.±	2.11	2.46	0.70
C.D. at 5%	6.27	7.32	2.08
C.V. %	8.01	8.1	2.60

Table 2: Effect of different treatments on nitrogen, phosphorus and potash content in seed and stover of summer sesame (*Sesamum indicum* L)

Treatments	Nitrogen content		Phosphorus content		Potash content	
	Seed (%)	Stover (%)	Seed (%)	Stover (%)	Seed (%)	Stover (%)
T_1	2.66	1.07	0.60	0.32	0.57	0.58
T_2	3.05	1.23	0.67	0.37	0.66	0.63
T_3	3.07	1.24	0.68	0.40	0.66	0.64
T_4	3.07	1.24	0.75	0.40	0.66	0.70
T_5	3.58	1.38	0.79	0.43	0.77	0.74
T_6	3.43	1.38	0.77	0.42	0.74	0.72
T_7	3.94	1.59	0.80	0.44	0.80	0.75
T_8	2.72	1.10	0.60	0.32	0.59	0.60
T_9	2.79	1.12	0.64	0.36	0.60	0.61
T_{10}	2.96	1.20	0.67	0.37	0.64	0.62
S.Em.$\pm$	0.15	0.06	0.03	0.02	0.03	0.03
C.D. at 5%	0.43	0.17	0.09	0.05	0.10	0.09
C.V. %	8.10	7.85	7.65	7.25	8.90	7.86

Table 3: Effect of different treatments on nitrogen, phosphorus and potash uptake in seed and stover of summer sesame (*Sesamum indicum* L)

Treatments	Nitrogen uptake		Phosphorus uptake		Potash uptake	
	Seed (kg/ha)	Stover (kg/ha)	Seed (kg/ha)	Stover (kg/ha)	Seed (kg/ha)	Stover (kg/ha)
T_1	20.68	13.81	4.62	4.12	4.44	7.45
T_2	28.88	17.47	6.36	5.17	6.24	8.91
T_3	29.26	17.53	6.54	5.61	6.32	9.09
T_4	34.01	17.79	8.29	5.79	7.38	10.09
T_5	46.26	21.44	10.25	6.64	10.05	11.55
T_6	42.27	21.09	9.42	6.40	9.11	11.05
T_7	60.06	28.06	12.16	7.76	12.21	13.31
T_8	24.88	14.18	5.50	4.21	5.39	7.77
T_9	25.60	14.99	5.91	4.75	5.54	8.06
T_{10}	27.33	16.25	6.21	4.99	5.87	8.57
S.Em. $\pm$	1.92	1.07	0.47	0.31	0.51	0.65
C.D. at 5%	5.69	3.18	1.39	0.93	1.53	1.93
C.V. %	9.78	10.16	10.75	9.78	12.26	11.71

Conclusion
On the basis of results of one year experiment, it can be concluded that the foliar spray of 100 ppm IAA (Indole acetic acid) as plant growth regulator at flowering and capsule formation stages was found effective for improving nutrient content (N, P and K) and their uptake by seed and stover of sesame and also gave higher values of quality parameters like chlorophyll content and oil content in medium black calcareous soil of south Saurashtra Agro-climatic Zone of Gujarat.

Acknowledgements
I am thankful to my respected advisor Dr. BB Ramani as well as the entire faculty members of College of Agriculture at Junagadh Agricultural University, Junagadh.

References
1. Baydar H. Effects of gibberellic acid on male sterility, seed yield, oil and fatty acid syntheses of safflower. Turkish Journal of Biology. 2000;24:259-168.
2. Baz AI, Safurat MS, Abdullan AR. Some physiological studies on soybean plant: Effect of some growth, yield, nodulation and chemical composition. Annals Agricultural Science Mashtohor. 1984;21(2):79-82.
3. Behera S, Padhiary AK, Rout S, Nayak A, Behera D, Nanda PK. Effect of plant growth regulators on morpho-physiological and yield parameters of some sesame (*Sesamum indicum* L.) cultivars. International Journal of Current Microbiology and Applied Sciences. 2017;6(11):1784-1809.
4. Bharud RW, Deore BP, Patil VA. Effects of growth substances on the growth and yield of methi. Journal of Maharashtra Agricultural University. 1988;13(1):340-341.
5. Carlsson AS, Chanana NP, Suh MC, Were BA. Sesame In: Kole C, *et al*. (Eds.) Compendium of transgenic crop plants-transgenic oilseeds crops; c2008. p. 227-246.
6. Deore BP, Bharud RW. Growth, yield and storability of fenugreek as influenced by foliar spray of growth substances. Journal of Maharashtra Agricultural University. 1990;18(2):208-210.
7. Farooqui AHA, Fatima S, Khan A, Sharma S. Ameliorative effect of chlormequat chloride and IAA on drought stressed plants of Cymbopogon martini and Cymbopogon winterianus. Plant Growth Regulators. 2005;46:277-284.
8. Fawzy ZF, Bassiony AME, Nemr MAE, Desu KME. Improvement in growth, yield and quality of two snap bean (*Phaseolus vulgaris* L.) varieties using some growth regulators. Journal of Applied Science and Research. 2011;7(12):2047-2055.
9. Geetha K, Sadewarte KT, Mahorkar VK, Joshi PS, Deo DD. A note on the effect of foliar application of plant growth regulators on seed yield in china aster. Orissa Journal of Horticulture. 2000;28(2):113-114.
10. Geetha K, Sadewarte KT, Mahorkar VK, Joshi PS, Deo DD. A note on the effect of foliar application of plant growth regulators on seed yield in china aster. Orissa Journal of Horticulture. 2000;28(2):113-114.
11. Gott KA, Thomas TH. Comparative effects of gibberellins and Nsubstituted pathalimide on seed germination and extension growth of celery (*Apium graveolens* L.). Plant Growth Regulation. 1986;4(3):273-279.
12. Idrees M, Khan AM, Aftab T, Naeem M. Synergistic effects of gibberellic acid and triacontanol on growth, physiology, enzyme activities and essential oil content of coriander (*Coriandrum sativum* L.). The Asian and Australasian Journal of Plant Science and Biotechnology. 2010;4(1):24-29.
13. Paspatis EA. Effect of GA3 application and nitrogen fertilization on yield and quality of celery. Annals Del Institute Phyto pathologiquebenaki. 1995;17(2):131-139.
14. Patil BM. Response of groundnut (*Arachis hypogeal* L.)

to the exogenous application of growth hormones (IAA and GA3). Journal of Bioscience and Agriculture Research. 2019;22(1):1829-1834.

15. Sao S, Sahu PK. Contemporary impact of fly ash with soil and growth hormone on germination status of peanut (*Arachis hypogeal* L.). International Journal of Agronomy and Agricultural Research. 2013;3(12):36-42.
16. Singh P. Effect of levels and sources of phosphorus and bio-regulators on growth, yield and quality of groundnut on calcareous soil of south Rajasthan. Ph.D. Thesis (Unpublished). Agricultural University, Agra. 1991.
17. Tagade R, Deotale RD, Sable S, Chore CN. Effect of IAA and kinetin on biochemical aspects and yield of soybean. Journal of Soil Crops. 1998;8(2):172-173.
18. Travaglia C, Reinoso H, Boltini R. Application of abscisic acid promotes yield in field cultured soybean by enhancing production of carbohydrates and their allocation in seed. Crop and Pasture Science. 2009;60:1131-1135.