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Response of plant growth regulators on growth and yield of groundnut (*Arachis hypogaea* L.)

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Abstract
The field experiment was conducted during *kharif* season of 2023 at Crop Research Farm, Department of Agronomy. The experiment was laid out in a Randomized Block Design with 10 treatments and replicated thrice. The treatments consisted of 3 levels of GA_3 (50ppm, 75ppm and 100ppm) and 3 levels of IAA (30ppm, 40ppm, 50ppm) along with recommended doses of fertilizer and a control (20:60:40 kg N-P-K/ha). Application of GA_3 at 100ppm and IAA at 50ppm (Treatment 9) recorded highest plant height (34.88cm), Nodules/plant(134.78), maximum plant dry weight (24.77), crop growth rate (23.64), No. of pods/plant (21.22), kernel yield (2.11kg/ha), test weight (242.30g),seed yield (3616.2 kg/ha), haulm yield (3718.4 kg/ha) and also recorded maximum gross return (186387.6 INR/ha), net return (139543.6 INR/ha) and B:C (2.97).

Keywords: Groundnut, plant growth regulator (GA3, IAA), economics

Introduction
Groundnut (*Arachis hypogea* L.) is one of the commercial crops of the world that rank 13th among the food crops grown over an area of 5.40 million ha and production of 5.43 million tonnes with a productivity 910 kg/ha. In India, groundnut is known as poor man's almond. Groundnut is one of the valuable vegetable oil crops and its seeds contain high amount of edible oil (47%) and protein (38%) Atasie *et al*., (2009) [1]. Groundnut is a self-pollinating, annual herbaceous legume. Groundnut is the world's fourth most important source of edible oil and third most important source of vegetable protein. It is an annual legume, native of South America (Brazil), but it is grown throughout the tropical and warm temperate regions of the globe. Cultivated groundnut is also known as peanut and the seeds are also known as kernel, these kernels/seeds are used for manufacturing of confectionary nut flour, protein and peanut milk**.** About two third of the world's groundnut production is used as oil and remaining one third is consumed as food.

Growth hormones can contribute to the improved growth and development of field crops with higher yields, e.g. groundnut Khan *et al*., (2011) [5]. In addition, auxins and GA_3 are important growth hormones that can affect the development of plant morphological and yield contributing attributes. Besides their primary role growth regulation, growth hormones also affect timing of flowering, the sex of the flowers, senescence of leaves and fruits, fruits development, etc. Most of the workers have studied the effect of growth regulators on seed germination Chauhan *et al*., (2009) [3] and Patil *et al*., (2012) [8]. Recent studies Rastogi *et al*., (2013) [9] have focused on the impact of growth regulation on yield contributing parameters, hence it can increase the yield of the crop. This present study deals with the response of groundnut to the IAA and GA_3 in relation to morphological and yield contributing attributes, such as height of plant, number of root nodules, number of pads per plant, seed size, seed weight and yield. Gibberellic acid is generally used plant growth regulators and recently Indole acetic acid is new emerging plant growth regulators. In oilseed crops, PGR's perform significant responses on crop growth and yield. Plant growth regulators can be successfully working to enhance the yield in the economically important oil seed crops Rastogi *et al*., (2013) [9]. IAA has been found to increase the plant height, number of leaves per plant, pod size with consequent enhancement of Karnel yield in groundnut Lee (1990) [7].

It also increases the flowering, fruit setting, dry weight of crops Gurdev and Saxena, (1991) [4].

Materials and Methods

The experiment was carried out during *kharif* season of 2023 at the CRF (Crop Research Farm) SHUATS, Prayagraj, Uttar Pradesh. The soil of the experimental plot was found to be sandy loam in texture and soil pH was neutral. The experiment was laid out in Randomized block design (RBD) with 10 treatments replicated thrice. The treatment consisted of 3 level of GA_3 (50ppm, 75ppm and 100ppm) and IAA (30ppm, 40ppm and 50ppm) as a foliar spray and a control (20:60:40 N:P:K kg/ha). The data were recorded and statistical analysed by analysis of variance method (ANOVA). The results are presented at 5% level of significance (p=0.05).

Results and Discussion

Plant dry matter (g)

At 60 DAS, significantly highest plant dry weight (24.77g), were recorded in T_9 with GA_3 100 ppm + IAA 50 ppm. The significant improvement in the dry weight of plant might be due to GA_3 which enhanced the source-sink relationship in the plant and induced photo-assimilate translocation in the plant. Khan and Khan (2016) [6] also reported applications of IAA on soyabean increased stem and total dry weight, respectively.

Number of pods per plant

Treatment with GA_3 100 ppm + IAA 50 ppm (Foliar spray) was recorded significantly highest number of pods per plant (21.22). Number of pods per plant was constantly increased with the concentration of GA_3. The increase in the number of pods /plant may be due to the increase in the number of branches/plant in the IAA treatment. Similar results were reported by Behera *et al.,* (2017) [2] and Vekaria *et al.,* (2017) [13] in sesame.

Number of kernels per pod

Treatment with GA_3 100 ppm + IAA 50 ppm (2.11) was recorded maximum No. of kernels per pod which was significantly superior over all the treatments. However, treatment with GA_3 100 ppm + IAA 40 ppm (2.00) were statistically at par with treatment with GA_3 100 ppm + IAA 50 ppm as compared to other treatments. The increase in the number of kernels/pods may be due to the higher photosynthetic activity and more nutrients in the sinking direction, resulting in healthier kernels/pods. Similar results were reported by Behera *et al.,* (2017) [2] in sesame.

Test weight (g)

Treatment with GA_3 100 ppm + IAA 50 ppm (242.30) was recorded maximum seed index. However, treatment GA_3 100 ppm + IAA 40 ppm (240.96) were statistically at par with treatment with GA_3 100 ppm + IAA 50 ppm as compared to other treatments. Test weight was significantly higher in indoleacetic acid, which may have been due to increased crop photosynthesis, which was facilitated by both improved photosynthetic efficiency and the source-to-sink ratio. The above results are consistent with Upadhyay and Ranjan (2015) [12] in soyabean.

Seed yield (kg/ha)

Treatment with GA_3 100 ppm + IAA 50 ppm (3616.26) was recorded maximum seed yield which was significantly superior over all the treatments. However, treatment with GA_3 100 ppm + IAA 40 ppm (3320.43) were statistically on par with treatment with GA_3 100 ppm + IAA 50 ppm as compared to other treatments. The significant increase of seed yield under the various plant growth regulator appear to be due to their significant impact on the number of pods/plants, test weight and increase in growth parameters. These findings are in line with Sarkar *et al.,* (2002) [10] and Sudadi (2012) [11] in soyabean and Lee (1990) [7] in groundnut.

Economics

Maximum gross returns (186387.6 INR/ha) followed by net return (139543.6 INR/ha) and B:C (139543.6 INR/ha) was recorded in T_9.

Table 1: Response of plant growth regulators on growth and yield of groundnut.

S. No.	Treatment Combinations	Plant dry weight (g) 60 DAS	No. of pods/plant	No. of kernel/pods	Test weight (g)	Seed yield kg/ha	B:C ratio
1	GA_3 50 ppm + IAA 30 ppm	17.88	18.56	1.56	225.04	2171.90	1.46
2	GA_3 50 ppm + IAA 40 ppm	18.44	18.67	1.89	228.83	2691.52	2.04
3	GA_3 50 ppm + IAA 50 ppm	19.58	18.89	1.78	239.63	2696.66	2.03
4	GA_3 75 ppm + IAA 30 ppm	19.30	19.22	1.67	238.79	2554.73	1.86
5	GA_3 75 ppm + IAA 40 ppm	19.86	19.00	1.56	230.90	2281.29	1.55
6	GA_3 75 ppm + IAA 50 ppm	20.24	19.33	1.67	237.10	2551.28	1.84
7	GA_3 100 ppm + IAA 30 ppm	20.86	18.89	1.89	228.48	2719.07	2.01
8	GA_3 100 ppm + IAA 40 ppm	23.55	20.67	2.00	240.96	3320.43	2.67
9	GA_3 100 ppm + IAA 50 ppm	24.77	21.22	2.11	242.30	3616.26	2.97
10	N-P-K 20-60-40 kg/ha (Control)	15.76	18.00	1.56	219.23	2051.99	1.36
	S.Em (±)	0.56	0.43	2.72	3.71	58.41	_
	CD (P=0.05)	1.68	1.27	8.09	11.01	173.56	_

Conclusion

It is concluded that application of GA_3 100 ppm and IAA 50 ppm (T_9) recorded highest yield and benefit cost ratio in groundnut.

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