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Janki Prasad
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

DK Tripathi
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

OP Singh
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Deepak Kumar Rawat
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Madhukar Singh
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Corresponding Author:
Janki Prasad
Department of Crop Physiology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India

Effect of growth regulators on growth parameters of lentil (*Lens culinaris* L.)

Janki Prasad, DK Tripathi, OP Singh, Deepak Kumar Rawat and Madhukar Singh

Abstract
Lentil (*Lens culinaris* L.) is a member of the Leguminaceae (Fabaceae) family. It is one of the most important and nutritious *Rabi* pulse. It is mostly eaten as 'dal'. The dal is made by splitting the grain in 2 cotyledons. The whole grain is also used in some of the dishes. Since it is a leguminous crop, it improves the fertility of soil through biological nitrogen fixation. It is generally grown as rainfed crop during Rabi season after rice, maize and pearl millet. Lentil has been part of the human diet, also has the third-highest level of protein, after soybean and hemp. Lentil is deficient in two essential amino acids, methionine and cysteine. The maximum increase in plant height was recorded by the application of GA_3 (50ppm) followed by IAA (50ppm) and NAA (50ppm) respectively over the control during both the years. On the other hand, TIBA (50ppm) acted in a reverse direction means reduced the plant height. Maximum retardation effect was seen in the treatment of TIBA (50 ppm) treatment. Maximum increased in number of branches were recorded under TIBA 50 ppm followed by IAA 50 ppm. Application of Cytokinin (5 ppm) on the other hand, led to the reduction in number of branches during both the years of experimentation.

Keywords: *Lens culinaris*, growth regulators, GA_3, IAA, NAA (50ppm), TIBA, Cytokinin biological nitrogen fixation, methionine and cysteine

Introduction
Lentil (*Lens culinaris* L.) is a member of the Leguminaceae (Fabaceae) family which is most important and nutritious Rabi pulse grown as rainfed crop after rice, maize and pearl millet. It has the potential to cover the risk of rainfed farming. The plants are ploughed back into the soil as green manure also. It is mostly eaten as 'dal'. The dal is made by splitting the grain in 2 cotyledons, which are deep orange red or orange yellow in color. The whole grain is also used in some of the dishes. Since it is a leguminous crop, it improves the fertility of soil through biological nitrogen fixation. Lentil seeds also provide a source of starch for textiles and printing. Lentil residue form important livestock feed. Lentil floor is used for thickening of soups. It is mixed with wheat flour in bread and cake production. Lentil has been part of the human diet, also has the third-highest level of protein, after soybean and hemp. Lentil ranks fifth in the world production of pulses with its high carbohydrate, protein and amino acid contents. India ranked first in the area and second in the production with 43% and 37% of world area and production respectively. The highest productivity is recorded in New Zealand (2667 kg/ha) followed by China (2239kg/ha). Canada ranks first in production (38%) due to very high level of productivity 1971 kg/ha as compared to India 600 kg/ha (FAO 2013) [1]. The term plant growth regulators (PGRs) cover the broad category of organic compounds other than nutrients. A large number of synthetic compounds exhibit PGR- like activity and marketed for commercial use, particularly NAA,TIBA, IAA, GA_3, Cytokinin etc. The impact of PGRS in manipulating physiological processes in crop production include germination, vigor's of plant, nutrient uptake from soil etc. (Kathiresan and Balasubramanian, 1995) [3, 4].
The PGRs helps to increase the number of flowers on the plant when applied at the time of flowering. The flower and pod drop may be reduced to some extent by spraying various growth regulators on foliage (Ramesh and Thirumuguran, 2001) [5]. Foliar application of GA_3, increased the plant height by increasing the number of internodes and also stimulates both vegetative and subsequent reproductive growth in black gram. GA_3, increased the length of the main axis and thus plant height in groundnut.

Materials and Methods

Experimental site and location

The field experiment was conducted under field conditions during two Rabi seasons *viz*. 2019-20 and 2020-21 at Student Instructional Research Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur to examine the effect of applied growth regulators on growth vigour of lentil. District Kanpur is situated in the central Uttar Pradesh. Geographically it is located at 26.28^0 North latitude, and 80.25^0 East longitudes at an elevation of about 127 meters above mean sea level.

Experimental Materials

In the present study, DPL-62 Variety of Lentil was taken as experimental materials to find out the response of TIBA, GA_3, Cytokinin, IAA and NAA on physiological, biochemical and yield parameters of lentil. The variety was collected at seed Farm legume section, C.S.A.U.A. & T. Kanpur.

Statistical design and layout

Variety (V_1): DPL-62
Replications: 3 (Each treatment were replicated three times)
Treatments: In all three were 11 treatments comprising all possible combinations and one variety of lentil as given below.

Growth regulators and doses	
T_1	Control (Unsprayed)
T_2	TIBA-25 ppm
T_3	TIBA-50ppm
T_4	GA_3-25ppm
T_5	GA_3-50ppm
T_6	Cytokinin-5ppm
T_7	Cytokinin-10ppm
T_8	IAA-25ppm
T_9	IAA-50ppm
T_{10}	NAA-25 ppm
T_{11}	NAA-50 ppm

Planting material

Seeds of the one genotype *viz*. DPL-62 differing in seed colour, shape and size, plant habit, canopy architecture, maturity and seed yield were obtained from the economic botanist, Legume section, C.S. Azad University of Agriculture and Technology, Kanpur.

Seed sowing

Seeds were sown in the field behind the plough, keeping the rows 30 cm apart and maintaining a depth of 5 cm, as for as possible. The open furrows were planked immediately after sowing. Plant to plant spacing within the rows was maintained at 10 cm. The crop was irrigated and weeded as per seasonal requirements.

Preparation of growth regulators, solutions and spraying

The desired quantities of each growth regulator *i.e.* TIBA, GA_3, Cytokinin, IAA and NAA were weighed on a single pan automatic electric balance. IAA and NAA were firstly dissolved in a few drops of ethyl alcohol and there after the alcoholic solution were made up to 1000 ml with distilled water with stirring and were kept in stopper flasks. GA_3 was first dissolved in boiling distilled water and the volume was made up to 1000 ml with it. Cytokinin and TIBA were directly dissolved in distilled water and volume was made up to 1000 ml. A few drops of 'Teepol' were added as a wetting agent to each solution, followed by vigorous shaking.
Thus, the solution was prepared carefully and sprayed on the plants with the help of one litre hand sprayer (automizer) and 1 litre of each solutions was sprayed in each plot (4.5X 3 m^2) at 30 days after sowing. Control plants were unsprayed. Caution was always taken to clean the sprayer by rinsing it several times with the solution intended for the next spray in order to avoid any residual effect of the previous hormone.

Observations

The observations were recorded at successive stages of growth. The following observation were recorded during both the years of investigation at plant height and branching of plant which happened to occur at 35, 60, 85, 110 and 135 days after sowing (DAS) at harvest.

Results and Discussion

Data pertaining to growth parameters of lentil *viz*., plant height and number of branches per plant at different stages of crop are influenced by different treatments are presented.

Plant height

It is evident from the Table- 1 that plant height was considerably influenced by growth regulator treatment during both the years, caused significant increase over control in this respect. The maximum increase in plant height was obtained by the plant under GA_3 (50 ppm) treatment.
A similar effect was also exerted by GA_3 (25 ppm) followed by IAA (50 ppm), but it failed to touch the level attained by GA_3 which being significant statistically as compared to control on the other hand, there was reduction in height of the plants treated with TIBA (50 ppm). However, TIBA (50 ppm) showed least position in this connection over the control during both the years. These effects once initiated during the early stage of branching continued at successive stages of growth *viz*, flowering, pod formation, seed development and maturity respectively.
A similar effect was also exerted by GA_3 (25 ppm) followed by IAA (50 ppm), but it failed to touch the level attained by GA_3 which being significant statistically as compared to control on the other hand, there was reduction in height of the plants treated with TIBA (50 ppm). However, TIBA (50 ppm) showed least position in this connection over the control during both the years. These effects once initiated during the early stage of branching continued at successive stages of growth *viz*, flowering, pod formation, seed development and maturity respectively. Increase in plant height occurring from sprays of GA in well documented by Verma *et al.* (2004). In chickpea. Kumar *et al*. (2017) [6] reported the reduction in plant height of pea plant due to TIBA application.

Table 1: Effect of growth regulators on height (cm) per plant at different stages of plant growth 2019-20 and 2020-21.

Treatments	2019-20			2020-21		
	60 DAS	110 DAS	At harvest	60 DAS	110 DAS	At harvest
Control	18.23	33.30	32.85	18.26	33.40	32.86
TIBA-25 ppm	16.65	30.75	30.15	16.50	30.70	30.20

TIBA-50 ppm	15.12	29.30	29.10	15.16	29.35	29.25
GA_3 -25 ppm	24.45	38.20	37.40	25.50	38.45	37.28
GA_3 -50 ppm	25.56	38.90	38.12	25.62	38.96	38.15
Cytokinin- 5 ppm	22.18	34.85	34.48	22.25	33.78	33.60
Cytokinin-10 ppm	22.76	35.30	35.20	22.84	33.90	33.75
IAA- 25 ppm	23.68	37.40	36.72	23.85	37.75	37.50
IAA- 50 ppm	24.10	37.85	37.00	24.21	38.25	38.10
NAA- 25 ppm	22.42	35.80	35.45	20.56	34.56	34.48
NAA- 50 ppm	23.26	36.60	36.50	22.34	35.65	35.55
SE (d) ±	0.54	0.98	0.94	0.62	0.99	1.25
C.D at 5%	1.14	2.04	1.96	1.28	2.66	2.62

Table 2: Effect of growth regulators on Number of branches per plant at different stages plant growth (2019-20)

Treatments	**Growth stages (DAS)**		**Growth stages (DAS)**	
	2019-20	**2020-21**	**2019-20**	**2020-21**
	60	**60**	**110**	**110**
Control	4.33	5.00	7.66	9.33
TIBA-25 ppm	7.66	8.00	11.33	13.66
TIBA-50 ppm	9.00	9.33	13.00	15.00
GA_3 -25 ppm	6.00	6.33	9.33	11.33
GA_3 -50 ppm	6.66	7.00	10.33	12.66
Cytokinin- 5 ppm	4.67	5.66	8.33	10.00
Cytokinin10 ppm	6.33	6.66	10.00	12.00
IAA- 25 ppm	7.00	7.33	10.66	13.00
IAA- 50 ppm	8.66	9.00	12.66	14.66
NAA- 25 ppm	5.33	5.66	8.66	10.66
NAA- 50 ppm	8.00	8.33	12.00	14.33
SE (d) ±	0.25	0.26	0.38	0.45
C.D at 5%	0.52	0.55	0.80	0.96

Table 3: Effect of growth regulators on branches per plant at different stages plant growth (2020-21).

Treatments	**Growth stages (DAS)**			
	35	**60**	**85**	**110**
Control	3.00	5.00	8.00	9.66
TIBA-25 ppm	5.66	8.00	11.66	13.66
TIBA-50 ppm	7.33	9.33	13.33	15.33
GA_3 -25 ppm	4.66	6.33	9.66	11.66
GA_3 -50 ppm	5.33	7.00	10.66	12.66
Cytokinin- 5 ppm	3.66	5.66	8.33	10.33
Cytokinin-10 ppm	5.00	6.66	10.33	13.33
IAA- 25 ppm	5.66	7.33	10.66	13.33
IAA- 50 ppm	7.00	9.00	12.66	14.66
NAA- 25 ppm	4.00	5.66	8.66	10.66
NAA- 50 ppm	6.66	8.33	12.33	14.66
SE (d) ±	0.19	0.26	0.39	0.46
C.D. at 5%	0.41	0.55	0.82	0.97

Number of branches per plant

Table-2 and 3 indicated that, different plant growth regulators significantly influenced the number of branches at all stages of growth maximum being under the TIBA (50 ppm), it was closely followed by IAA (50 ppm) and both were significantly superior in comparison to NAA (25 ppm), Cytokinin (5 ppm) and control treatment at branching stage of growth.

At flowering stage (35 DAS), TIBA (50 ppm) gave maximum number of branches as compared to all other treatments similar result were also recorded by IAA (50 ppm), followed by NAA (50 ppm) and TIBA (25 ppm) during both the years of experimentation. At the pod formation stage (60 DAS), TIBA (50 ppm) gave number branches as compared to all other treatments. It was followed by IAA (50 ppm) and NAA (50 ppm), whereas, minimum number of branches was recorded under the treatment Cytokinin (5ppm) during both years of experimentation.

At the seed development stage, TIBA (50 ppm) increased the number of branches than all other treatments it was closely followed by IAA (50 ppm) and NAA (50 ppm) respectively in both the years.

At the maturity stage, all plant growth regulators treatments significantly increased the production of number of branches over the control during both the years. TIBA (50 ppm) produced more branches, than IAA (50 ppm). On the other hand, Cytokinin (5 ppm) had least position in this respect over the control during both the years. Singh *et al.*, (2017) [6], Yadav *et al.*, (2008) [7] and Adam and Jahan, (2014), Kumar *et al*. (2017) [6] reported the increase in number of branches by TIBA application. It also stimulated branching from lower nodes but restricted branching from higher nodes, whereas cytokinin has poor effect in increasing number of branches in lentil crop in the present study.

References

1. Fisheries FAO. Aquaculture department. Global aquaculture production statistics for the year. 2013.
2. Rahman F, Hussain A, Nath NC. Milk characteristics of a captive Indian rhinoceros (*Rhinoceros unicornis*). Journal of Zoo and Wildlife Medicine, 1993, 528-533.
3. Kathiresan G, Balasubramanian TN. Influence of growth regulatory substance on the germination of clip and single budded sets of different age cane. Cooperative Sugars. 1995;26:695-699.
4. Kathiresan G, Balasubramanian TN. Influence of growth regulatory substance on the germination of clip and single budded sets of different age cane. Cooperative Sugars. 1995;26:695-699.
5. Ramesh K, Thirumurugan V. Effect of seed pelleting and foliar review. Health. 2010;2(11):1335-1344.
6. Singh K, Ghai M, Garg M, Chhuneja P, Kaur P, Schnurbusch T, *et al.* An integrated molecular linkage map of diploid wheat based on a *Triticum boeoticum*× T. monococcum RIL population. Theoretical and Applied Genetics. 2017;115(3):301-312.
7. Yadav RK, Raj Bahadur, Nirbhay Singh, Chaturvedi GS. Effect of bio regulators on growth and grain yield in field pea. J of Food Leg. 2008;21(3):206-207.